Irritable bowel syndrome: a case for musculoskeletal assessment

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Irritable Bowel Syndrome
A case for musculoskeletal assessment

by

Valerie King

Abstract
Abdominal pain of non-visceral origin has been recognised as a clinical entity for many years. In many gastroenterology clinics up to 50 per cent of patients attending have no pathological cause to their symptoms and such patients often become chronic attenders and suffer repeated investigation without resolution of their problem. They are often left with a 'label' of Irritable Bowel Syndrome (IBS) without a precise diagnosis being made. This is both unsatisfactory for the patient and physician. This study set out to determine the incidence of musculoskeletal causes of abdominal pain and to determine what diagnostic tools will help identify this group of patients and thus allow the physicians to refer the appropriate patients at an early stage. The aims were to identify questions that act as predictors of the presence of abdominal pain of musculoskeletal origin, patterns of pain presented in this group of patients and the ability of physiotherapists to detect cases of abdominal pain of musculoskeletal origin. The incidence of abdominal pain of musculoskeletal origin in this study was 14 per cent. Questions that act as predictors include an affirmative response to pain being aggravated by movements such as bending, twisting and turning, and coughing and sneezing, and a negative response to change in bowel habit, symptoms being aggravated by food and no weight change. The ability of the physiotherapist to detect cases was 88.3 per cent. No particular pattern of pain areas emerged to differentiate patients with abdominal pain of visceral and musculoskeletal causes. Early assessment of the musculoskeletal system by a trained physiotherapist is recommended. An early referral will lead to prompt and appropriate treatment and, consequently, to a reduction in costs for the NHS. For patients where the cause of their abdominal pain is not obvious it is unacceptable that they are left with the diagnosis of IBS without the musculoskeletal system being assessed. This study shows that such an assessment is vital to detect cases where the pain has a musculoskeletal origin.

Key words
Physiotherapy; Musculoskeletal; Irritable Bowel Syndrome; Abdominal Pain; Gastroenterology
Irritable Bowel Syndrome

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Valerie King

A Doctoral Thesis

Submitted in partial fulfilment of the requirements
for the award of

the degree of Doctor of Philosophy

of Loughborough University

20 October 1998

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Declaration

This thesis is the record of a research study conducted by me at the Departments of Physiotherapy and Gastroenterology, Addenbrooke’s NHS Trust Hospital, Cambridge.

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Study outline

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Chapter One

Introduction: Background and aims

Abdominal pain is a common clinical problem which may have many causes. Fifty per cent of patients attending gastroenterological clinics have abdominal pain of unknown origin (Manning et al. 1978, Thompson & Heaton 1980). Such abdominal pain, with or without a change in bowel habit, is referred to as the Irritable Bowel Syndrome (IBS). The term IBS is an all-encompassing way of describing a collection of chronic abdominal symptoms for which no pathological cause can be found.

IBS and its variants affect about one-third of the population, but most sufferers do not see a doctor. There are more physician visits in the United States of America for IBS than for inflammatory bowel disease. The number of days spent in hospital are similar for the two conditions (Grant & Keegan 1968, Thompson 1990).

There is no universally agreed approach to treatment; indeed there is no widely agreed understanding of its pathophysiological or psychological processes. It has been considered a functional disorder rather than an organic one because no specific structural, biochemical or infectious cause has been found.

The diagnosis of IBS is often made in the absence of physical findings to explain the symptoms or is made by the absence of detectable organic disease and the presence of symptom criteria (Manning et al. 1978, Thompson et al. 1989). The disorder is often a diagnosis of despair after the patient has undergone extensive investigations and, on occasions, surgery with little relief of their symptoms. It has, in the past, been poorly managed due to lack of understanding of its pathophysiology, lack of diagnostic precision and

Patients can suffer disabling symptoms for many years, throwing considerable burden on the health system with repeated investigations and visits to their General Practitioner and gastroenterology clinics. It is considered unacceptable that 40 per cent of patients with acute abdominal pain return home without a diagnosis (Bourne 1992). There is no reason that a patient should be sent home in a state of frustrated perplexity just because the viscera and serious pathology have been excluded as the source of pain (Gallegos & Hobsley 1992). In recent years, however, other causes and associations have been noted, such as:


- Air swallowing (Calloway & Fongay 1985).


Role of antibiotics in altering the gut flora (Alun-Jones et al 1984).

Several authors have recognised the importance of the musculoskeletal system as a potential cause of abdominal pain. Early studies of referred pain demonstrated that the structures around the spine are capable of producing pain in the abdomen (Kellgren 1938, 1939, Lewis & Kellgren 1938). More recent work has emphasised the need to examine the spine as a source of abdominal pain. In some of these cases the pain can be relieved by lignocaine intercostal blocks (Ashby 1977, Mollica et al 1986, Jorgensen & Fossgreen 1990). Carnett (1926) recognised that a lesion in the abdominal wall itself could cause abdominal pain. Other recent studies have stressed the importance of examining the abdomen for musculoskeletal lesions and have proposed treatment methods (Heinz & Zavala 1977, Bourne 1980, Gray et al 1988, Thomson et al 1991, Greenbaum & Joseph 1991, Gallegos & Hobsley 1989, 1992).

It has also been shown that a greater percentage of patients with functional abdominal pain complain of back pain than do a group of controls (Jorgensen & Fossgreen 1990). Despite this evidence, patients attending gastroenterological clinics often undergo a series of abdominal investigations, some of which are invasive, without any attention being given to the musculoskeletal system.

A pilot study conducted in 1987 by the Department of Gastroenterology, Addenbrooke's NHS Trust Hospital, Cambridge, looked at various factors to determine the precise nature of irritable bowel syndrome. This included the possibility that there may be a musculoskeletal component. Following the assessment of patients by a physiotherapist in the pilot study, it was decided that this – and certain other areas -- warranted further investigation (Hunter 1987).
Aims

This study was one part of a multi-disciplinary investigation to identify the precise cause of abdominal pain in patients with IBS conducted by the Department of Gastroenterology at Addenbrooke's NHS Trust Hospital, Cambridge. It focused on a group of patients with unexplained abdominal pain. The study aimed to identify those patients whose pain has a musculoskeletal origin. The question arose as to whether it was possible to make such a diagnosis at an early stage of presentation before a patient has undergone a regime of investigations and several clinic appointments.

It is recognised that, in the first instance, any organic diseases must be ruled out. Once this has been done, the more accurate the definition of the underlying cause of the pain, then the more appropriate the treatment that can be given and at an earlier stage of referral. Therefore, the study sought to identify which symptoms and assessment techniques would indicate that abdominal pain has a musculoskeletal component.

The aims of this study were to identify:

- Questions that act as predictors of the presence of abdominal pain of musculoskeletal origin.
- Patterns of pain presented in this group of patients.
- The ability of the physiotherapists to detect cases of abdominal pain of musculoskeletal origin.
The following approach was used:

- Development of self-administered and physiotherapist-administered history-taking questionnaires and a physiotherapist-conducted physical examination for use with patients with unexplained abdominal pain.

- Evaluation of the ability of the history-taking questionnaire as a predictor for the presence of abdominal pain of musculoskeletal origin.

- Measurement of the reliability, relevance, specificity, sensitivity and predictive value of the history-taking questionnaire.

- Identification of physical examination procedures that are the most relevant for this patient group.
Chapter Two

Defining Irritable Bowel Syndrome

"All bowels are irritable and all bowels are irritated. Indeed, every time we eat a meal we enhance intestinal motor function" (Hurst 1919).

Most people at some time or other suffer from a bout of non-organic abdominal pain associated with stress or after a bout of gastroenteritis. For the majority of people the symptoms gradually disappear; however, for the unfortunate others their symptoms continue.

IBS has for many years been defined by what it is not, for example, it is not an organic disease. Organic disease is defined as a disease associated with detectable or observable changes in the body organs (Anderson et al. 1998). The emphasis now is that a diagnosis of IBS should be a positive one while investigations must be kept to the minimum (Farthing 1995b).

IBS has often been described as a functional disorder in which there is recurrent abdominal pain with or without other gastrointestinal symptoms not explained by structural or biomechanical abnormalities (Thompson et al. 1992, Thompson 1993). A functional disorder is regarded as a disease where no specific changes in the body organs are detectable.

In some situations, however, "functional" is used as a synonym for an imaginary condition and can be an indication of a psychiatric disorder. Thus, patients with such "functional disorders" are often viewed as hypochondriacs, malingerers or attention seeking. Throughout this study, though, "functional disorder" is used to describe a disorder of physiologic function, which is a normal manifestation of an illness (Wingate 1991).
IBS is not a single, homogeneous condition. It is more appropriate to consider IBS as an umbrella term or as a label for unexplained abdominal pain which can have many causes. As there is much variability in symptom presentation, classification is difficult. There do, however, appear to be several subgroups and, indeed, IBS has been described as a symptomatic expression of several entities (Thompson 1990). The term “symptom complex” is now used to describe conditions with multi-symptoms presentation (Farthing 1995b).

Diagnosis of IBS is most commonly made by its symptom presentation (Thompson 1984a, 1985). Manning et al (1978) concluded that six abdominal symptoms discriminated the painful variant of irritable bowel syndrome (spastic colon) from organic bowel disease:

- Abdominal distension and pain.
- Looser and more frequent bowel movements with onset of pain.
- Pain relieved by bowel action.
- Rectal passage of mucus.
- Constipation.
- Sense of incomplete evacuation.

Manning speculated that the more of these symptoms that were present the greater the likelihood it was that the patient had IBS (Manning et al 1978). The sensitivity of these criteria and their ability to discriminate irritable bowel syndrome from inflammatory bowel disease has been questioned (Talley et al 1990b, Thompson 1984a).
However, Manning's criteria, combined with the results of other investigations of discriminatory symptoms (Mazumdar et al 1988, Kruis et al 1994), formed the basis for the initial definition of IBS developed at the International Congress of Gastroenterology (ICG) in Rome 1986.

These “Rome Criteria” are now the most commonly used as entry criteria for research studies in IBS (Thompson et al 1992):

1. At least three months of continuous or recurrent symptoms.

2. Abdominal pain relieved by defecation, or associated with a change in frequency or consistency of stool, and/or ...

3. Disturbed defecation featuring two or more of:
   - altered stool frequency
   - altered stool form (hard or loose/watery)
   - altered stool passage (straining or urgency; feeling of incomplete evacuation)
   - passage of mucus, and/or ...

4. Bloating or feeling of abdominal distension.

These criteria exclude two other types of functional disorder -- chronic painless constipation and chronic painless diarrhoea -- that have in the past been included within the diagnosis of IBS.

This definition, however, does not incorporate all individuals whose symptoms fall under the umbrella term IBS. It is suggested that it is best to accept the definition of an IBS diagnosis in its broadest sense (Read 1991).
Diagnosis

Diagnosis of IBS involves identifying certain symptoms, for example, abdominal pain, altered bowel function, or bloating, consistent with the disorder and excluding other medical conditions that might have similar clinical presentation. The specificity for the diagnosis of IBS has been enhanced and simplified through the use of symptom-based criteria (Thompson 1984b, Thompson et al 1992). Specific physiological measures to identify IBS are lacking. Lowered pain thresholds to balloon distension of virtually every part of the digestive tract may provide physiological markers for IBS. This hyperalgesia may explain the majority of clinical symptoms reported by these patients (Mayer & Gebhart 1993).

Evaluation of the patient includes a complete history taking, physical examination including sigmoidoscopy and additional testing where indicated. Other recommended studies include examination of the stool (ova and parasites, osculate blood and laxatives), complete blood count, sedimentation rate and serum chemistries. In certain patients imaging studies, for example, upper gastrointestinal series, colonoscopy with rectal biopsy, and barium enema (for patients over 40 years old), will be needed (Drossman 1994). The physical examination should reveal no abnormality, although scars from unnecessary abdominal surgery are often common (Burns 1986).

It should also be noted that IBS symptoms may co-exist alongside a carcinoma or a polyp, as well as with other colonic disorders (Drossman 1994). With such similarity in symptoms it is important to exclude those that indicate a structural disorder. Weight loss, fever, blood in the stool and anemia are not due to IBS (Kruis et al 1994). A cluster of symptoms appears to characterise patients with functional illness when compared with those patients with organic disease, for example, frequent pain episodes of long duration, diffuse localisation of pain which is often associated with food, eating and bowel disturbance or change in bowel habit (Talley et al 1989).
Other factors may confound the diagnosis of IBS. Laxative use, beta-adrenergic blockers, antidepressants and opioid analgesia may also affect the gut and produce symptoms. Thus, a patient should be closely questioned as to the usage of such medicines (Thompson 1991). Food stuffs with additives such as mannitol, fructose and sorbitol may cause episodic diarrhea (Hyams 1983), as does milk for those who are lactose intolerant.

It appears that patients with IBS suffer a wide range of non-gastrointestinal symptoms (Whorwell et al 1986, Sloth & Jorgensen 1988, Prior et al 1989, Jorgensen & Fossgreen 1990, Carson 1995). Symptoms include nocturia, frequency and urgency of micturition, incomplete bladder emptying, back pain, excessive fatigue, vomiting early satiety and, in women, dyspareunia. This diversity was irrespective of whether or not a patient had a psychiatric disorder. Recognition of these symptoms may prevent referral to the wrong medical specialism and inappropriate investigation (Whorwell et al 1986).

In particular, female patients with IBS featuring iliac fossa pain are often referred to gynaecology clinics and can undergo repeated laparoscopies, even hysterectomy, with little improvement in their symptoms (Prior et al 1992). It has been observed that IBS symptoms worsen during menstruation and are correlated with increased levels of various perimenstrual symptoms (Longstreth 1994).

**Epidemiology**

Population surveys of the prevalence of irritable bowel syndrome have suggested rates from 14-20 per cent (Thompson & Heaton 1980, Drossman et al 1982, Sandler et al 1984). They also revealed that less than 20 per cent of persons with symptoms of IBS seek medical advice. More recent work has shown that functional gastrointestinal symptoms occur in up to one-fifth of adults in the industrialised world (Jones & Lydeard 1992, Heaton et al 1992).
Other studies have shown that the prevalence of IBS appears to be greater in China than in the West, with an increased tendency for medical consultation (Wen & Pan 1988). It has been recorded as a transcultural disorder, with similar prevalence reported in China, India, Japan and South America, although its prevalence may be lower in other parts of South Asia and in Africa (Thompson et al 1992). Cultural factors may also affect health care seeking patterns, for example, in India and Sri Lanka male patients predominate (Drossman & Thompson 1992).

Some studies note incidences as high as 27 per cent but recognise that the group investigated was young females who are known to be associated strongly with IBS (Prior et al 1989). Many studies have found that females are more often affected than males with ratios varying from 1.5:1 (Waller & Misiewicz 1969) to 5.2:1 (Keeling & Fielding 1975).

IBS can occur at any age, and it is quite common in children. In a survey of 1000 children in British schools 11 per cent had abdominal pain of sufficient severity to interfere with their activities three or more times in a three month period (Jones 1989).

The peak age of onset is in the third decade and the condition shows a familial pattern but whether this indicates a genetic predisposition or is a reflection of environmental factors remains to be determined (Whorwell et al 1986).

The irritable bowel syndrome accounts for between one-fifth and one-half of referrals to gastroenterologists and represents a substantial workload for hospital specialists (Farthing 1995a). With such a large group of patients it is essential that a positive diagnosis is delivered and treatment is appropriate (Whorwell 1989a).
Pathogenesis

Definition of the pathophysiology is far from clear and no universally accepted strategies for treatment have been developed. The symptoms of which patients complain vary greatly and a pattern usually develops, be it one of pain or of altered bowel habit. The predominant complaint is usually one of pain, the site of which can vary between patients. Pain is usually felt in any of the quadrants of the abdomen and many patients usually have more than one site of pain.

It is not uncommon, though, for symptoms to be precipitated by a gastrointestinal infection, antibiotic use, or abdominal or gynaecological surgery, all of which depress the resistance of the gut and allow new organisms to become established in the colon (Van der Waaij 1983).

After having finally established symptom criteria for diagnosis (Thompson et al 1992) more recent work has focused on the cause of IBS. Research has focused on two main avenues of study: either it is a motor disorder or a sensory disorder. Other areas of investigation have been food intolerance and psychological influence.

Motility

The disturbance of bowel habit with IBS has led investigators to study intestinal motility and transit (Snape et al 1976, McKee & Quigley 1993). This is because pain associated with IBS is frequently located in areas referable to the colon (Lynn & Friedman 1995). Thus, many attempts have been made to identify motor abnormalities in the colon as a source of symptoms.

Several groups have identified changes in the gastrointestinal motility of patients with IBS displaying increased motility in response to environmental
or enteroceptive stimuli (Drossman 1994). Initially, it was believed that the major culprit was the colon (Snape et al 1976, 1977), but further research has established that IBS represents a motility disorder of the whole gut (Moriarty & Dawson 1982, Swarbrick et al 1980, Mayer & Raybould 1990).

Further work has identified the weakness of many of the studies on colonic motility, and they suggest that the greatest obstacle is the lack of understanding of normal colonic motility due to its complexity, intrinsic variability and sensitivity to extrinsic influences. The balance of evidence suggests that it is unlikely that IBS is characterised by disordered basal colonic motility. Altered motility does not account for some more of the common features of the disorder (Drossman 1994). They feel that there may well be an exaggerated colonic response to certain foods for instance, which may contribute to a patient’s symptoms (McKee & Quigley 1993).

Despite many studies on motility, few clear cut differences have emerged between healthy control subjects and IBS patients. While motor abnormalities may be present in some patients with IBS, these are not consistent and can overlap significantly with a healthy control population. Lack of correlation of motor events with typical symptoms seen during prolonged ambulatory monitoring of gut motility has raised questions about the role of altered motility in functional bowel disorders (Kellow et al 1988, Richter et al 1989, Kellow et al 1990, Fefer et al 1992, Farthing 1995a, 1995b). Furthermore, factors such as patient selection and methodological differences may account for such diverse results.

Enhanced visceral sensitivity

For more than 20 years evidence has suggested that some IBS symptoms may be due to a disorder of visceral sensation or that it plays a part in the syndrome (Mayer & Raybould 1990, Mayer & Gebhart 1993). Enhanced sensitivity or hyperalgesia describes a condition in which pain threshold is
reduced and/or the response to a painful stimulus is greater in magnitude and longer in duration. It is suggested that patients have altered patterns of referral of visceral sensations. Altered sensations and motor reflexes may present in response to a physiologic stimulus, for example, distension of the viscera. A small percentage of patients' symptoms are triggered by clear events, for example, enteric infections, road traffic accident and surgery. These are mechanisms that relate to tissue irritation and inflammation and can result in long lasting alterations in visceral sensory pathways. Sensitisation can occur at the level of peripheral terminals of spinal afferents (peripheral sensitisation), the dorsal horn or more central sites (central sensitisation) and it can be long lasting.

Studies have shown that in balloon distension of the ileum and colon, IBS patients experience awareness of distension and painful symptoms at pressures and volumes that are significantly lower than control subjects (Ritchie 1983, Prior et al 1990) and these low thresholds occur even when controlling for neuroticism (Whitehead et al 1990).

It is hypothesised that, in these cases, there is an abnormal perception of normal physiologic changes (Drossman & Thompson 1992). The presence of visceral hyperalgesia is seen as the most consistent abnormality in chronic abdominal pain syndrome (Mayer & Gebhart 1993). However, not all investigators have been able to produce increased rectal sensitivity (Kendall et al 1990). It has also been suggested these responses may be due to secondary hyperalgesia associated with central hyperexcitability in IBS patients (Farthing 1995a).

There is no exclusive pathway for visceral sensation. It is mediated via somato-sensory pathways with the viscero-somatic neurons being located deep in the dorsal horn in the thoracic spine. The high incidence of somatic pain in patients with IBS may suggest that somatic and visceral hypersensitivity can occur together. A link has been established between
patients with IBS and fibromyalgia, which may be linked to a specific upregulation of visceral and somatic receptors (Yunus et al 1981, Bennett 1989).

This work on visceral sensitivity is only beginning to be understood. It has been proposed that several factors alter neuroreceptor and afferent spinal neuron function and central nervous system (CNS) modulation of afferent input in such a fashion that it produces long term sensitisation of pathways involved in the transmission of visceral sensation (Drossman 1994). Such factors may include genetics, inflammation, motility, local nerve irritation and psychological factors (Marek et al 1989, 1990).

It is thought that enhanced visceral sensitivity may be a component but not the whole cause of this disorder (Mayer & Raybould 1990), partly because there are substantial overlaps between sensation thresholds of patients with IBS and healthy controls (Farthing 1995b). Future pain research will lead to a greater appreciation of the mechanisms at work in the alterations to sensory processing. This will then lead to a clearer understanding of the processes involved in chronic abdominal pain.

Doubtless, there will be further studies of these factors in the future but, as is the case with the studies on motor activity, the work on visceral hypersensitivity to date does not differentiate IBS patients clearly from other groups.

The search for psychological markers

Little doubt exists that emotional factors can alter the function of the gut. The gut, innervated by the enteric nervous system is modified by hormones and has extensive connections to the brain. Thus, the pathways exist for interaction between the mind and the gut. Figure 1 (page 19) shows the bi-directional pathways that exist providing the linkage between visceral
afferent sensation and intestinal motor function and both can be modified by higher cortical centres (Drossman 1994). The term “gut-brain axis” has been coined to describe the link through which stress and other behavioural factors affect gastrointestinal function and through which stimuli from the abnormally responsive gastrointestinal tract are transmitted to the brain (Collins 1988). This multidirectional system may also explain potential relationships between altered pain sensation, gut dysmotility as well as mood disturbance (Mayer & Gebhart 1993, Drossman 1994).
Figure 1: Integrated processing of information within brain-gut axis. External and internal sensory information is integrated within neural circuits in the central nervous system, the spinal cord, the prevertebral ganglia and the enteric nervous system. (Reproduced by kind permission. The Gastroenterologist (1994) V2/N4, 315-26. Little, Brown and Company, Inc.)
Any acute stress, such as a pending examination or an interview, can produce bowel frequency, nausea, vomiting or early satiety. Such reactions are often exaggerated in patients with functional gastrointestinal disorders (Whitehead et al 1982). However, the role of stress and psychological factors in the pathogenesis of IBS is unclear. Anxiety, which does appear to be increased in IBS patients, is often related to the fear of cancer. In recent decades the increase in colon cancer, coupled with an increased perception of the disease, increased community emphasis on screening and early diagnosis are all factors that encourage an anxious patient to seek medical advice.

Illness generated chronic stress applies particularly to anticipatory anxiety of diarrhoea predominant IBS patients, where they are anxious of not reaching the bathroom in time (Whitehead et al 1980). Anxiety can lead to major lifestyle changes. Transient symptoms may become chronic and persistent. Although some symptoms of IBS appear to be unrelated to psychological distress, this distress may influence which patients consult a doctor (Drossman 1989, Whitehead et al 1988).

Some studies have concluded that, as a group, IBS patients exhibit more symptoms of anxiety and depression (Hislop 1971, Palmer et al 1974). Other studies found that psychosocial 'predictors' did not contribute to a positive diagnosis of IBS because they were also common in organic disease (Smith et al 1990).

However, the validity of some early studies (Hislop 1971, Palmer et al 1974) has been doubted. Some were carried out before any clear criteria for IBS had been developed, while entry criteria for others was often vague, so allowing inclusion of almost any patient with chronic symptoms of abdominal dysfunction. Most of these studies involved patients attending hospital, so raising the question of selection and bias. Hence, the results may reflect an overestimation of psychological disturbances. Recent studies, using more stringent entry criteria, have questioned the general perception of the
psychoneurotic nature of the IBS patient (Kumar et al 1990) and whether psychopathology is a major explanation for IBS (Talley et al 1990a).

Other studies working with groups in the community have shown that IBS patients differ psychologically in many ways from non-IBS patients and normals (Sandler et al 1984, Drossman et al 1988, Whitehead et al 1988). Those patients who consulted physicians for bowel symptoms were more likely to report pain than those who did not, but it is felt that pain was not sufficient to explain the visits. The reported higher prevalence of psychopathology among a patient population with IBS may be due to behavioural influences that lead to health care seeking (Sandler et al 1984). The studies do not suggest, though, that a particular personality profile for an IBS patient exists but that, in line with the heterogeneous nature of IBS, different psychological subgroups may exist.

Symptoms consistent with an IBS diagnosis have been found to affect approximately one-quarter of the population, yet only a minority of these consult their physician (Drossman et al 1982, Jones & Lydeard 1992). It has been established that a significant proportion of the ‘healthy’ population experience the symptoms associated with IBS (Thompson & Heaton 1980), so it is valid to ask what distinguishes those who decide to consult the medical profession about these symptoms. This has led to the concept that those who seek advice suffer not so much from IBS as from “illness behaviour” (Sandler et al 1984, Wingate 1991) which is as manifest in organic gastrointestinal disorders as in IBS (Smith et al 1990).

How the illness is perceived, experienced and acted upon can result in increased pain reporting behaviours, physician visits or medication use, the seeking of alternative medical treatments (Drossman 1994) and requests for unneeded surgery (Burns 1986).
Elevated scores on bodily preoccupation, disease phobia and hypochondriacal belief have been noted in an IBS group (Gomborone et al 1995). Patients with IBS who seek advice often exhibit chronic illness behaviour and are frequent attendees at their General Practitioner's clinic (Whitehead et al 1982). Symptoms of IBS have been shown to be common in patients being treated for depression. These patients were more likely to have a personal and family history of bowel disease, back pain, weakness, heartburn and nocturnal bowel movements compared to patients with depression but without IBS (Masand et al 1995).

One author has posed the question "what comes first?":

- Whether it is the affective disorder or the patient's attitude to illness that leads to the production of abdominal symptoms, or their heightened awareness of mild and clinically unimportant abdominal symptoms that were previously disregarded.

- Alternatively, whether it is the chronic abdominal symptoms that produce the affective disorder or disturbed perception, or it is an increasing concern about serious illness that propagates the syndrome (Farthing 1995a).

Clinical experience suggests that patients with IBS may be expected to experience significant impairment in psychological, social and role functioning (Drossman 1994). Some individuals with IBS appear to be helped by hypnotherapy and psychotherapy (Whorwell et al 1984, Whorwell 1989b, Harvey et al 1989, Farthing 1995a). It has been emphasised that psychological treatments should be held in reserve for those patients who do not respond to first line medical treatment (Creed & Guthrie 1989, Creed 1994). Gomez & Dally (1977) emphasises that psychiatric assessment should not be considered simply as a last resort.
Food intolerance

There is evidence that symptoms can be attributed to food intolerance (Alun-Jones et al 1982, Alun-Jones 1985, Hunter & Alun-Jones 1985) Lewis 1995). Symptoms after eating food are often the most prevalent explanation from patients; and may be related to specific foods or to the amount of food (Mayer & Gebhart 1993).

Several groups of foods have been shown to act as triggers of symptoms. Capsaicin in peppers selectively stimulates unmyelinated c-fibres, such as peripheral terminals of spinal and vagal afferents (Maggi & Meli 1988, Holzer 1988). This may affect changes in the mucosal blood flow, gastric acid secretion and motility, presumably via axon reflexes of spinal afferents (Mayer & Raybould 1990, Mayer & Gebhart 1993). Other food groups such as wheat, dairy and spicy products also appear to aggravate patients' symptoms. It has been suggested that the mechanisms responsible for food induced symptoms involve alterations in the stimulation of gastrointestinal mechano- and/or chemo-receptors (Mayer & Gebhart 1993).

Small alterations in intestinal gas composition are associated with malabsorption of lactose, sucrose and sorbitol which can cause abdominal symptoms (Haderstorfer et al 1989, Heaton 1989). Nanda et al have shown that 47 per cent of patients with IBS responded to a systematic exclusion diet (Nanda et al 1989). Other studies have also shown that dietary manipulation can relieve patients of their symptoms (Alun-Jones et al 1982, Hunter et al 1985, Alun-Jones 1985, Smith et al 1985, Hunter 1991b).

The role of dietary fibre is controversial. Ten years ago virtually every patient with IBS was recommended a high fibre diet despite there being evidence to show that fibre was no better than a placebo (Ritchie & Truelove 1980, Klein 1988). Indeed, recent studies have shown that such diets can actually make symptoms worse in as many as 50 per cent of patients.
(Whorwell 1989a, Mayer & Gebhart 1993, Francis & Whorwell 1994). The main indication for a high fibre diet in treating IBS is where there is associated constipation (Farthing 1995a).

Recent work has hypothesised that, rather than being an immunological disease, food allergy may be a disorder of bacterial fermentation in the colon and suggests that it may be more appropriately called an “enterometabolic disorder” (Hunter 1991b).

**Infection**

Often patients can recall an episode of diarrhoea or food poisoning. This episode of gastroenteritis may act as the trigger, which disrupts bowel function and heralds the start of IBS symptoms. Some authors put the emphasis on the role of the gut flora (Hunter 1991a) and its disturbance in the case of infections and antibiotic use (Van der Waaij 1983, Alun-Jones et al 1984). Even when the infection has ceased, however, the symptoms may persist. It is uncertain why chronic dysfunction persists despite the resolution of the primary insult.

**Summary**

Although there is a need to exclude serious pathology, extensive investigations can enhance patient anxiety and expectation, as well as being a drain on National Health Service (NHS) resources. Retrospective studies have shown that IBS is a “safe diagnosis” provided patients have undergone a thorough examination including sigmoidoscopy and blood tests (Holmes & Salter 1982).

It is accepted that IBS is a generalised disorder of the gastrointestinal system and patients can present with a diverse range of symptoms, thus making a precise definition difficult (Read 1991). It may be that IBS, like
bronchospasm, is the final common pathway of dysfunction provoked by several different mechanisms.

Often in clinics, once organic pathology has been ruled out, little effort is made to determine the exact cause of the problem. It is important to remember that the absence of demonstrable pathology does not detract from the reality of a patient's problem (Whorwell 1989a).

Some authors conclude that the term is probably best not used at all for, once a patient has the IBS label, a physician may suppose that a definite diagnosis has been made. Thus, the diagnosis would be better defined in terms of the presenting symptoms, such as "unexplained diarrhoea or abdominal pain" (Hunter 1995).
Chapter Three

Visceral and Musculoskeletal Pain

Pain

The current working definition of pain as proposed by the International Association for the Study of Pain (IASP) describes pain as an “unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage” (Merskey 1986, 1991).

Despite increasing work in the field of pain, its mechanisms and those of referred pain are still not clearly understood. This can prove to be a frequent source of confusion in the identification of the source of the pain and the direction of treatment.

Pain has to arise from an innervated structure or the nerve itself (Maigne 1996). Most pain impulses begin with activation of peripheral nociceptors and conduction through myelinated A-δ and unmyelinated C fibres to the dorsal root ganglion. From here signals travel predominantly via the spinothalamic tract to the thalamus and somato-sensory cortex where they are interpreted and modulated (Markenson 1996, Siddall & Cousins 1997).

Visceral pain

The gut is a dynamic organ almost always on the move. The driving force is the gut muscle. From the mid-oesophagus to the anus the gut muscle is smooth and under involuntary control, which distinguishes it from skeletal/striated voluntary muscle (Thompson 1990). The viscera have dual innervation from the parasympathetic and sympathetic nervous systems which penetrate the central nervous system at the same levels as autonomic
afferents (Figures 2 and 3). Most forms of visceral sensation, especially visceral pain, are mediated by visceral afferent fibres running in sympathetic nerves (Cervero 1987). Spinal projections of visceral afferents are largely restricted to the thoracic, lumbar and sacral segments (Ness & Gebhart 1990).

**Figure 2: The sympathetic nervous system.** The central column indicates the spinal cord. The lines to its right represent post-ganglionic fibres in the grey rami leading into the spinal nerves for distribution to blood vessels, sweat glands and pilorector muscles. (Reproduced by kind permission. Guyton A.C. & Hall J.E. (1996): Textbook of medical physiology. 9th Edition, pp 770. W.B. Saunders.)
Neuroreceptors are situated throughout the abdominal viscera but they are of low density innervation and not so numerous as in other structures such
as the skin. There may be sleeping silent receptors within the viscera to
signal changes occurring in inflammatory states (Procacci et al. 1986).

Visceral pain results mainly from distension, stretching or inflammation of
the nerve fibres surrounding hollow or solid organs. Distension sets up
forcible contractions of the smooth muscle wall leading to spasm of the
also strongly associated with motor reflexes which may lead to muscle
spasm, referred pain and hyperalgesia of somatic origin (Ness & Gebhart
1990). It can be accompanied by nausea, feeling unwell and other autonomic
presentations (Grieve 1986b, McMahon 1994). The referred pain may be
appreciated on a different part of the body surface and can be at a
considerable distance from the diseased viscera (McMahon 1994, Stone
1996). Parietal pain results from chemical or bacterial irritation of the
parietal peritoneum and is usually sharp, more constant and also more
localised (Stone 1996).

Visceral pain is segmental, with the site of the pain corresponding to the
dermatome from which the diseased organ receives innervation (Cervero
1987). It is often perceived in the midline irrespective of the location of the
organ. This is because the abdominal organs receive sensory afferents from
both sides of the spinal cord. The area of referral may depend upon whether
the organ is derived from the embryological foregut, midgut or hind gut

The painful sensations evoked by noxious visceral stimulation differ
substantially from those caused by cutaneous injury (Table 1). In contrast to
the sharp, well localised pain evoked by cutaneous injury, visceral pain tends
to be midline, diffuse and poorly located and discriminated. It is often
described as a deep, dull ache, gnawing or cramp and it has a wavelike,
waxing and waning quality (Cervero 1986, Grieve 1986a, Willis 1986, Ness &
Table 1. Differences between the descriptions of visceral and cutaneous pain.

<table>
<thead>
<tr>
<th>Visceral</th>
<th>Cutaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dull</td>
<td>Sharp</td>
</tr>
<tr>
<td>Wavering</td>
<td>Sustained</td>
</tr>
<tr>
<td>Poorly localised</td>
<td>Focal</td>
</tr>
<tr>
<td>Autonomic disturbance</td>
<td>Stands out alone</td>
</tr>
<tr>
<td>Described in terms other than ‘pain’</td>
<td>Clearly ‘pain’</td>
</tr>
<tr>
<td>Induces restlessness</td>
<td>Prompts immobility</td>
</tr>
<tr>
<td>Can be unaffected by movement</td>
<td>Aggravated by movement</td>
</tr>
</tbody>
</table>

Confusion may arise from signals from viscera that share common segmental innervation, for example, the heart and oesophagus. It is not possible, therefore, to differentiate pain from one viscus from pain in another viscus by the description of the pain. The referred pain may mask the original ‘true’ visceral pain (Procacci et al 1986). Visceral pain is renowned for not being reliably ‘typical’.

It has been established that the somatic representation of the viscero-somatic neurones is less precise than that of somatic neurones and there is wide divergence of visceral afferents in the spinal cord. In comparison with the surface of the body the viscera are sparsely innervated by afferents to the spinal cord (Ness & Gebhart 1990). This may help to explain the relatively diffuse nature of visceral pain including symptoms that radiate from the viscera (Tattersall & Cervero 1987, Goodman & Snyder 1995).

Diffuse pain becomes localised as visceral afferents increase due to the process of facilitation and activation of silent nociceptors. Greatest localisation is apparent when a somatic structure, for example, the paries, becomes involved in the pain producing process (Ness & Gebhart 1990). Acute appendicitis, a mid gut structure when inflamed, may present first as dull pain localised to the peri-umbilical area, accompanied by nausea and sweating. As the inflammation advances through the viscera to the parietal
peritoneum, the pain shifts to the right iliac fossa classically localising to McBurney's point. The pain changes from dull to sharp, often exquisitely tender, with reflex guarding and rebound tenderness (Berk & Haubrich 1991).

However, not all diseased viscera present symptoms that are perceived at a distance from the organ. A peptic ulcer can be localised to a finger tip point at the exact site (Haubrich 1995, McMahon 1994). Unlike the visceral peritoneum, the parietal peritoneum is innervated by nociceptors and the pain is well localised to that area of inflammation.

It is important to remember that visceral sensation does not always equate with pain (McMahon 1994). Some viscera do not give rise to pain, including the liver and lung, even when being destroyed by malignancy (Procacci et al 1986, Willis 1986). The normal mucosa of the alimentary tract seem to be insensitive. Biopsies can be taken from the gastrointestinal mucosa without anaesthetic, and a heat probe and laser beam can be applied eliciting no sensation. However, this area, together with the urinary tract, bladder and gall bladder, can be sensitive to changes in tonus, tight contractions, ballooning distension, or inflammation (Procacci et al 1986, Berk & Haubrich 1991). The membrane that envelops organs, the visceral peritoneum, is also insensitive to pain so that, except in the presence of inflammation and ischemia, it is possible to have extensive disease without pain (Procacci et al 1986, Goodman & Snyder 1995).

**Referred visceral pain: the viscero-somatic link**

An important phenomenon often associated with visceral disease is the referral to somatic structures. When faced with a patient presenting with pain the clinician has to take into consideration the local structures that could cause pain and those that may refer to that area. The term "referred pain" was coined by Head (1893), who wanted to emphasise referral of
sensations originating in the organs to the skin and other structures. It is used generally to describe pain that travels from the source of the problem or is deemed to originate in an area in the body at a distance from where it is perceived. Essentially, impulses ascending from the spinal cord are misconstrued as originating from somatic structures because this is the normal mode of presentation. Referred pain may also be accompanied by cutaneous or muscular hyperalgesia in the area of the referral (Head 1893, Procacci et al 1986, Ness & Gebhart 1990).

Much work has been completed since the publication of Head's theories (Mackenzie 1909, Theobald 1941, Ruch 1946, Sinclair et al 1948). More recently, the existence of bifurcated axons in the peripheral sensory nerves has been identified (Taylor et al 1984). They have demonstrated sensory units which have one branch supplying the skin and another branch coming from muscle or other subcutaneous structures. Such branched sensory units have a single cell body in a dorsal root ganglion and a single proximal axon travelling to the spinal cord from the ganglion cell as shown in Figure 4.

![Figure 4: Referred pain due to branched sensory neurons. The primary afferent shown has branches supplying both the arm and the heart.](Reproduced by kind permission. Bowsher D. (1994): Nociceptors and peripheral fibres. In Pain. Management by physiotherapy. Wells P.E., Frampton V. & Bowsher D. 2nd Edition. Butterworth-Heinemann.)
Other reasoning focuses on the convergence of separate peripheral sensory units on to the same cell in the spinal cord (Ruch 1946), as shown in Figure 5, which is the current model used for studies into referred visceral sensation.

![Diagram of referred pain](image)

**Figure 5: Referred pain due to convergence.** The nerve cell in the spinal cord receives input from two different peripheral neurons, one supplying the heart and one supplying the arm. Signals from the heart may be interpreted as coming from the arm. (Reproduced by kind permission. Bowsher D. (1994): Nociceptors and peripheral fibres. In Pain. Management by physiotherapy. Wells P.E., Frampton V. & Bowsher D. 2nd Edition. Butterworth-Heinemann.)

Recent neurophysiological evidence has provided support for Ruch’s theory (Cervero 1986, 1987, Willis 1986, Risling et al 1987, Tattersall & Cervero 1987). This theory explains the segmental nature of referred pain and there is evidence of somato-visceral convergence in spinal neurons. Visceral pain is usually referred to the somatic area that is innervated by the same spinal cord segment that receives input from the originating viscus (Cervero 1986, Cervero & Tattersall 1986, Tattersall & Cervero 1987, McMahon 1994). Therefore, all neurophysiological interpretations of visceral pain are based on viscero-somatic integration (Cervero & Connell 1984).
The terms viscero-somatic and somato-visceral are used to identify the direction of motor discharge to the target organ or receptor (Hix 1976). Visceral afferents terminate in the spinal cord and contact the same dorsal horn cells situated in the thoracic spinal ganglia as do nociceptors coming from the skin (Cervero & Connell 1984). There are excitatory and inhibitory interactions between the somatic and visceral inputs (Foreman et al 1981, Milne et al 1981, Ness & Gebhart 1990).

This convergence of nociceptors from somatic and visceral structures on the same cells and subsequent projection to pathways in the spinal cord to the higher centres results in the brain interpreting the signals as having come from the skin, an interpretation which has been learned from more common previous experiences in which the same tract fibres were stimulated by cutaneous afferents (Cervero & Connell 1984, Bowsher 1994). For example, pain referred from the heart to the shoulder is interpreted as a local musculoskeletal problem in the shoulder; it is interpreted as coming from the body wall even though the somatic nociceptor may be inactive (Bowsher 1994).

Viscero-somatic convergence provides the neural substrate for the phenomenon of cutaneous referral of visceral pain (Milne et al 1981). All visceral afferent fibres that enter the thoracic spine join the sympathetic chain by way of the splanchnic nerves. The majority of the splanchnic afferent fibres project to the lower thoracic spine T6-T11, and so it is these segments that contain the main area of projection of visceral afferent fibres from the upper abdomen. The organisation of the visceral sensory system has been likened to that of a trip-wire alarm whereby a few peripheral sensors activate a generalised response. Pain is often only one component of the total response when these sensors are activated (Cervero 1987). The lower thoracic spinal cord receives the bulk of the visceral sensory input and can be viewed as a junction box where visceral and sensory information is jointly processed.
The actual number of afferent fibres that reaches the spinal cord are very few (Cervero & Connell 1984). Such a low density of sensory innervation leaves little scope for fine discrimination and precise localisation. This, Cervero (1986) feels, is probably the reason for the diffuse nature of visceral pain. Some spinal cord neurons have a purely visceral input but many show a convergent input from the viscera and cutaneous primary afferents.

Somatic neurones are located in lamina II, III, IV and V of the dorsal horn. In contrast, viscero-somatic cells are found in lamina I, V, VII, and VIII (Cervero & Tattersall 1985, Willis 1986, Tattersall & Cervero 1987) and are absent from II, III and IV (Figure 6; page 36). In particular, lamina I receives extensive viscero-somatic convergence onto neurones in this area and so appears to be an important area for the processing and relaying of convergent inputs from somatic and visceral afferent fibres.

Most of the neurons in lamina I are nociceptive (Willis 1986, Tattersall & Cervero 1987). Lack of prominent visceral primary afferents in the substantia gelatinosa implies different processing for visceral and cutaneous information (Willis 1986).

Most of these neurones receive somatic nociceptive inputs either exclusively or in combination with low threshold mechanoreceptive inputs. This provides support for the "convergence-projection theory" or referred visceral pain (Ruch 1946). Many of the viscero-somatic neurones in lamina V, VII and VIII are excited more strongly by stimulation of subcutaneous tissues, particularly muscle, than by stimulation of the skin. This is in line with the clinical signs of referred visceral sensation which usually present in subcutaneous structures, especially muscle cramps, rather than cutaneous pain.
Figure 6: Locations of the recording sites of somatic and viscero-somatic neurones. Recording sites have been superimposed on a standard section of the T11 spinal cord segment. Lamination of the grey matter has been indicated. (Reproduced by kind permission. Cervero F. & Tattersall J.E.H. (1986): Somatic and visceral sensory integration in the thoracic spinal cord. In Visceral sensation. Cervero F. & Morrison J.F.B. (eds, 1986). 67, 197. Elsevier.)

The spinothalamic tract is the major pathway involved in signaling pain including visceral pain (Foreman et al 1981, Ness & Gebhart 1990). Noxious visceral stimuli can activate single spinothalamic neurons as powerfully as do cutaneous stimuli (Foreman et al 1981). Other pathways involved are the spinoreticular, spinocervicothalamic and the spinomesencephalic tract.
Spinothalamic tract cells receive a convergent input from nociceptors of the skin and from fine afferent fibres of the viscera. They also receive convergent input from A-δ and C fibres in visceral nerves as they do from A-δ and C fibres in cutaneous and muscle nerves (Ness & Gebhart 1990). The exact site to which a pain of visceral origin is referred is almost certainly determined finally by the higher centres in the brain. This is most likely due to central mechanisms within the spinal cord. Visceral sensation depends upon sensory pathways that ascend in both the dorsal and ventral parts of the spinal cord (Willis 1986). Most visceral afferent fibres that enter the spinal cord do so through the dorsal roots (Willis 1986).

At the higher centres the afferent impulses are registered, sorted and modulated (Figure 7; page 38). These centres of the brain influence how pain is perceived and how the reaction manifests itself. Descending pathways also modulate pain perception and the response to pain (Markenson 1996, Siddall & Cousins 1997).
In trying to explain the phenomenon of referred pain Melzack and Wall (1982) suggest that "... the explanation has to lie within the central nervous system where the activity triggered by the primary lesion excites neighbouring areas in the central nervous system to produce heightened sensitivity."

**Site of referred pain from the viscera**

The site of referred pain from the viscera for a given stimulus is constant for any one individual but may vary from individual to individual. It is not always confined to the segment in which stimulation occurs and a degree of overlap can be present. Table 2 shows the approximate segmental derivation of the viscera that should be considered when assessing abdominal pain.


<table>
<thead>
<tr>
<th>Part of the body</th>
<th>Areas of the spine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart</td>
<td>C8-T4</td>
</tr>
<tr>
<td>Lungs</td>
<td>T2-T5</td>
</tr>
<tr>
<td>Oesophagus</td>
<td>T4-T5</td>
</tr>
<tr>
<td>Stomach and duodenum</td>
<td>T6-T8</td>
</tr>
<tr>
<td>Liver and gall bladder</td>
<td>T7-T8 right</td>
</tr>
<tr>
<td>Pancreas</td>
<td>T8 Left</td>
</tr>
<tr>
<td>Small intestine</td>
<td>T9-T10</td>
</tr>
<tr>
<td>Appendix and ascending colon</td>
<td>T10-L1</td>
</tr>
<tr>
<td>Epididymis</td>
<td>T10</td>
</tr>
<tr>
<td>Ovary, testis and suprarenal</td>
<td>T11-T12, L1</td>
</tr>
<tr>
<td>Bladder fundus, kidney, uterine fundus</td>
<td>T11-L1</td>
</tr>
<tr>
<td>Colonic flexure</td>
<td>L2-L3</td>
</tr>
<tr>
<td>Sigmoid colon, rectum, cervix, neck of bladder, prostate and urethra</td>
<td>S2-S5</td>
</tr>
</tbody>
</table>
The embryological derivation shows that some organs have a wide spread origin, hence disease of the viscera may present in different areas. Doran's work on the patterns of referral from the common bile duct describes clearly the varying areas of pain arising from one structure. Sixteen patients reported no pain at all after 2-5ml air had been injected into the balloon of a Foley catheter which had been sewn into the bile duct whilst the patients were undergoing a cholecystectomy. The remaining group reported various patterns of pain referral (Doran 1967). The spread of symptoms in the patients suggests that, even in small structures as the common bile duct, the afferent fibres are scattered over many segments.

Figures 8-12 illustrate the sites of referred pain on inflating the balloon of a Foley catheter sewn into the common bile duct.

Figure 8: Pain referred to both sides of the midline from xiphoid to umbilicus: 20 cases, T6-T10 dermatomes.
Figure 9: Pain referred to the right costal margins and right upper abdominal quadrant: 10 cases, T7-T11 dermatomes.

Figure 10: Pain referred to epigastrium in the midline and across the back: 6 cases, T6-T10 dermatomes.
Figure 11: Pain referred only to the back on both sides of the vertebral column: 5 cases, T6-T10 dermatomes.

Figure 12: Pain referred only to the back but confined to one side: 4 cases, T7-T9 dermatomes. (Figures 8-12 reproduced by kind permission. Doran F.S.A. (1967): The sites to which pain is referred from the common bile duct in man and its implication for the theory of referred pain. British Journal of Surgery 54/7, 599-606. Blackwell Science Ltd.)
Certain diseases can produce symptoms at a distance from the source and can produce more than one area of pain so making diagnosis difficult.

**Table 3. Site of referral for visceral pathologies.**

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Site of referred pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute pancreatitis</td>
<td>Back, epigastric and left hypochondria, upper left lumbar pain when chronic</td>
</tr>
<tr>
<td>Pancreatic carcinoma</td>
<td>Epigastric/upper abdominal pain radiating to the back</td>
</tr>
<tr>
<td>Cholecystitis, biliary colic</td>
<td>Right hypochondrium, epigastrium, right scapula and shoulder, between scapula, thoracic pain</td>
</tr>
<tr>
<td>Renal colic</td>
<td>Loin pain radiating to the groin and scrotum in males</td>
</tr>
<tr>
<td>Acute appendicitis</td>
<td>Peri-umbilical; localises to right iliac fossa</td>
</tr>
<tr>
<td>Perforated peptic ulcer</td>
<td>Epigastric; right shoulder (rare); whole of abdomen, radiating back pain</td>
</tr>
<tr>
<td>Ruptured aortic aneurysm</td>
<td>Back, lumbar region</td>
</tr>
<tr>
<td>Basilar pneumonia</td>
<td>Pain beneath the costal margins</td>
</tr>
<tr>
<td>Duodenal ulcer</td>
<td>Back pain; midline T6-T10 area, left shoulder</td>
</tr>
<tr>
<td>Perforated duodenal ulcer</td>
<td>Right shoulder</td>
</tr>
<tr>
<td>Ruptured spleen causing distension in the abdomen</td>
<td>Left shoulder pain (Kehr's sign -- a result of free air or blood in the abdominal cavity causing distension)</td>
</tr>
<tr>
<td>Crohn's disease</td>
<td>Umbilical and back pain; may have migratory arthralgias</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>Mid-thoracic pain, left arm pain</td>
</tr>
</tbody>
</table>

Visceral pathologies are well noted in the literature as the following examples demonstrate. A duodenal ulcer may refer pain to the centre of the thoracic spine, left shoulder and left axilla. Back pain may be the first and only symptom (Pounder & Fraser 1995). Pancreatitis commonly presents as epigastric pain of a penetrating quality which can radiate to the upper lumbar region and can be associated with nausea and vomiting, malaise and
weakness. The pain is unrelated to food intake (Goodman & Snyder 1995, Lankisch 1995). Pancreatic carcinoma may present upper abdominal pain which may radiate to the back; other symptoms may include weight loss and jaundice (Brunt et al 1988). Crohn’s disease may present as peri-umbilical pain with back and hip pain, with relief of pain after passing flatus or opening the bowels. Patients with Crohn’s disease may also complain of migratory arthritis or back pain due to ankylosing spondylitis (Meyers 1995).

Aneurysm of the abdominal aorta affects four per cent of the adult population. It may present as sudden, severe low back pain as well as abdominal, chest and leg pain, although some are asymptomatic. A pulsatile abdominal mass and hypotension are also common features (Cates 1997). Accompanying testicular pain may precede a rupture (Cates 1997, Coy & Chatfield 1997). Patients may present with an increase in their familiar arthritic back pain and one should be aware of the possibility of a separate cause to this increase. The suddenness, severity and spread of pain should alert the clinician to serious pathology (Stone 1996). A ruptured spleen may present with somatic pain in the left upper quadrant or “shoulder strap” area. Patients would present with a history of trauma (Stone 1996).

Renal conditions can present with flank and back pain, for example, renal colic can produce an intense pain along the border of the twelfth rib and can progress to the abdomen and groin. It can be mimicked by irritation of the costal nerve T10-T12, but the pain will not be colicky and may be altered by a change in position (Brendler 1998). It can be affected by jolting movements but may not by spinal movements. A bladder infection can also refer pain to the lower abdomen (Ogilvie & Evans 1987). In some bladder conditions there may not be obvious changes in urine. Acute pyelonephritis may present with aching in T12 to L1 lateral to the spine; this pain arises from acute distension of the capsule of the kidney and can be dull and constant, which may radiate to the pelvis and the groin. Kidney stones may present as back pain which radiates to the flank or the iliac crest (Bullock et al 1994).
In gynaecological conditions patients often complain of backache, where the nociceptive innervation of the uterus is confined to the lining of the cervix and referred backache is caused by distension of the structure (Bonica 1990, Guzinski 1990, Goodman & Snyder 1995). Prostate problems often present with accompanying lumbosacral backache (Fenoglio-Preiser et al 1989).

Patients with functional abdominal pain appear to complain of more back pain than a group of controls (Jorgensen & Fossgreen 1990). Many patients showed vertebral anomalies localised to the lower thoracic and upper lumbar segments, the same ones that innervate the gastrointestinal system. This suggests the link of abdominal pain and back pain. It is proposed that the back pain may arise due to the viscero-somatic reflexes, where the stimulation of visceral receptors might, via afferent nerves to the spinal cord, spread to corresponding dermatomes and myotomes causing spinal tenderness and fixation of the vertebra (Lewit 1978, Cervero & Connell 1984, Cervero & Tattersall 1985, Cervero 1986, 1987, Jorgensen & Fossgreen 1990). Care must be taken when assessing a patient in order not to misinterpret these musculoskeletal signs as the cause of a patient’s abdominal pain. The spinal symptoms are a result of the visceral pathology not the cause of it.

The viscera have been described as the “great deceivers” in terms of patterns of presenting pain (Grieve 1986b). Many clinicians have been deceived by patients presenting with apparently musculoskeletal problems. For instance, an 18-year old female presented with right-sided upper lumbar pain on walking and sitting, eased by lying down and no other clinical details of significance. On examination of her spine this appeared to be a postural problem. At her next consultation she reported that there was blood in her urine and a renal scan clearly showed a kidney stone (Hunter 1995).
**Musculoskeletal Pain**

The pain quality provoked from somatic structures depends more upon the structure stimulated than upon the nature of the stimulus (Lewis 1938). Cutaneous pain is usually described as focal, within well defined boundaries and can be of a burning quality. An increase in the density of nerve endings in the skin probably accounts for increased sensitivity (Weddell 1945).

Ligamentous and muscle pain has been described as aching in quality, and injection of these structures can give rise to some referred pain (Kellgren 1938, Lewis 1938). Figure 13 demonstrates the areas of referred pain following injection of the interspinous ligaments. Different muscles were found to differ in sensitivity (Kellgren 1938). Repeated injections of these soft tissues produced consistent patterns of pain distribution for each individual (Kellgren 1938).

![Figure 13: Distribution of pain arising from injection of interspinous ligaments T2 to L2. Alternate areas are hatched and stippled. (Reproduced by kind permission. Kellgren J.H. (1939): On the distribution of pain arising from deep somatic structures with charts of segmental areas. Clinical Science 4/1, 36. Portland Press.)](image)

Some muscles have widespread origins and insertions and, not surprisingly, stimulation of these muscles may well produce patterns of pain at a distance from the muscle location muscle itself. Structures deep to the ligaments, including zygapophyseal joints, give rise to a more diffuse pain which follows...
a segmental pattern with diffuse boundaries (Kellgren 1939, Dreyfuss et al 1994a, 1994b, McMahon 1994).

Pain may also arise from damage to the nervous system itself. Neurogenic pain is the term used to describe damage to the nerve roots. Pain may originate in neural tissue 'outside' the spinal cord's dorsal horn or, in the case of facial pain, 'outside' the cervicotrigineminal nucleus (Bowsher 1994).

Neurogenic pain is often described as burning or shooting, and is aggravated by cold and stress, which suggests autonomic involvement. These patients can suffer from allodynia where pain is produced by non-painful stimuli, for instance, light touch and cool objects (Merskey 1986). There may possibly be sensory defects, where sensitivity to pinprick and temperature are diminished.

Early work on root pain observed that most patients had muscle weakness or numbness in association with their pain (Lewis 1938, Kellgren 1939). Studies have looked at differentiating between somatic referred and root pain. Somatic referred pain, for example, from the stimulation of non-neural soft tissue and facet joints as well as the annulus, has been described as deep, dull, static, nauseating, boring and aching in quality, and hard to localise (Feinstein et al 1954, McCulloch & Waddell 1980, Dreyfuss et al 1994a, 1994b). None reported the pain as sharp, electric, burning or tingling (Dreyfuss et al 1994). In contrast, stimulation of the nerve root gives a sharper, well localised pain often with paraesthesia, and is described as electric, sharp or shooting (McCulloch & Waddell 1980).

Referred pain from the musculoskeletal system

Studies in the 1930's showed patterns of referred pain after stimulation of muscle and deep somatic structures (Kellgren 1938, 1939, Lewis 1938, Lewis & Kellgren 1938). More recently, it has been noted that experimental and
clinical data are not always the same. Hockaday and Whitty (1967) showed that the site of pain reference from connective tissue lesions is quite variable. Each individual's response to the stimulation of pain sensitive structures will remain consistent but the distribution pattern will vary from person to person (McCall et al 1979). This work does not support the concept of anatomically fixed segmental reference-like dermatomes or scleratomes as stated in earlier work (Kellgren 1938, 1939, Lewis 1938). Referred pains may miss out a segment and spread into adjacent segments (Hockaday & Whitty 1967). For an individual the reference site appears to be constant and individual scleratome maps would be valid. The presence of overlap between each individual level indicates the lack of clear segmental innervation (Doran 1967, McCall et al 1979, Bogduk & Valencia 1994, Dreyfuss et al 1994a, 1994b).

Rigid adherence to textbook schematic representation can lead to a misinterpretation of a patient's symptoms (Grieve 1986a). Unfortunately, symptoms that do not fit into the textbook patterns are often unjustly regarded as inconsequential (Brodal 1981). Farfan (1977) emphasises this concept: "The surgeon forced to depend on the neurological signs leans on a broken reed. In 60 to 65 per cent of instances the neurological signs indicate only the 'neurologic area' in which to seek the problem."

Grieve (1986a, 1986b) suggests that, rather than relying on textbook patterns of a patient's symptoms, a thorough physical examination consisting of careful palpation of each segment is vital to ascertain which segments and structures are responsible. It is well to remember that a patient's complaint may not be due to a single pathology. Two or more separate lesions may produce symptoms in the same area (Hockaday & Whitty 1967, McCall et al 1979). Hence, the location of any referred pain cannot be used to deduce the exact segmental location of its source (Bogduk & Valencia 1994). One set of symptoms may obscure the presence of the other and thus lead to confusion as to their source (Ashby 1977).
Referred tenderness

Patients with pain often complain of tenderness or an increased sensitivity which may be local at the site of the lesion, over the surrounding areas or at a distance from the lesion (Fairbanks et al 1981). A patient with referred tenderness in the abdominal wall may be subject to an unnecessary laparotomy. Rib angles often become exquisitely tender when there is a lesion in the thoracic spine. Apart from tenderness the skin can become acutely sensitive, often with patients being unable to tolerate tight clothing. Other reflex changes that can occur are pallor, coldness, sweating, altered soft tissue texture and thickening (Grieve 1986a).

Sensory disturbances may be appreciated in seemingly unrelated areas (Appenzeller 1978) and can be ignored or dismissed by clinicians as having no relevance. Poor correlations have been found between sensory pattern changes and the segmental level of the lesion (Davis et al 1952). Investigations have noted that, in addition to pain, muscle rigidity and referred hyperalgesia are noted when areas of the spine are injected. This may be local to the area or at a distance from the site of the injection (Hockaday & Whitty 1967, McCulloch & Waddell 1980). Work completed by Travell and Simon (1983) has extensively investigated tenderness in the immediate area of soft tissue "trigger points" and has described areas of referred tenderness at some distance from these points (see Figures 18 and 19, pages 80 and 81, for examples).

Differentiation between pain of visceral and musculoskeletal origin

It can be difficult to differentiate between pain of musculoskeletal and visceral origin. Generally, it is thought that patients with musculoskeletal pain will have symptoms that are aggravated by movements and certain postures and relieved by rest, antalgic postures and activities. This pattern
of provocation and relief comprises the distinguishing features. Musculoskeletal pain may be constant but is more likely to be intermittent. On the other hand suspicions of non-musculoskeletal pain are raised when a patient complains of pain that is constant, is less influenced by posture and complain of severe night pain (Maitland 1988, Goodman & Snyder 1995). Although this can be the case for many patients, it is far too simplistic to be classed as a rule. It is known that many visceral diseases do not behave in this way and can easily mimic musculoskeletal conditions (Grieve 1994a, 1994b). Many patients with visceral disease are able to relieve their symptoms by adopting various postures. Kidney pain may be relieved with the patient leaning towards the uninvolved side (Brendler 1998). Gall bladder pain may decrease with the patient leaning forward, as does pancreatic pain which may also be relieved with the patient sitting upright, leaning forwards or lying on their left side hugging their knees (Epstein et al 1992, Goodman & Snyder 1995, Hawes & Sherman 1995, Lankisch 1995).

Many serious pathologies can mimic benign musculoskeletal conditions in terms of aggravating and easing movements. Acute appendicitis will be aggravated by movements, including hip flexion, walking and lumbar spine movements and can be eased by drawing the legs up to the chest (Goodman & Snyder 1995). Upper urinary tract infection may be aggravated by activity and relieved by rest (Fox & Saunders 1978). In patients with bone tumours the pain is aggravated when supine but decreases once up and about (Sim et al 1977). Intradural tumour pain is aggravated by sneezing and lying down but can be eased by walking around (Cassidy et al 1997). Thoracic neurofibroma pain can be provoked by coughing, bending and sneezing but can be relieved by rest in some and exercise in another (Black 1944). Symptoms of spinal cord malformations can be provoked by stooping and exercise yet relieved by rest (Amnioff & Logue 1974). Many musculoskeletal conditions do not fit into the “aggravated by movements/eased by rest” scenario, including zygapophyseal and some disc conditions.
One should always be concerned when the patient complains of severe back pain yet has full, pain free range of movement or when no position reduces the pain, especially where there is no particular cause for the pain and the symptoms are increasing (Grieve 1994b, Goodman & Snyder 1995). Suspicions of a non-musculoskeletal cause to a patient's pain should be raised where a patient has painful and limited side flexion away from the painful side when both rotations are free (Cyriax & Cyriax 1993).

However, all the classic features of musculoskeletal disease, including pain aggravated by movements, may occur in tumours of the vertebral column (Sim et al 1977). In fact, it is probably best to avoid being dogmatic about the nature of musculoskeletal and non-musculoskeletal conditions. There are many areas of overlap in symptom presentation.

It is wise, therefore, to be mindful of non-musculoskeletal pain if a patient describes their back pain as being worse at night and as being unaltered by position (Borianai & Weinstein 1997). They may find relief moving around, sleeping curled up, writhing around, pacing the floor or sleeping in a chair (Cole 1987, Grieve 1994a, 1994b, Goodman & Snyder 1995, Borianai & Weinstein 1997). This may include such conditions as vertebral osteomyelitis, septic discitis, Cushings disease, osteomalacia, primary and metastatic cancer of the spine, Paget's disease, ankylosing spondylitis and TB spine. If night pain is relieved by aspirin then osteoid osteoma should be suspected (Borianai & Weinstein 1997). Many patients, however, with back problems, including disc and zygapophyseal disorders, have interrupted sleep and find relief by moving around and pacing the floor (Coyote 1998). Discogenic night pain is more often provoked by movement in bed and the lower day-time intensity due to gravitational compression (Bianco 1968).

Generally, visceral disease will have associated symptoms. Where back pain is accompanied by haematuria, nocturia, change in stool including melena, nausea, fatigue, vomiting, chills, diarrhoea, fever, night sweats, weight loss,
loss of appetite, gait disturbance or pain altered by foods, a non-musculoskeletal cause should be investigated (Borianai & Weinstein 1997).

Bladder and bowel changes since the onset of symptoms may indicate cord compression from a variety of sources including disc and spinal tumour. Severe writhing pain with sweating and dizziness may indicate a vascular catastrophe, such as a ruptured abdominal aortic aneurysm. Trigger points producing musculoskeletal pain may also be associated with nausea and sweating (Travell & Simon 1983). Generally, musculoskeletal pain will not have any associated symptoms.

The onset of the symptoms is not a good indicator of the nature of the problem. However, one needs to be alert when a patient has a sudden onset of severe backache for no apparent reason as malignancy may be the cause (Goodman & Snyder 1995, Borianai & Weinstein 1997). Similarly, back and abdominal pain at the same level should also raise one suspicions.

Appendicitis presents one of the most intriguing problems of diagnosis. Lane and Grabham (1997) suggest that right iliac fossa pain is often diagnosed as appendicitis but as many as 30 per cent of appendectomies are not needed. Particular difficulty arises in differentiating between appendicitis and pelvic inflammatory disease in females; other diagnoses include tears of the right iliopsoas muscle, right external oblique aponeurosis, superficial inguinal (Lacroix et al 1998) and ring-torn uterosacral ligament (Kumar 1996).

If a patient's symptoms cannot be reproduced or altered then further investigations are required. It is important to remember that both musculoskeletal conditions and visceral disease can be present at the same time. Pain from heart disease and from the chest wall can present in the same region, as can gallstones and thoracic pain (Goodman & Snyder 1995). An awareness of the areas to which visceral disease can refer pain is important as in many instances physiotherapists are first line clinicians.
Chapter Four

Musculoskeletal Sources of Abdominal Pain

"Life is not a composite of the functions of the viscera. Man does not perform glomerular filtration and tubular reabsorption; he does not vasodilate, he does not constrict and he does not oxygenate; he does not peristalse and he does not secrete. Life is not the sum of the activity of our internal organs, despite the preoccupation of medicine with those internal organs.

"Man does all things that we see each other do. He moves, runs, works, plays tennis, builds buildings..... Human life is expressed through the contractile processes of striated muscle. Every aspect of human life as acted out by the body's muscles and joints" (Korr 1967).

The musculoskeletal system is seen as the primary machinery of life: "Every aspect of human life is acted out by the body's muscles and joints" (Korr 1967). In this study attention has been focussed on those structures of the musculoskeletal system that have the potential to produce abdominal pain. The musculoskeletal system can be viewed as a participant in the response of the total body to the stresses placed upon it by the internal and external environment (Greenman 1978).

The thoracic spine

The musculoskeletal system has a unique capacity for producing a plethora of symptoms which can seem unrelated at times. Where pain is the chief complaint, one must be aware that in some cases things may not be what they appear. The thoracic spine has been described as having the "capacity for much mischief" (Grieve 1994b). Musculoskeletal disorders can masquerade as abdominal, pulmonary and cardiac conditions and visceral
conditions can produce symptoms that appear to be musculoskeletal in origin (Grieve 1986b, Errico et al 1997). Patterns of pain from the viscera can dupe the unsuspecting clinician (Maigne 1996). The accompanying symptoms of thoracic pain can be misleading which can lead to incorrect diagnosis and inappropriate treatment. Patients often complain of a mixture of symptoms, including nausea and vomiting, bloatedness, local areas of tenderness and sweating, as well as pain, indicating that the autonomic nervous system is involved (Grieve 1986b).

Pain in the thoracic area poses more diagnostic difficulties than in any other region of the spinal column due to its link with the viscera via the sympathetic and parasympathetic nerves. Both visceral sympathetic and somatic nociceptive afferents converge in the same dorsal horn (Cervero & Connell 1984, Cervero & Tattersall 1985, Cervero 1986). Also, visceral and somatic noxious stimuli may be conveyed in the same spinothalamic tract (Foreman et al 1981, Ness & Gebhart 1990). Thus, pain in the thoracic spine region may be referred from the viscera or from local structures in that area. It has been shown that the thoracic spine can be responsible for producing symptoms similar to angina and it is recommend that in all cases of angina pectoris the thoracic spine should be examined (Hamberg & Lindhal 1981, Bechgaard 1981). It must be remembered that the thoracic spine is the commonest area for metastatic tumours (Murray et al 1989, Simeone & Lawner 1992, Borianai & Weinstein 1997, Kostuik 1997).

Over the years there has been a prolific amount of research into the cervical and lumbar spine; by contrast, one could argue that the thoracic spine is the poor relation and has been neglected. One of the reasons for this may be that the thorax is generally considered as a relatively motionless and rigid structure, contributing little to overall spinal motion. Yet the thoracic spine is capable of six degrees of motion along the three cardinal axes of the body as shown in Figure 14 overleaf (Lee 1993). It has been shown as a complex
three-dimensional structure with coupled motion characteristics (Panjabi et al 1976, Lee 1994).

Figure 14: Movement at a motion segment of the thoracic spine has six degrees of freedom: 1 = Translation along the anteriorposterior axis (Tz); 2 = Translation along the latero-medial axis (Tx); 3 = Translation along the superoinferior axis (Ty); 4 = Rotation around the Z axis (Rz); 5 = Rotation around the X axis (Rx); 6 = Rotation around the Y axis (Ry). (Reproduced by kind permission. Valencia F. (1988): Biomechanics of the thoracic spine. In Physical therapy of the cervical and thoracic spine, Grant R. (ed.). Pp 44. Churchill-Livingstone.)

The thoracic spine is an intricate and integral part of the body, with its own abilities, interfaces and relationships. Panjabi noted there are three distinct regions in the thoracic spine: upper, middle and lower segments. The two end segments appear to be transitional zones towards cervical and lumbar regions. The middle zone T3-T9 is of utmost importance due to the combination of a narrow canal and critical vascular supply (Panjabi et al...
1991, Errico et al 1997). This has significance where there is spinal injury or deformity, or when spinal surgery is performed (Currier et al 1992, Errico et al 1997).

It has been found that the size of the canal is related to the incidence of back pain (Porter et al 1980) and the canal is affected by physiologic stresses in childhood (Clark et al 1985). This narrow canal increases the susceptibility to cord impingement and may well play a part in the cause of abdominal pain.

The lower region -- the transition zone from thoracic to lumbar -- shows a distinct enlarging of the spinal canal from T10-T12. This occurs when the ribs change from a complete unit at T10 to floating ribs at T11 and T12. As a result of this the spine shows less resistance at this level (Panjabi et al 1991).

There are other significant anatomical differences between the mid-thorax region (T3-T9) and the lower thoracic region (T10-L1). The facets of the transverse processes of the lower mid-thoracic vertebrae are more plane than those of the upper mid-thoracic vertebrae and tend to be orientated in a superolateral direction (Williams et al 1989).

It is important to consider that the thoracic spine has more articulations than any other part of the spinal region. In addition to the intervertebral body and zygapophyseal joints, it has two extra complexes in the form of the costovertebral and costotransverse joints where the ribs attach. The rib articulations and musculature add significant stiffness to the region (Andriacchi et al 1974).

Ribs one to seven are regarded as true ribs being connected by costal cartilages to the sternum. The remaining five are regarded as false with the cartilages of the eighth to tenth joining the superior costal cartilage. The costo cartilage tips of the eleventh and twelfth ribs do not articulate with the
anterior chest. The eleventh and twelfth ribs do not have a costotransverse joint and articulate only with the body of T11 and T12 respectively. The inferior demi-facet on the body of T9 for the tenth rib is small and often absent. This rib articulates with one facet on the body of T10 and often does not attach to the transverse process at all (Williams et al 1989).

**Innervation and sources of pain**

Few studies have been completed on the innervation of the thoracic spine. Groen has recently clarified the innervation of the thoracic disc and surrounding structures. They noted that it is innervated by a dense microscopic plexus which accompanies the anterior and posterior longitudinal ligament (Groen et al 1990). Other studies have described the thoracic dorsal rami and the thoracic sinuvertebral nerve (Bogduk & Valencia 1994). The structures that receive innervation and which are, therefore, potential sources of pain include the thoracic vertebrae, that is, the zygapophyseal joints, dura mater, intervertebral discs, longitudinal ligaments, posterior thoracic muscles and the costotransverse joints (Bogduk & Valencia 1994, Dreyfuss et al 1994a, 1994b).

**Zygapophyseal, costovertebral and costotransverse joints**

Compared to the data on the cause of lumbar and cervical spine pain, data on the thoracic spine is lacking. Analysis of pain symptoms must be based on extrapolated principles derived from studies on the cervical and lumbar spine together with the few studies on thoracic spine (Bogduk & Valencia 1994).

The zygapophyseal, costovertebral and costotransverse joints can be responsible for both local and referred pain (Nathan et al 1964, Shealy 1975, Wilson 1987, Skubic & Kostuik 1991, Bogduk & Valencia 1994, Dreyfuss et al 1994a, b). The zygapophyseal joints in the thoracic spine have been
shown to contain a small number of mechanoreceptors that may provide proprioceptive and protective information to the central nervous system regarding joint function, stability and position (McLain & Pickar 1998).

Pain patterns from the zygapophyseal joints in the thoracic spine have been described (Dreyfuss et al 1994a, 1994b). Posterior thorax pain may be unilateral or bilateral and can radiate to and from the spine (Valencia 1988, Dreyfuss et al 1994a, 1994b). Degenerative thoracic spine disease is uncommon when compared to that of the lumbar spine. Thoracic zygapophyseal arthropathy has highest frequency at C7-T1, T3-T5 and T11-L1. Isolated levels are uncommon (Nathan 1962, Nathan et al 1964, Shore 1985).

The costovertebral joints presenting with full facets, particularly at T1, T11 and T12 appear to be most affected by arthritic changes (Nathan et al 1964). This suggests that this type of joint is more vulnerable to the mechanical irritation of constant rib motion than is the type of joint seen in the remaining vertebrae, where two hemi-facets are separated by the intervertebral disc and the intra-articular ligament. Support from surrounding soft tissues may play some part in reducing mechanical trauma in the costovertebral joints as it does in the intervertebral joints themselves (Nathan et al 1964).

The inferior costovertebral hemi-facets of the vertebrae were found to be more affected by arthritis and this may be due to the obliquity of the ribs that point medially and upwards against the vertebral bodies. The close relationship of the intercostal nerves and the sympathetic plexus to these arthritic changes could account for radiating symptoms along the line of the peripheral nerve even to the abdominal wall and altered sensations due to interference with the sympathetic plexus (Nathan et al 1964, Mollica et al 1986).
Patients may present with simple back ache but can also complain of abdominal and chest wall pain (Slocumb 1984, Mollica et al 1986). Their back pain may not be mentioned due to the dominance of the abdominal pain, as symptoms at the source may be inconsequential for the patient. The pain may be described as “deep”, “dull ache”, “boring”, “cramp-like”, “nauseating” and “similar to delayed muscle soreness” (Dreyfuss et al 1994a, 1994b). Other symptoms may include radiculopathy, myelopathy and pseudo-claudication which can develop gradually. Acute myelopathy may present after minor trauma to the area (Mitra et al 1996).

The onset of pain may be sudden, for instance, after lifting or twisting, or of gradual onset and can be accentuated by movements of the thorax including deep breathing and coughing (Mollica et al 1986). Examination of this patient can often detect faulty postural mechanics with an increased thoracic kyphosis (Mollica et al 1986, Grieve 1988, Maitland 1988). The posterior pain may manifest itself when the patient returns from a flexion manoeuvre and is often accentuated by hyperextension in the case of zygapophyseal degeneration. In examining the spine, tenderness is often located over the costotransverse articulation and this tenderness may follow the line of the intercostal nerve. Lateral pressure on the spinous process is a useful technique to determine the level affected. This technique produces vertebral rotation which tends to compress the facet joints on one side, and distracts them on the other side with tension on the capsule; clinically there may be sensory changes on the surface of the abdomen (Cyriax & Cyriax 1993).

Radiological examination, including computerised tomography (CT), demonstrate facet hypertrophy, ossification of the ligament flavum and the posterior longitudinal ligament and multi-level osteophytes.

Lignocaine intercostal blocks are often the choice of treatment if conservative therapies fail (Ashby 1977, Mollica et al 1986, Errico et al 1997). Tenderness near the tip of the vertebral transverse process is a particularly valuable sign
if a local injection is the treatment of choice. This could be explained by the intercostal nerve being relatively exposed at this point (Ashby 1977). Excision of the vertebral end of the rib, including the head, neck and costovertebral joint with its ligaments, in an attempt to relieve the pain has been described (Raney 1966).

Thoracic canal stenosis is the result of degenerative changes in the three-joint complex of the spine (disc and zygapophyseal joints), with osteophyte narrowing of the canal resulting in pain and neurological symptoms. The site of the cord compression may be central within the canal, or more lateral within the lateral recess, or within the neural foramen or some combination of these (Errico et al 1997). Canal stenosis in the thoracic spine, although uncommon, can have serious consequences due to the anatomy of the thoracic vertebrae and spinal cord as discussed earlier. Localised stenosis can be treated by surgical decompression but the outcome of decompression for diffuse stenosis is poor (Mitra et al 1996).

In summary, a vertebral origin of abdominal pain should be suspected where this pain is accompanied by back pain and is related to specific movements or positions adopted by the patient. There are areas of abdominal hyperaesthesia and segmental lumbar or thoracic movements that provoke the patient's pain. Confirmation of this hypothesis can be made if there is clear improvement with the infiltration of the suspected site (Ashby 1977, Mollica et al 1986, Gallegos & Hobsley 1992).

**Osteophytes**

The predominance of anterior osteophytes in the thoracic spine, particularly at level 10 and on the right side, has been demonstrated. By the age of 40 years, all cadavers examined exhibited anterior osteophytes (Nathan 1962). The osteophytes of the lumbar and thoracic spine appear to develop earlier and faster than in the cervical and sacral regions but, after the age of fifty
years, the cervical ones developed faster so that in the seventh decade the incidence was similar to that of the lumbar and thoracic spine.

In the thoracic spine there is an asymmetrical distribution of osteophytes which appears to be related to the position of the aorta. As the aorta descends on the left hand side of the spine at level T5-12, osteophytes are found on the right hand side. From the point where the aorta reaches the mid-line until its termination, osteophytes develop symmetrically on both sides of the vertebrae, forming a kind of canal for the artery. Figure 15 demonstrates the distribution of right- and left-sided osteophytes. The costovertebral joints may play some part in limiting the posterior extension of osteophytic development (Nathan et al 1964).

Figure 15: The distribution of right- and left-sided osteophytes of the vertebral column in 346 skeletons of white and negro races of both sexes. This shows a preponderance of osteophytes along the right side of the 5th to 12th thoracic vertebrae and show the highest frequency are found in the thoracic region. (Reproduced by kind permission. Nathan H. (1962): Osteophytes of the vertebral column. J. Bone Joint Surg. 44/2, 243-68. Br. Ed. Soc. Bone Joint Surg., London.)
The thoracic region showed the greatest incidence of fusion of vertebrae particularly at the ninth and tenth levels (Figure 16). The localisation of the osteophyte was generally characterised by the shape of the vertebrae.

![Graph showing distribution of 4th degree (fused) anterior osteophytes in the different vertebrae.](image)


Osteophytes appear to be outgrowths of healthy bone that develop as a defence mechanism against pressure movements of the trunk (Nathan 1962). They tend to develop where the pressure is greatest and they are generally stronger than the rest of the vertebrae, being composed of compact bone rather than cancellous bone (Nathan et al 1964).

The greater frequency of anterior osteophytes seems to be the result of the greater pressure to which the anterior part of the vertebrae is exposed during movements. During flexion the anterior portion of the vertebrae must absorb all the forces exerted by the body weight and any weight being lifted. In extension the load on the posterior part is mitigated to some extent by the posterior zygapophyseal joints and neural arches (Nathan et al 1964).
**Spinal neoplasms**

Neoplastic diseases of bone can affect the thoracic vertebrae. Primary tumours of the skeleton are rare but the thoracic skeleton is the commonest site of metastatic deposits from carcinoma and resultant spinal cord compression (Murray *et al* 1989, Simeone & Lawner 1992, Weinstein & McLain 1992, Borianai & Weinstein 1997, Kostuik 1997). Skeletal metastases are produced by all forms of malignancy, with the prostate, breast, lung and lymphoreticular being the most common (Errico *et al* 1997, Kostuik 1997). Spinal neoplastic disease is most frequent in the thoracic spine especially at T4 and T11. This may be due to the proximity of thoracic segments to the lungs and breasts, the common sites of origin for spinal secondary deposits (Simeone & Lawner 1992).

Although neoplastic pain is often described as being continuous, it is not always necessarily so. In some cases the pain can be relieved by moving around and by adopting antalgic positions. Systemic back pain is often not eased by recumbency. Bone pain of metastases is often accompanied by fever, fatigue, weight loss and chills. A patient may be unable to lie still, particularly supine, or describe sleeping in a chair or curling up to sleep or pacing the floor as easing their symptoms (Sim *et al* 1977, Borianai & Weinstein 1997). The clinician should be suspicious where a patient presents with a sudden onset of progressive central back pain, pain down the limbs which is non-dermatomal and gross weakness in the legs with full straight leg raise (Grieve 1994b, Goodman & Snyder 1995). Pathological fractures are not uncommon which may produce radicular pain and spinal cord compression (Simeone & Lawner 1992, Borianai & Weinstein 1997). Metastatic cancer must be considered when unexplained spinal pain develops in a patient with known primary cancer (Kostuik 1997). 'Bony lesions can be clinically “silent”, but they can often be detected by a bone scan and by blood screening for hypercalcaemia.
Osteoid osteoma and osteoblastoma present with severe spinal stiffness and pain with a scoliosis to the affected side, with the tumour being on the concave side (Dixon 1980, Weinstein & McLain 1992). If the scoliosis is of rapid onset this may indicate a rapidly expanding tumour which may result in neurological deficits (Borianai & Weinstein 1997). The pain is often worse at night but is often dramatically relieved by aspirin. It is found mainly in children and adolescents; and rarely in patients above the age of 30 years old (Weinstein & McLain 1992). The pain is often referred and so treatment and investigation may be focused in the wrong direction. Sim believes that of all the tumours that may simulate a benign musculoskeletal condition, osteoid osteoma is probably the most guilty (Sim et al 1977).

Ewing's sarcoma commonly presents in the first three decades. Although the majority are involved in the sacrum, the thoracic spine is more frequently involved than the lumbar spine or the cervical spine (Weinstein & McLain 1992, Borianai & Weinstein 1997).

Although not a spinal tumour, malignant testicle tumours are worth mentioning as they often present as thoracic pain initially. Metastases from the testes progresses through the lymphatics via the spermatic cord to the para-aortic, retroperitoneal and retrocrural lymph nodes, then through the thoracic duct to the posterior mediastinum and supraclavicular lymph nodes. Vascular spread may also occur, usually involving the lungs as well as the lymph nodes (Grieve 1994a, Horwich & Bajolin 1997).

However, the first complaints of a patient may be of thoracic pain when the para-aortic lymph nodes are involved as the primary tumour is often painless. The pain may often be provoked by coughing and sneezing and they may have a marked night pain; symptoms which are not uncommon in patients with mechanical back pain (Horwich & Bajolin 1997). In several cases, treatment for the back pain was undertaken, before progressing
neurological signs alerted the clinician to investigate further (Cole 1987). In the advanced stage there can be weight loss, lethargy, malaise and dyspnea. X-ray investigations will only reveal metastasis of vertebral bone when the involvement is gross or at least well advanced (Grieve 1994a).

Other disease processes affecting the thoracic spine

Rheumatoid arthritis can affect the costotransverse, costovertebral and zygapophyseal joints and the disc (Simpson & Booth 1992). Dissection of the rheumatoid spine shows lesions in the thoracic discs due to spread from adjacent costovertebral joints. The costovertebral joint is affected more than the costotransverse and the zygapophyseal joints (Bywaters 1974). Synovial cysts at the zygapophyseal joint can impinge as an epidural mass on the spinal cord causing pain or neurological deficit (Harris 1993).

Adolescent osteochondritis (Scheurmann's disease) is normally painless but it may result in a kyphosis in the thoracic spine which may precipitate a disc lesion over time. The increased kyphosis and disc lesion could lead to pain being referred to the abdomen (Bohlman & Zdeblick 1988, Yablon et al 1988, Balague et al 1989, Errico et al 1997). Patients may present with limited extension of the spine (Cyriax & Cyriax 1993, Cassidy & Petty 1995).

With ankylosing spondylitis the thoracic spine is affected as the disease progresses with all the joints of the spine being affected (Bywaters 1974, Bessette et al 1997). The patient presents with a classic stiffened spine, the lumbar spine becoming flattened and rigid. As the thoracic spine becomes affected it develops the classic thoracic kyphosis and the patient may complain of abdominal pain (Simpson & Booth 1992, Cyriax & Cyriax 1993, Wollheim 1993).

Senile osteoporosis, which mainly affects post-menopausal women, involves the thoracic spine. In the main, osteoporosis affects the trabecular bone
which results in wedging. Crushing of the vertebral body is progressive with resulting irreversible spinal shrinkage and deformity. Shrinkage of the thoracic and lumbar vertebrae results in increased abdominal creases and the potential for abdominal pain. The distance between the tenth rib and the iliac crest is reduced to the point of impact which can be painful (Woolf & St John-Dixon 1988, Hall & Einhorn 1997). Paget's disease can affect all the vertebrae: in 65 per cent of cases the lumbar spine is affected, with L4 and L5 being most commonly affected; in 45 per cent it is the thoracic spine. Patients present with back pain and some may exhibit symptoms of spinal stenosis. A marked kyphosis is often due to degeneration and pathologic fractures may also be present (Hall & Einhorn 1997).

Ribs

The ribs may account for abdominal and chest pain. The terms “rib syndrome”, “costochondritis”, “costochondralgia” and “Tietze's syndrome” have all been used to describe painful chest wall syndromes (Raney 1966, Grant & Keegan 1968, Pinals 1989, Errico et al 1997).

“Tietze's syndrome” is described as a painful, benign non-suppurative swelling involving one or more costochondral or sternoclavicular junctions (Errico et al 1997). The diagnostic criteria for all forms of this syndrome are the exact reproduction of the patient's symptoms when the area involved is compressed usually at the costochondral junction or over the painful cartilage area. The tender point would usually be localised to one or more costochondral junctions in either side of the anterior chest wall (Rawlings 1962).

On examination there is often little to see. There may be a minimal amount of swelling in the case of an acutely sprained rib articulation. Symptoms will be exacerbated by deep breathing, coughing and movements of the thoracic spine involving stretching, twisting and bending and turning over in bed.
(Rawlings 1962, Mollica et al 1986). The severity and duration of pain will vary. The patient is also able to locate fairly accurately the painful area. This pain is often described as deep and sharp "like pleurisy" or "heart attack" (Grant & Keegan 1968). This condition may affect one or several ribs and there may be accompanying tenderness of the dorsal spine in some cases, especially in the "vertebrocostal-costal syndrome" type (Skorneck 1960, Grant & Keegan 1968).

Pathological proof is limited. Since the cartilaginous tissue has a poor blood supply it is one of the few structures in the body not capable of manifesting the usual microscopic changes of inflammation. Gross changes of cartilage enlargements do occur at the costochondral junction (Rawlings 1962).

With pathological proof lacking, diagnosis is a clinical one. X-rays of the area involved demonstrate insignificant changes. Only in cases of presumed Tietze's syndrome has some literature shown that X-rays demonstrate increased density, porosity and expansion of the involved ribs, as well as perichondral and periosteal elevation with secondary enlargement of both cartilage and bone (Skorneck 1960).

There may be a history of trauma to the area which can be sudden or gradual, or associated with persistent cough and respiratory strains (Goodman & Snyder 1995). Minor mechanical deformities of the ribs may exist. There needs to be only a slight mal-alignment of the articulation of the rib to cause discomfort and pain in the thorax or the abdomen.

Infiltration of the area with local analgesia and cortico-steroid is often the treatment of choice. Although relapses and recurrences are common, the course of the condition is self-limiting and benign (Pinals 1989).
Slipping rib syndrome

Slipping rib syndrome occurs when the medial fibrous attachments of the eighth, ninth and tenth ribs is inadequate or ruptured allowing the cartilage tip to slip superiorly and anteriorly. This results in impingement on the adjacent rib or the nearby intercostal nerve (Cyriax 1919, McBeath & Keene 1975, Mooney & Shorter 1997). This condition may cause a variety of somatic and visceral complaints and is often confused with a gall bladder disorder (Lum-Hee & Abdulla 1997). There may be a perception of a slipping movement of the ribs or an audible click (Lum-Hee & Abdulla 1997).

Clinically, patients have pain in the inferior costal regions and will complain of “pain under my ribs” or “clicking under the ribs”. They may have accompanying pain in the back or around the axilla. They will be able to locate the pain fairly easily. The pain can vary in quality and severity but is often sharp and aggravated by deep breathing and physical activity. Hyperaesthesia can often be found along the line of the intercostal nerve (Vincent 1978).

Although generally present in middle-aged people it can affect children. In children it is felt to be a neglected entity and it is suggested that, if paediatricians were more aware of the syndrome, this group of patients could be spared numerous investigative studies (Porter 1985, Lum-Hee & Abdulla 1997, Mooney & Shorter 1997).

The onset in both adults and children can be insidious, although there may be reports of earlier trauma. Diagnosis is often by reproducing the patient's pain on palpation of the appropriate rib or cartilage. The hooking manoeuvre is often used to aid diagnosis (Heinz & Zavala 1977, Vincent 1978). As this syndrome is always unilateral, the hooking manoeuvre will be pain-free on the asymptomatic side. They suggest that the examiner should curve his fingers and hook them under the inferior rib margins and pull them anteriorly. If the costal cartilages are causing the condition, the
patient will recognise their characteristic pain and possibly a clicking sound as the cartilages rub against one another. Exhaustive investigations and X-rays are of little value except in ruling out other disorders and should be avoided (Wright 1980, Lum-Hee & Abdulla 1997, Mooney & Shorter 1997). Reassurance and injection of the affected area with local anaesthetic are first line treatments. Nerve blocks are sometimes successful. Surgery to remove the offending cartilage is reported to be successful in alleviating the symptoms in some cases (Vincent 1978, Porter 1985).

**Disc lesions**

Disc lesions are rare in the thoracic region but they do exist and may account for a higher proportion of thoracic pain than is often realised (Currier et al 1992, Cyriax & Cyriax 1993).

The anatomy of the thoracic spine predisposes it to spinal cord impingement. The thoracic canal is relatively small leaving little room for the spinal cord. The blood supply to the thoracic cord is also tenuous (Errico et al 1997). The signs and symptoms depend on the location of the herniation, the size of the lesion, the size of the bony canal and the health of the spinal cord (Currier et al 1992). Patients may present with pain, sensory disturbances, cold feet, weakness, tightness around the chest or abdomen and bladder and bowel dysfunction. The pain can be midline, unilateral, or bilateral. Coughing and sneezing may aggravate the symptoms (Carson et al 1971). Some disc lesions are asymptomatic (Errico et al 1997). Thoracic disc lesions most commonly occur at lower thoracic levels (T11-T12) and are often associated with pain in the lumbar region and abdominal pain. Compression of the T11 or T12 roots provokes discomfort in the iliac fossa simulating ureteral calculi or renal disease (Taylor 1964, Currier et al 1992, Errico et al 1997).

Articular signs in these patients are seldom obvious. Causes of disc disease include trauma and degeneration. Some authors have suggested an
association between Scheurmann's disease and herniated thoracic discs (Bohlman & Zdeblick 1988). Diagnosis is best done by magnetic resonance imaging (MRI) scanning (Currier et al 1992).

Discitis

Discitis is an inflammatory lesion affecting the intervertebral disc and has been shown to affect children, peaking at the age of six years (Stambough & Saenger 1992). It is a syndrome of symptomatic narrowing of the disc space associated with fever and elevated erythrocyte sedimentation rate (ESR). The disc narrowing occurs mainly in the lumbar spine but can occur in the thoracic (Menelaus 1964, Stambough & Saenger 1992). The aetiology is unclear. Some believe the lesion is caused by a traumatic separation of the vertebral end plate (Alexander 1970, Stambough & Saenger 1992); while others believe that the condition is of bacterial aetiology. The most common organism isolated is Staphylococcus aureus (Doyle 1960, Boston et al 1975, Wenger et al 1978).

Patients often present with a gradual onset of subchondral pain radiating to the umbilicus and have difficulty walking and sitting. There may be associated nausea and anorexia. Patients are often misdiagnosed initially with appendicitis and pyelonephritis.

On examination, they present with limited spinal movements, paravertebral muscle spasm and localised spinal tenderness and restricted straight leg raise. Abdominal examination in most cases is unremarkable. In the early stages there is often an absence of radiologic changes and bone scans are useful in confirmation of the diagnosis (Leahy et al 1984). Most children respond to antibiotics, rest and, in some cases, spinal plaster of paris jacket. Further spinal X-rays at a later date showed narrowing of disc space and, in one case, spinal fusion (Leahy et al 1984, Stambough & Saenger 1992). Disc space infection may present as severe pain at night, with the patient not
being able to sit up or get out of bed. The pain will become constant regardless of position or movement, but active movements may aggravate the pain (Kurz et al 1992, Goodman & Snyder 1995).

The abdominal wall

The abdominal wall comprises the parietal peritoneum, fat, aponeurosis, musculature and skin. The entire nerve supply of the anterior abdominal wall comes from the sixth to twelfth intercostal nerves and the first lumbar nerve (Williams et al 1989).

Seventy years ago Carnett (1926) described simulation of visceral pain by “intercostal neuralgia”. The symptoms were acute or chronic, constant or intermittent, and could spread over a period of years. His key signs were tenderness persisting when the abdominal muscles were tensed, combined with palpation.

The patient is examined supine and the site of the maximum tenderness identified by the patient. As the patient must be able to locate clearly the area with the tip of their finger, a more diffuse presentation of pain area is probably not going to respond to this examination procedure. The patient is asked to fold his arms across his chest and sit halfway up. If continued palpation at the same point elicits similar or increased pain then the test is said to be positive. Carnett’s hypothesis was that if the cause of the pain is intra-abdominal the tensed muscle should now protect the viscera and the tenderness should diminish. If the abdominal wall is to blame, the pain will be at least as severe or increase (Carnett 1926).

Recently, Carnett’s work has gained favour as a simple means of identifying abdominal wall disorders. Amended versions of the test have been devised to put less muscular stress on the patient so less fit people are able to complete the test. The patient is examined as before but they are asked to lift their
head and shoulders just enough to tense the abdominal muscles without flexing the trunk, while the clinician continues to palpate (Ashby 1977, Gallegos & Hobsley 1992, Sharpstone & Jones 1994). This revised test has been found to be sensitive and specific (Gray et al 1988, Greenbaum & Joseph 1991, Thomson et al 1991). However, it is problematic as to whether this test could implicate the thoracic vertebrae and other structures in that region which may produce abdominal symptoms. I consider that investigation and refinement of this test is necessary to rule out the involvement of the thoracic spine in contributing to a patient's symptoms.

Studies employing Carnett’s test estimated that a saving of US$900 was made per case on unnecessary investigations (Greenbaum & Joseph 1991, Greenbaum et al 1994) and that using the test avoids the “occasional misadventure of investigation” (Thomson et al 1991). Sharpstone and Colin-Jones (1994) say that a positive Carnett sign, followed by a successful injection of local anaesthetic, must be one of the most cost effective procedures in gastroenterology.

Other authors emphasise that every general practitioner should be able to diagnose a painful abdominal wall lesion and be able to treat it (Bourne 1992). In a series of 98 patients, between 75-100 per cent were cured with a local injection of a mixture of triamcinolone acetonide and lignocaine (Bourne 1980).

It is important to remember that a positive Carnett sign is not infallible and should be interpreted in the context of a full history taking and physical examination including examination of the dorsal spine and any peripheral areas that are relevant (Hall et al 1991, Thomson et al 1991).

The term “chronic abdominal wall pain” (CAWP) has been coined to describe pain within the abdominal wall and includes pain from nerve entrapment. It is recognised that many patients with CAWP are often misdiagnosed and
undergo investigations for visceral disease. Symptoms that are used to discriminate abdominal wall pain from visceral pain are where there is a constant site of superficial tenderness which should be able to be localised by the patient's fingertips. The area of maximum tenderness must be small (less than 2cm diametre) rather than a vague diffuse pain. This tenderness is increased by abdominal wall tensing. The application of these criteria and the response to local infiltration of anaesthetic appears to identify accurately most patients with CAWP (Greenbaum & Joseph 1991, Haubrich 1991 Greenbaum et al 1994).

Tears of the external oblique aponeurosis and superficial inguinal ring have been shown to cause lower abdominal pain in hockey players. The pain can have a gradual onset and be aggravated by ipsilateral hip extension and contralateral trunk rotation. The pain can be worse in the morning, especially hip extension from a sitting position and in getting up from a chair. Surgery revealed tears of the external oblique aponeurosis and tears of the superficial inguinal ring (Simonet et al 1995). The ilioinguinal nerve may be trapped in scar tissue formed at the area of the torn aponeurosis and it is felt that this plays a major part in the symptom presentation (Lacroix et al 1998).

**Intercostal neuralgia and abdominal cutaneous nerve entrapment syndrome**

Intercostal neuralgia and abdominal cutaneous nerve entrapment syndrome are terms used to describe pain and symptoms caused by compromise of the abdominal cutaneous nerves (Carnett 1927, Applegate 1972, Applegate & Buckwalter 1997). Symptom presentation can lead clinicians to the mistaken diagnosis of gallbladder disease and appendicitis (Carnett 1927). The sixth to tenth right intercostal nerves supply the right upper quadrant of the anterior abdominal wall and so irritation of these nerves is often mistaken for biliary lesions (Williams et al 1989).
Entrapment of the abdominal cutaneous nerve can occur anywhere along its length, but entrapment more commonly occurs where it is anchored at the following five locations (Applegate 1972, Applegate & Buckwalter 1997):

- Spinal cord.

- Origination point of the posterior cutaneous branch.

- Origination point of the lateral branch.

- Where the nerve makes an almost 90 degree turn to enter the rectus channel.

- The skin.

Figure 17 (page 75) shows in detail the site of anterior abdominal cutaneous nerve entrapment and area for infiltration of local anaesthetic.

The pathology appears to be ischaemia of the affected nerve (Applegate & Buckwalter 1997). It is suggested that the peripheral nerve gets compressed in a narrow space between a fibrous band or becomes kinked when turning sharply before suddenly changing course. This can arise when the anterior cutaneous branch of the thoraco-abdominal nerve becomes entrapped in the fascial sheath of the rectus abdominus (Mehta & Ranger 1971, Applegate 1972, Applegate & Buckwalter 1977, Doouss & Boas 1975).
Bony conditions that can cause compression and abnormal stretch on the nerve include where the nerve arises from the apex of the concave portion of a scoliotic curve. Angulation of the vertebrae due to degenerative disc disease may do the same thing. Scar tissue from surgery or trauma can compress the nerve. The T8 or T9 nerve can be entrapped in a cholecystectomy scar. Cases of biliary pain have been mimicked by neurofibroma of the seventh and eighth spinal nerve roots on the right side. Thoracic lateral cutaneous nerve entrapment has been cited as causing disabling abdominal wall pain in pregnant women (Peleg et al 1997).

Symptoms may present as localised tender spots at the edge of the rectus sheath and are often experienced as a severe, burning, intermittent pain but can be dull. It may or may not be affected by rest or exercise, although twisting and flexion movements often aggravate the pain (Applegate & Buckwalter 1997). Generally, there is no systemic upset. Paraesthesia and hyperaesthesia may be present and a patient may be unable to tolerate tight fitting clothes such as belts and waistbands (Doouss & Boas 1975). It is recognised that the abdomen needs to be examined specifically for tenderness localised to the anterior abdominal wall, the lower ribs or superior pubis particularly in or adjacent to incisional sites (Roberts 1962). The onset is generally insidious but direct trauma, intense abdominal muscle training or inflammatory conditions could also lead to entrapment of the nerve as it passes through or close to the abdominal muscle layers (Lacroix et al 1998). It is often treated with nerve blocks with local anaesthetic (Mehta & Ranger 1971, Hall & Lee 1988, Applegate & Buckwalter 1997, Peleg et al 1997).

Ilioinguinal and iliohypogastric nerve entrapment

The ilioinguinal and iliohypogastric nerve arises from the T12/L1/L2 nerve roots. These are nerves that are likely to be damaged during surgery, such as in appendectomy, hernia repair and Pfannensteil incision, as can any
cutaneous nerves in abdominal and thoracic surgery (Lacroix et al 1998). A patient may complain of a burning feeling in the iliac fossa, the inguinal region radiating to the groin and at the top of the thigh and the lower abdomen. It is often aggravated by movements such as walking and standing, while flexion of the hip often gives relief. It has been suggested that partial rhizotomy may be a valuable technique for long term pain control in cases where the first line treatment of intercostal blocks does not give relief (Haynsworth & Noe 1990).

Sharpstone & Colin-Jones (1994) say it is difficult to make a clinical distinction between a true nerve entrapment or a myofascial trigger point. They suggest that being able to distinguish between the two is not always possible.

Diabetic radiculopathy

Thoracic diabetic radiculopathy causing abdominal bulging and abdominal and trunk pain is a rare complication of diabetes (Chaudhuri et al 1997). There may be associated cutaneous hypersensitivity. Longstreth (1997) indicates that there is electromyographic evidence of nerve root denervation in some patients (Longstreth 1997). This condition predominantly affects the right side of the abdominal wall, although it may be bilateral, involving three to four adjacent nerve roots in the region of T6-T12 (Chaudhuri et al 1997, Longstreth 1997). The pain can be of various types, which may be aggravated at night, increased by light touch and may be accompanied by localised abdominal wall paresis with protrusion of the abdominals. Weight loss may be a feature which normally resolves as the pain is eased. Spontaneous recovery is the norm, but some patients have recurrent polyradiculopathy. Early recognition is essential to avoid expensive and extensive investigations of the viscera (Chaudhuri et al 1997, Longstreth 1997).
Fibromyalgia and myofascial syndrome

Fibromyalgia and myofascial syndrome are usually defined as chronic inflammation of the fibrous connective tissue in muscles giving rise to pain and stiffness. Patients may complain of multiple tender areas. One-third of patients with fibromyalgia also report symptoms consistent with irritable bowel syndrome (Romano 1988, Maigne 1996). Sleep abnormalities have also been correlated with musculoskeletal symptoms in primary fibromyalgia (Moldofsky & Scarisbrick 1976). Diagnosis of myofascial syndrome is dependent upon the demonstration of trigger points (Bennett 1993).

Iliocostalis myofascial syndrome is reported in a 47-year old man with C6 quadriparesis, which presented as tenderness in the right lower quadrant in the abdomen. Diagnosis of nephrolithiasis and appendicitis were considered but routine blood count and an abdominal X-ray intravenous pylogram were both normal. Examination revealed extreme tenderness in the right lower quadrant, right flank and right posterior subcostal area. A three-day course of spray and stretch to the iliocostalis cleared the symptoms (Schwartz et al 1984).

Other muscular causes can confound experienced clinicians. Sandford and Barry (1987) report a 61-year old woman with increasing right upper quadrant pain of several weeks duration. She had a history of gastrointestinal illness, including a previous cholecystectomy and three other abdominal surgeries, and underwent extensive abdominal investigations, all eliciting normal results. A physical medicine examination reproduced her abdominal pain by pressure on the latissimus dorsi and was localised on resisted internal rotation, extension and adduction of the shoulder. She reported that the week previous to the onset of the symptoms she had spent up to six hours a day playing the slot machines. Treatment consisted of spray and stretch techniques to the muscle along with re-education of muscle function.
Kondziella (1985) noted that a group of patients with non-specific pain in the upper, middle and lower abdomen suffered from stiffness of the psoas muscle but that no pathological findings were obvious. It appeared that the stiffness was caused by joint dysfunction at the thoracolumbar junction. Manual therapy and lignocaine injection were used to treat these disorders.

There is a wealth of muscle attached to and surrounding the thoracic spine both posteriorly and anteriorly, but there is little evidence to substantiate the concept of muscles causing thoracic pain (Bogduk & Valencia 1994). It is recognised that muscles provide effective protection and stability of the joints. Any pathological process that affects this stability may lead to a recurrence of pain or increase the vulnerability of that area to injury (Janda 1978, 1994, Panjabi 1992, Hides et al 1994, Cholewicki & McGill 1995, Hodges & Richardson 1995, 1996, Wilke et al 1995).

In conditions where patients experience acute pain the increase in muscle tone plays a decisive role in pain production. It has been suggested that this muscle tone increase is probably the link in the pathogenesis chain that is necessary to perceive a joint dysfunction as a painful condition (Janda 1994).

**Trigger points**

Myofascial trigger points are a common but often overlooked cause of abdominal pain (Maigne 1996). It is defined as a locus of hyper-irritability or point of hypertonicity associated with a taut band located within a muscle. If sufficiently hypersensitive it may give rise to referred pain (Travell & Simon 1983).

Trigger points cannot be located anatomically or histopathologically via biopsy or scans. There have been reports of fibrous tissue reactions and bands with fatty infiltration and aggregates of nerve fibres (Sharpstone & Colin-Jones 1994). The cause is open to conjecture; they may be caused by
mechanical overload, as a sequel to local inflammation, stress to the muscle including trauma or can represent viscero-somatic responses to visceral disease (Bonica 1990).

An active trigger point is always tender and found as a palpable band of muscle fibres which seem to prevent full lengthening of the muscle fibres caused by associated spasm (Travell & Simon 1983, Maigne 1996). Within the abdomen, myofascial trigger points are often found in rectus abdominus, transversus abdominus and the external obliques. Figures 18 and 19 show patterns of referred pain from trigger points in the abdominal muscles. Symptoms referred from these trigger points can sometimes mimic visceral disease (Bonica 1990). Patterns of pain from trigger points in the abdominal muscles are less consistent from patient to patient than patterns in other muscles.

![Figure 18: Pain patterns produced by trigger points (X) in the abdomen. A: Trigger point in the external oblique muscle overlying the lower part of the anterior chest wall. B: Pain in the groin and testicle, with radiation to the upper lateral abdominal caused by a trigger point in the lower lateral abdominal wall musculature. The solid black depicts the essential zone and stippled pattern depicts the spillover zone.](image-url)
Figure 19: Pain patterns produced by trigger points (X) in the rectus abdominus muscle. A: Right lower quadrant pain in the region of McBurney's point caused by a trigger point in the lateral border of the ipsilateral rectus abdominus muscle and by a trigger point at the upper attachment of the rectus abdominus muscle that occasionally causes lower esophageal spasm. B: Pain pattern produced by trigger points in the lower part of rectus abdominus. The solid black represents the essential zone and the stippled pattern represents the spillover. (Figures 18-19 reproduced by kind permission. Bonica J. (1990): Management of pain. 2nd Edition, pp 1279-80. William & Wilkins).

Paediatric abdominal pain

Recurrent abdominal pain is a common paediatric problem. Children with abdominal pain, where the cause had been thought to be psychosomatic, have exhibited tense and tender abdominal muscles (Apley 1975). They also demonstrated a typical pattern of muscular tension and tenderness, often with tension headache, tension chest pains and other general symptoms such
as loss of appetite and disturbed bowel habit. It is speculated that the cause of this phenomenon is part of a broader complex of reactions of central nervous system origin which consists of stress induced tension and attacks of pain in different muscle groups (Alfven 1993).

**Rectus sheath haematoma**

Rectus sheath haematoma is a rare cause of abdominal pain, but is a well recognised complication of abdominal trauma or surgery (Finnance *et al* 1995). Its location and presentation may lead the clinician to investigate the viscera (Hill *et al* 1995). Common causes include acute coughing attacks, anticoagulant therapy, muscular exertion, trauma, over-training of the abdominal muscles and hypertension (Maffuli *et al* 1992, Hill *et al* 1995). More uncommon instances can arise as a complication following marrow transplantation. This group of patients may be at risk due to prolonged inactivity, thrombocyopenia and administration of high doses of corticosteroids (Zainea & Jordan 1988). Suspected abrupto placenta can be misdiagnosed by clinical and ultrasound examination and rectus sheath haematoma is only detected at surgery. This type of haematoma is produced by disruption of a deep epigastric vessel (Rimkus *et al* 1996).


Summary

There is substantial evidence in the literature that the musculoskeletal system is capable of producing abdominal symptoms. Most authors agree that the vast majority of cases of abdominal pain are of visceral origin but one should always check the musculoskeletal system when the routine screening investigations are negative (Ashby 1977, Mollica et al 1986). Yet often, when a clinician is faced with a patient presenting with abdominal pain, musculoskeletal causes are only thought of when everything else has been ruled out. By this time the patient may have undergone extensive investigation, suffered unnecessary anxiety and may be left with a label of irritable bowel syndrome without resolution of their symptoms.

The need to rule out serious pathology is acknowledged but it is clear that there is a need to ask questions about the musculoskeletal system to detect if it may be contributing to a patient's symptoms. This should be done on a patient's first attendance at clinic. This study aimed to identify those questions that are the most appropriate for this line of investigation.
Chapter Five

Diagnostic tools

To develop hypotheses and determine differential diagnoses for a given set of symptoms one must collect information in a systematic manner (Jones et al 1995). This requires tools that will enable the collection of valid and reliable details of the symptoms, the background to the problem and appropriate physical measurements. The quality of these tools is central to the accuracy of the study (McGibbon 1997a, 1997b). Conclusions drawn from an incomplete database can lead to an inaccurate diagnosis and delay of appropriate intervention (Stone 1996). The data and measurements gained from them will be used to determine whether there is a musculoskeletal component to a patient's abdominal symptoms.

Principles of questionnaire design

There are several established questionnaires concerned with musculoskeletal problems and disability, but they concentrate mainly on functional ability and psychological well-being and were not specific enough for this study (Bowling 1991, Garret et al 1993, Mawson 1995).

Questionnaires exist for diagnosing inflammatory bowel disease, for instance, ulcerative colitis or Crohn's disease, which address the socio-psychological aspects as well as recording gastrointestinal symptoms and systemic symptoms (Guyatt et al 1989), but they also do not tackle the musculoskeletal aspects of abdominal pain. Accepted standards for data collection when assessing patients with spinal musculoskeletal problems were set out by Maitland (1988), McKenzie (1981) and Grieve (1988), but they do not include questions which are vital when assessing patients with abdominal pain, that is, those relating to bowel habit and dietary
information. It was decided, therefore, that a new questionnaire would need to be devised for this research study. The literature on questionnaire design and diagnosis was reviewed in preparation for this stage.

Decisions on what information was relevant to the study and what conclusions were to be tested were made at the outset. The aims of the study should, naturally, determine the content of the questions (Bogdan & Biklen 1992, Oppenheim 1992).

The questionnaire can be seen as a planned survey, that is, a form of data collection from which one can describe, deduce and conclude. The aim of the questionnaire must be to communicate with the patient and so must be clear, unambiguous and focused on a particular item or experience (Bennett & Ritchie 1975, McGibbon 1997a).

The clinical interview: taking the history

History-taking is one of the most important parts of the consultation and has been regarded as “the art of dialogue in the quest for evidence in order to make a diagnosis” (Roth 1985, Wolf 1991, 1995). From a patient’s description of their symptoms the clinician should be able to formulate hypotheses as to the cause of the problem (Berk & Haubrich 1991, Jones et al 1995). Time spent devising the correct questions to tease out the relevant information is time well spent. By spending time with a patient the clinician gleans information about the patient as a person rather than simply as a medical entity. Many clues can be gathered from the way a person has described their symptoms, for example, their tone of voice, their body posture and facial expression all provide clues for the clinician (Jones et al 1995, Wolf 1991, 1995).

Sir Zachary Cope (1926) emphasised the need for thorough questioning and a physical examination in every case of an acute abdomen. This is still
relevant today. Sharpstone & Colin-Jones (1994) iterated this: a “careful history is crucial and an examination should always include an assessment of tender spots with Carnett’s sign, hyperaesthesia and tenderness over the vertebral column.” It is important, though, not to jump to early diagnostic conclusions upon finding so called “classic” signs and symptoms (Stone 1996).

It has been suggested that the medical profession has become obsessed with technology: “There are times and circumstances ... when we may become unduly reliant on such tools to furnish a diagnosis. It is all too easy to succumb to 15 minutes history and five days of tests. A purposeful effort of history taking can lead to a more discriminating use of tests” (Haubrich 1995).

It has been claimed that 90 per cent of gastrointestinal diagnoses are suggested by the history, five per cent by physical findings and five per cent by investigations (Roth 1985). In musculoskeletal medicine there appears to be an increase in demand for lumbo-sacral X-rays for patients with low back pain. It is known that acute back pain is caused by conditions which cannot usually be diagnosed by X-rays and that pain correlates poorly with degenerative changes found on X-rays; such changes as are revealed by these X-rays are usually normal, age-related ones and should not be called arthritis (CSAG 1994).

It has been stated that if the examination is to survive, each aspect of its contribution to the management of the patient must be critically evaluated (Gallegos & Hobsley 1992). However, studies of clinicians’ ability to take efficient, well-structured histories has met with dismal results and these skills do not improve with seniority or experience (de Dombal 1979).

Information about recent medical events is usually straightforward, but the recall of past events is often less clear. Some types of medical information are recalled more easily than others with hospital episodes being
remembered better than physician visits (Cannell & Marquis 1967). The term "telescoping" has been used to describe the memory in terms of its selectivity and the distorted nature of the information it recalls (Singleton et al 1993). Recency and impact are important determinants of memory retention with regard to medical information; the greater the period between events the less accurate its recall. The memory is often influenced by incidental emotional factors as well as the process of extinction.

Whatever type of questionnaire is employed the respondent still has the option to decide what information is communicated and what is withheld. Positive motivation can be derived from the desire to influence their present state; for instance, they may believe that they will receive quicker or better treatment by completing the questionnaire.

Designing the questionnaire: structured versus unstructured approaches

A structured approach to history-taking has been shown to increase diagnostic accuracy by approximately ten per cent (Gunn 1976). It is essential that pertinent details are extracted while avoiding excessive volume which can distort the true picture. As the information is gathered its meaning and relevance must be analysed (Jones et al 1995).

Structured questionnaires are those where every respondent receives the same questions in the same order. It may present a series of options for answers or simply a "Yes/No" option. It has been shown that when independent examiners use their own system of evaluating the musculoskeletal system the resultant findings exhibit poor inter-rater reliability (McConnell et al 1980). Prior agreement upon tests and procedures to be used, areas to be examined and method of recording improves examiner agreement (Beal et al 1980, Beal & Dvorak 1984, Beal & Patriquin 1995).
A structured questionnaire allows for easy comparison of information and minimises measurement error (Bennett & Ritchie 1975). However, standardisation may not improve the validity of the data (Singleton et al 1993). By contrast, an unstructured questionnaire offers much more flexibility to the interviewer and the respondent. There are guidelines as to what should be covered, but the interviewer may ask whichever questions they wish, in any order and may probe for further information to obtain complete answers. This type of approach is clearly preferable from a standpoint of validity but is fraught with problems of reliability and open to error from several angles. It makes comparison of information and generalisation very difficult (Bogdan & Biklen 1992, Singleton et al 1993).

It is recognised that an interviewer's behaviour can influence responses; answers can be 'suggested' by using reinforcing behaviour, for instance, smiling or leaning forwards towards the patient (Coolican 1994). It is known that attitudes, expectations, appearances and the behaviour of an interviewer and a respondent can influence the accuracy of the data and so introduce error. An interviewer may adopt a dominant role and so the responses are, in part, an attempt to preserve the relationship. These influences may be detrimental to the quality of the data (Cannell et al 1968, Bogdan & Biklen 1992, Oppenheim 1992, Coolican 1994).

Where a structured questionnaire involves an interviewer, this person is instructed to take no initiative to further probe the patient, nor to reword the question, nor to make any irrelevant comments for rapport; the interviewer's role is strictly limited to the content of the questionnaire as written down (Bogdan & Biklen 1992).

When the pros and cons of each type of questionnaire were assessed the researcher considered that a structured questionnaire was the most suitable for the study. The principal reason for this was that an unstructured questionnaire would bring a wealth of information but that it would be
difficult to analyse it, particularly when trying to assess which questions are the most useful in diagnosing patients.

Open versus closed questions

It is accepted that open questions provide more information and are often expressive and spontaneous (Oppenheim 1992). Mellner (1970) maintains that questionnaires must allow for some individual comments as restricted answers can lead to loss of information.

Some have suggested that questions should be worded in such a manner as to enable the patient to answer in a frank, unguarded manner and that useful information is gleaned by allowing the patient to talk freely (Wolf 1991). With open questions no specific response is required but reliability is low (Burroughs 1975). Also, open questions make it difficult to predict what information will be given and so not all of it will necessarily be of value.

It has been suggested that patients must be allowed to describe the nature of their pain rather than choosing from options (Nelson et al 1979), although it is acknowledged that options are necessary in certain situations. However, the classification of open-ended questions can lead to error and interpretation can vary from individual to individual. This poses problems for the researcher when trying to analyse responses, hence closed questions are more preferable (Schooler 1956).

Answering open questions requires more effort from the respondent when compared to simply ticking a box or choosing from a list of options. Too many open questions can be off-putting and take time to complete (McGibbon 1997a). The respondents are asked to recall information, whereas with closed questions they are asked to recognise information. Furthermore, it has been shown that more information is recognised than recalled (Belson & Duncan 1962).
Closed questions require the respondent to consider each one in terms of a number of responses. By keeping the choice of responses to a minimum, the stability of the responses to the test as a whole is maximised. A multiple choice approach presents a statement followed by a list of possible answers, so providing a framework of reference for all respondents and the effect of memory is reduced as the respondent is reminded of the options (Singleton et al 1993).

Closed questions are more appropriate in situations where information is to be scored or coded, and then analysed. They also make group comparisons easier and are often better where there are a number of questions and a known range of possible responses (Sommer & Sommer 1991, McGibbon 1997a).

On the negative side closed questions can be regarded as constraining, limited and artificial; they can produce a lengthy document in an effort to collect all the relevant data, which can make its appearance off-putting, hence it is vital that the most appropriate questions are chosen in this format to elicit the pertinent information required for the study. Respondents may become irritated by the unilateral nature of a structured survey. They cannot qualify or expand their answers and are forced to choose alternative answers which may appear inappropriate for themselves (Oppenheim 1992, Singleton et al 1993).

A structured interview consisting of closed questions has the added problem of loss of information due to condensation and compression of the questions. In addition, details of facial expression and body language are lost. It has been said that this type of questionnaire can only reveal the bare bones of information and that, while it reveals the general structure of a situation, it loses out on details (Sommer & Sommer 1991).
Considering this information it was decided that a series of closed questions was preferable, particularly when considering the need to code and analyse the information gathered. It was recognised that there can be a loss of information with this type of question and questionnaire but that careful construction can help to reduce the overall effect of this.

**Question wording and layout**

Question wording is of paramount importance in eliciting the right information from a respondent. Poorly worded questions tend to produce misleading information (Sommer & Sommer 1991, McGibbon 1997a). In deciding on the wording, a respondent’s knowledge and ability to answer the question must be considered. Efforts must be made to avoid wording that is perceived as impersonal, mechanical and demeaning. The vocabulary used must be straightforward, concise and unambiguous (McGibbon 1997a).

Questions should relate to only one time frame and one particular aspect of a patient's symptoms (Moser & Kalton 1971).

It is essential to be specific, as general questions can lead to imprecise responses. Ambiguous questions can be interpreted in a dissimilar fashion by different groups of people; in effect, different questions are being answered. Words such as “fairly” and “generally” are too vague. Abbreviations, technical jargon, acronyms and ambiguous questions should be avoided (Cheeson 1993, McGibbon 1997a).

The order in which the questions are presented is also important. In some questionnaires it is better to spread related questions throughout the questionnaire so that respondents do not assimilate the response from one question to the other as individuals can be astute in detecting cues as how to respond. Spreading related questions throughout the questionnaire also allows for testing of the robustness of the questionnaire. However, when one is aiming to gather information regarding a condition or a patient's
symptoms consecutive related questions are useful. Consecutive questions systematically develop a clinical picture from which one can generate hypothesis as to the cause of the problem. Related questions spread throughout the questionnaire may appear illogical, disruptive and frustrating to the respondent and the interviewer. It is important to remember, particularly with patient-administered questionnaires, that each question has a covert function, namely to motivate a respondent to continue (Bogdan & Biklen 1992). For the history-taking questionnaires developed in this study related questions were set out consecutively to aid respondents in their recall of symptom details.

A logical sequence and layout of questions is essential, as is a user friendly questionnaire with easy to follow instructions (McGibbon 1997b). Using a box, such as this: □ for tick options is rated better than using parenthesis or a circle (Major et al 1976). Current evidence has shown that documents are most easily read if black ink is used on yellow paper (Stein & Fowler 1990). In general, an attractive presentation, easy-to-read typeface and coloured paper may all help to improve response rate (McGibbon 1997b).

Later on, in the chapter concerned with the method, the approach taken to reviewing the appropriateness of questions and wording to reflect best practice is detailed.

**Self-administered versus administered**

Where a questionnaire is to be completed by a patient alone it must contain an introductory paragraph with clear instructions for completion (Sommer & Sommer 1991). With this type of questionnaire visual impact is important (Bennett & Ritchie 1975). It is recognised that self-administered questionnaires can be difficult for the young or elderly. Literacy is essential and a reasonable command of the English language is required to complete the questionnaire. Accuracy of information, particularly in self-administered
Some studies, however, have shown that self-administered questionnaires are able to produce a greater amount of information than the administered type (Young 1972). Self-administered and closed questions increase the test-retest repeatability (Bennett & Ritchie 1975), eliminate the need for an interviewer and can save on training and, thus, on costs. The face-to-face nature of an administered questionnaire improves the response rate and can, if permitted, offer more flexibility which can improve the quality of the data (Singleton et al. 1993). There is an intrinsic attractiveness to being interviewed about one's medical health (Sommer & Sommer 1991).

As one of the long term aims of this study was to identify a series of questions that could be used by clinicians and possibly in a computer-assisted interviewing format it was a decided that a self-administered format as well as a physiotherapist-administered format would be devised. A self-administered format was also chosen as, at a later stage, follow-up questionnaires would be sent by post.

Postal self-administered questionnaires compare favourably to those completed while a patient waits for an appointment (Scott 1961). The disadvantage of the postal method, though, is its poor response rate, being around 40-60 per cent typically (McGibbon 1997b). The rate can be increased by simple methods, for example, using an introductory letter and printing the questionnaire on coloured paper to catch the attention of the respondent. However, reminders are often necessary. Stamped envelopes are better than franked ones, and a hand-written address on the envelope also improves the return rate (Scott 1961). With a postal questionnaire, however, there is no control of the conditions in which it is answered, who answers it or the number of questions answered (Singleton et al. 1993).
Computer-assisted patient interviews

Computers can provide a means for the delivery of self-administered questionnaires. They have been shown to be better than clinicians at eliciting certain symptoms, can record severity of symptoms and can be used to monitor progress (Greist et al 1973, Dove et al 1977, Lucas et al 1977, Carr et al 1981, Ancill et al 1985, Levine et al 1989). Ratings of symptom severity from a computer-presented questionnaire compare favourably with details gained by a clinician (Carr & Ghosh 1983). Computerised interview results show high correlations with paper and pencil tests (Glaze & Cox 1991). Patients have reported the computer as “friendly” and “understandable” and seem to enjoy using computers (Grossman et al 1971, Carr et al 1981, Carr & Ancill 1983). Patients often feel more comfortable expressing feelings to a machine rather than a human interviewer (Erdman et al 1987). It has been noted that more items are recorded in computer-assisted interviews than in physician-recorded ones (Erdman et al 1987, Grossman et al 1971).

Computer-administered questionnaires have the potential for initial screening of patient symptoms (Glaze & Cox 1991, Lewis 1994) and data from these interviews have been used to diagnose uncomplicated abdominal conditions, thus avoiding the expense of specially trained interviewers (Card et al 1974).

Patients can feel more comfortable with a computer, taking their time over questions and pondering a response. This can be less stressful than a face-to-face interview. An initial explanation of the workings of the computer and introduction is essential (Carr & Ancill 1983). In this type of interview patients are often restricted to “Yes/No” responses or numbered keys. One of the attractions of computerised assessments, particularly in research, is the lack of observer bias and greater consistency of the assessment in different situations, resulting in high reliability of data. Time spent coding and data entry is also reduced (Greist et al 1973, Lewis 1994). It is emphasised that computers cannot replace the clinical skill of the clinician, but may be useful
as an adjunct to assessment and helpful as a screening procedure (Glaze & Cox 1991, Lewis 1994).

Self-administered questionnaires consisting of closed questions was the obvious choice for this study with one of the aims of the study being to identify a series of questions to be used as a screening process by the clinician and possibly in the future in a computer-assisted format.

**Sources of error**

It is important to recognise that potential sources of error exist at every stage of the data collection process (Moser & Kalton 1971) and many different types of error exist in measurement (McDowell & Newell 1987). Action should be taken to ensure the measurement process is as rigorous as possible with potential sources of error being anticipated and precautions taken to minimise them. The introduction of an interviewer at any stage introduces a source of error and reliability will suffer (Cannell *et al* 1968, Bogdan & Biklen 1992, Oppenheim 1992, Coolican 1994).

When an interviewer is present respondents have a tendency to reply “Yes” to items irrespective of their content (Oppenheim 1992). Error can arise from respondents' reactions to participating in studies, known as "reactive measurement effect". Individuals are known to vary their behaviour in differing situations and respondents may record what they consider to be the sociably desirable answer (Singleton *et al* 1993, Bowling 1995).

The truthfulness of the response is often determined by the nature of the questions asked and whether an individual is responding to an interviewer or a computer. In one study, people suffering from alcoholism were less likely to give a truthful answer to an interviewer as opposed to a computerised interview procedure (Lucas *et al* 1977). Other work, however, has found no differences between reported alcohol consumption levels when
computerised, face-to-face and self-report questionnaire formats were compared (Skinner & Allen 1983, Davis & Morse 1991).

Other factors can be regarded as “random measurement error” whereby temporary factors can influence the response given by a patient. A respondent’s mood and health may affect their replies; they may even take a dislike to an interviewer. The length of the questionnaire may adversely affect the response; an overlong questionnaire can induce boredom and fatigue. When being asked details of past history and events where the respondent has to recall information, the effect of memory is a potential source of error. A respondent’s ability to recognise information in closed questions is often more successful at retrieving information than open questions where the respondent has to recall the information (Belson & Duncan 1962).

Changes to the measurement instrument or procedure in the course of a study will undoubtedly be a source of error and should be avoided if at all possible. However, it would be necessary to make slight alterations to the wording as one questionnaire was to be self-administered and the other administered by a third party on another occasion so that the instructions and wording make sense. Such alterations must be kept to a minimum to facilitate data processing methods (Bogdan & Biklen 1992, Oppenheim 1992, Coolican 1994).

Reliability

A key feature of any measurement instrument is its reliability. This is described as the extent to which the test scores are consistent, dependable or repeatable, that is, the degree to which they are free of errors of measurement (Martin & Bateson 1986, Oppenheim 1992). The same measurements can be taken even though the conditions in which they are
taken may change. Reliability is concerned with the stability of the questions so that consistent results are obtained (Singleton et al 1993).

Reliability is maximised by appropriate construction and careful administration, and can be measured in a variety of ways (Bland & Altman 1986, Suen & Ary 1989, Howell 1992, Coolican 1994, Altman 1995).

**Validity**

The consideration: "Are we actually measuring what we are trying to measure?" relates to the validity of the procedure (Bourke et al 1985, Singleton et al 1993, McGibbon 1997b). It is essential to determine if the information gathered is appropriate to the investigation being undertaken.

One analogy describes validity and reliability in terms of archery: validity represents how close one gets to the target; whereas, how often the closeness to the target is achieved is reliability. Thus, shots may consistently miss the target and so be reliable but not valid (McDowell & Newell 1987).

Data may be proven reliable yet if the data is not valid, it is of no value to the study (Singleton et al 1993). However, the degree of reliability can set the limit to the degree of validity possible. Thus, validity cannot rise above a certain point if the measure is inconsistent to some degree (Oppenheim 1992).

Validity is particularly important in the process of making a diagnostic medical decision. A 'true' diagnosis is usually made on the basis of history, clinical examination, signs, symptoms and, at times, the results of one or more biochemical, electrical or other measurement processes. Although it is difficult to lay down exactly what criteria are used for the diagnosis of a given condition, a clinical decision based on all available information is, perhaps, the best available 'gold standard' for diagnosis.
Deciding on the value of questions

When deciding which questions to ask it is often difficult to prove conclusively that those used are representative of all possible options. The validity and value of the questions and, ultimately, the questionnaire as a whole must be determined. It is important to remember that the human brain, although functioning like an information system, is of limited capacity and can only process a certain number of items at a time (de Dombal 1979).

Collaboration at an early stage with colleagues working in the same field can be an invaluable source of information and checks the ‘face validity’ of the questions. ‘Face validity’ relates to the extent to which the questions are representative of all those that could be asked (McGibbon 1997b). Inviting clinicians to comment on how the questions actually relate to the topic in hand and asking their advice on question wording, selection and presentation is often revealing. What may be thought originally to be a clearly written question may be interpreted quite differently by others. It is dangerous to make assumptions about how respondents will react to individual questions and the questionnaire as a whole. Pre-testing the questionnaire and evaluation by colleagues can also ascertain any questions that are missing. Although it may be established in the literature what questions or tests are the most discriminating, in clinical situations these may not be used due to negligence or ignorance on the part of the clinician. Failure to pick the ‘best test’ may lead to incorrect decision making and treatment (de Dombal 1979). Structured data collection will improve collection of all the relevant details and, ultimately, diagnostic accuracy.

Panels of experts can be utilised to check the ‘content validity’ of the questionnaire. They will have knowledge of the subject and their views can be harnessed to further refine the questionnaire. It is recognised, however, that owing to the subjective nature of the responses, they are weak measures (McGibbon 1997b).
Experts can be chosen from the clinical field that is appropriate for the topic in question. The panel may also benefit from non-experts who can look at the questions through the eyes of a potential respondent and so provide a balanced view.

**Clinical reasoning in making a diagnosis**

Collecting information about a patient's problem and analysing that information to determine a differential diagnosis and a treatment plan forms the backbone of the work of physiotherapists in clinical practice. The term “clinical reasoning” is used to refer to this process of cognitive processing or thinking and looks at how a decision is reached from the clinical information presented (Higgs & Jones 1995). Skills in cognition (critical, creative, reflective, logical and analytical thinking) are essential for effective thinking and problem solving.

The collection of symptom information can lead to a wealth of data which may or may not be useful. It can, at times, become a mechanical exercise, without adequate reflection or ongoing analysis of the data being collected. Clinical reasoning is influenced by the “therapist (e.g. needs, goals, values, beliefs, knowledge, cognitive, interpersonal and technical skills), the patient (e.g. values and beliefs, individual physical psychological, social, and cultural presentation), and the environment (e.g. resources, time, funding and any externally imposed requirements)” (Higgs & Jones 1995, Jones et al 1995).

The goal of physiotherapy is to make the best treatment decision for a patient, which has been termed “wise action” (Cervero 1988). This means making the best judgment in a specific context. Conceptual models of clinical reasoning have been developed which seek to guide a therapist's evaluation and treatment planning activities (Barrows & Tamblyn 1980, Echternach & Rothstein 1989).
Payton (1985) has shown that physiotherapists essentially follow the same clinical reasoning processes to generate physical therapy problem lists and treatment plans as those used by physicians.

Decisions must be made as to what information to collect, what parts need particular attention and what can be set aside for the future. This must be considered in the context of a patient's problem. A plan of questioning can help a novice clinician ensure that nothing is forgotten, whereas an experienced clinician can often extract the information almost automatically, sometimes without any apparent order to the questioning. Experience can lead to an original plan being modified and adjusted to each patient's problem (Jones et al 1995).

**Hypothetico-deductive reasoning**

The hypothetico-deductive reasoning approach involves the generation of hypotheses based on clinical data and knowledge and the testing of these through further enquiry (Elstein et al 1978). This involves both *inductive reasoning*, that is, moving from a set of specific observations to a generalisation, and *deductive reasoning*, that is, moving from a generalisation to a conclusion in relation to a specific case (Ridderikhoff 1989). Inductive reasoning has also been described as "probabilistic reasoning" since a conclusion is reached, for example, concerning a diagnostic hypothesis (Albert et al 1988).

The evidence gathered from the interview process is evaluated in relation to existing knowledge. The level of knowledge and the ability to analyse are important factors in this reasoning process. It is important, though, to distinguish between what knowledge is essential and what is nice to know or is marginal or irrelevant (Hislop 1985). Throughout the history-taking procedure one is establishing hypotheses about the mechanism and source of
the problem. As the procedure continues one is gathering further information to prove or disprove those hypotheses (Magarey 1994).

Pattern recognition

Pattern recognition (or inductive reasoning) is a process whereby a clinician recognises what is presented before him, for instance, the limp of a person being a sign of them having suffered a stroke. Clinicians recognise similarities in patterns of pain and pain behaviour for different pathologies stored in their 'clinical memory'. However, in order to be able to recognise patterns correctly the clinician needs to have experienced that pattern previously and been told of the appropriate information to associate with it. Cognitive skills are employed at all levels of experience, whether by a novice dealing with hypothesis testing procedures or an expert who often uses pattern recognition to aid diagnosis (Jones et al 1995).

The initial hypotheses made may be as broad as “this is not a problem for physiotherapy” or “this sounds like a musculoskeletal problem” without a specific diagnosis being made. Additional or modified hypotheses will be made in the light of further details until there is sufficient information available for the clinician to make a diagnosis or summary.
Chapter Six

Method: Designing the tools and preliminary study

Plan overview

The nature of this particular thesis necessitated a multi-staged approach, with two diagnostic tools being developed: one concerned with history-taking, and the other used with the physical examination. It was envisaged that, in the future, the history-taking questionnaire would be used in a computer-administered format as a screening method in gastroenterological out-patient clinics prior to seeing the doctor as well as by clinicians including physiotherapists; consequently, both self-administered and physiotherapist-administered history-taking questionnaires were devised.

Table 4, overleaf, outlines the main stages undertaken in the research study.
Table 4. Research stages.

<table>
<thead>
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<th>Stage</th>
<th>Activity</th>
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| 1.    | Research instrument development  
       History-taking questionnaire  
       Physical assessment procedures |
| 2.    | Establishing face validity of the history-taking and  
       physical examination |
| 3a.   | Preliminary sample |
| 3b.   | Physician assessment |
| 4.    | Musculoskeletal assessment: self-administered and  
       physiotherapist-administered history-taking questionnaires and  
       physical assessment |
| 5.    | Comparison of physician and physiotherapist diagnoses |
| 6.    | Expert panel review of history-taking questionnaire by  
       physicians and physiotherapists |
| 7.    | Expert panel review of physical examination procedures  
       by physiotherapists |
| 8a.   | Refinement of research instruments  
       Re-application of research instruments. Main fieldwork |
| 8b.   | Physician assessment |
       questionnaire on two separate occasions and physical assessment |
| 10.   | Comparison of physician and physiotherapist diagnoses |
| 11.   | Comparison of pain areas in positive and negative subjects |
| 12.   | Establishment of a scoring system  
       History-taking questionnaire and physical examination  
       procedures |
| 13.   | Identification of questions and procedures to act as  
       predictors |
| 13.   | Data analysis |
Stage 1: Development of research instruments

Tools were developed which incorporated the relevant history-taking questions and physical assessment procedures, in particular, those relating to the thoracic spine, together with questions pertaining to the gastrointestinal system.

Although the debate about the value of a detailed history and personal communication is recognised, data collection in this study necessitated some form of structured approach, including closed questions, to enable the data to be analysed. This limited selection of information can mean that a good deal of detail is lost. By pre-testing the questionnaire, key information areas that were missing could be identified.

The majority of questions were designed as closed questions offering pre-coded options where necessary. Where “don’t know” and “not applicable” options were applicable they were included. Where choices of responses were offered they were exhaustive of all the possible answers. Where a question was not appropriate due to an earlier response, clear instructions were provided regarding how they should proceed. It was considered that a small series of questions could be devised to gain the relevant information without losing the necessary detail.

Although essentially collecting medical details the question and answer options, particularly in the history-taking questionnaire, were still written in simple, non-technical language as far as was possible as most respondents could not be expected to have any medical knowledge. The aim was to communicate at the lowest rather than an average educational level. Questions were worded to avoid leading a patient to answer in a particular manner. The questions were arranged consecutively which is the recognised format for a history-taking interview (Maitland 1988). Comments regarding the lack of order of questions came from the physiotherapists when asked to
give their opinion of the draft questionnaires. It appears that physiotherapists are more comfortable with a familiar pattern of sequential question presentation. It was felt that, when gathering information to develop a diagnosis, spreading questions regarding a similar topic throughout the questionnaire would be too disruptive. It was felt at this stage of the questionnaire development that a logical ordering of questions would be more appropriate. With hindsight similar questions spread within the questionnaire would have helped check the robustness of the questions. For further comment on this please see the discussion in Chapter 10.

A front sheet was designed with paragraphs of explanation and instruction. This included a brief outline of the purpose of the study and the usefulness of the information gathered in the questionnaire. Clear and precise instructions on how to complete the questionnaire were provided. The importance of filling in each section was stressed. However, accuracy and completeness could not be guaranteed, as discussed earlier, simply because the patient agreed to participate. A return date was indicated on the front sheet where appropriate. Pre-stamped addressed envelopes were also provided where necessary and a contact name with telephone number was provided. Where the questionnaires were given or sent to physiotherapists to answer themselves, coloured paper was used to help distinguish it from other documents and letters.

In this study the final clinical diagnosis was based on both an evaluation of the details gathered in the history-taking questionnaire and the findings of the physical examination.

History-taking questionnaire

Both the self-administered and physiotherapist-administered history-taking questionnaires were designed to extract the same information using identical questions. The sequence and presentation were identical in both
questionnaires; only alteration of the linguistic sense took place. The questions are set out in a similar format to established assessment procedures set out by Maitland (Maitland 1988).

Patients and physiotherapists were provided with an instruction and information sheet about the study and how to go about answering the questions. The physiotherapists were given clear instructions not to waiver from the text, to ask only those questions as set out on the sheets and to make no further probing for a response.

**History-taking details**

The history-taking questionnaire dealt with the following categories:

- Personal details.
- 'Body chart' for indicating areas of pain and symptoms.
- Description of pain and symptoms.
- Aggravating factors.
- Easing factors.
- Pattern of pain and symptoms.
- Bowel habit.
- History of the present condition.
- Previous treatment and outcomes.
General health and current medication.

Past medical history.

(See Appendix I & Appendix II for complete questionnaires.)

**Personal details**

Questions: 1-7


Details of age and a patient's day-to-day activities are important when assessing potential musculoskeletal pathologies. Working situations and activities, particularly involvement in sports and hobbies, give information about the stresses imposed on the musculoskeletal system. Patients involved in manual work may be more prone to wear and tear disorders such as spondylosis and spinal stenosis, whereas sedentary workers may be more prone to discogenic disorders (Jull 1997).

One cannot be definitive that certain conditions only occur within certain age groups, only generalisations can be made. Discogenic disorders tend not to affect elderly people, whereas this group will be affected by osteo-arthritis with osteophyte development. Neoplastic disease can affect all ages. Certain disorders are more prevalent in the young age group, for example, testicular cancer and osteoid osteoma, whereas other cancers, including bowel, lung, prostate and breast, affect mainly the middle to elderly age range. One must be alert to the young fit person who complains of an unexplained onset of back pain and similarly the elderly person complaining of a sudden increase in back pain for no particular reason as serious pathology may be the cause. Inflammatory disorders can affect any age, with males being more affected by ankylosing spondylitis and females more affected by rheumatoid arthritis.
Body chart

Question: 8
Rationale: Identifies areas of pain, pins and needles and increased sensitivity. Using a body chart is easier for a patient, rather than having to describe areas of the body in words.

Identifying areas of pain gives the clinician valuable indicators of all the potential mechanisms and sources of the problem. It is acknowledged that prediction of the source of a patient’s symptoms based on the location of the symptoms is unwise on account of the ability of structures to refer pain and the centrally initiated stimulation of receptors (Zusman 1992). The area of pain indicated will enable the physiotherapist to establish a number of hypotheses that will need further investigation (Magarey 1994). Areas of pins and needles or increased sensitivity can indicate peripheral or spinal nerve irritation or entrapment. Pins and needles in the hands and feet and around the mouth can signify hyperventilation. Pins and needles in the feet and/or hands may indicate cord or cordae equina signs.

It is important that all areas of pain are recorded, even if they appear to be unrelated. Multiple sites of pain may relate to altered function of the nervous system or pain of an inflammatory nature. A patient may concentrate on the predominant pain, that is, their abdominal pain, and so may neglect to inform the clinician of other pain, for example, rib or back pain, which may seem insignificant to them.

Description of pain and symptoms

Questions: 9-19
Rationale: Indicates intensity and persistency of the pain, and the depth and variation of the symptoms.
The nature of the pain is useful when hypothesising what structure and mechanism may be contributing to the problem, for instance, symptoms described as severe, shooting pains probably relate to nerve root irritation. The severity of the symptoms may also indicate how much or how little they need to be examined. With symptoms that are very severe and easily provoked a limited assessment would be advisable. A complete assessment would be appropriate for someone whose symptoms were mild and non-irritable.

Although the perception of the depth of the symptoms bears no relation to the true depth of the source of the problem it may help to differentiate between a muscular or joint lesion. Descriptions tend to be consistent among patients (Magarey 1994). Discogenic pain tends to be “deep” whereas zygapophyseal and soft tissue pain tends to be more superficial. The persistency of the pain may give some indication of the nature of the pathology. As discussed earlier it has been thought that one should be suspicious of a non-musculoskeletal cause if the symptoms appear constant. However, this can be true for some musculoskeletal conditions and not true for some inflammatory and neoplastic disorders. This information must be analysed together with all the other available details before hypotheses can be made.

Bloating is reported commonly by patients with gastrointestinal disorders, including food intolerance and “air swallowing”. Time free of pain can indicate the persistency of the symptoms and can also indicate a cyclical nature to the pain, for instance, symptoms related to the menstrual cycle or food intake.


**Aggravating factors**

Questions: 20-23

Rationale: Helps determine which factors are contributing to a patient’s symptoms.

As a generalisation symptoms from mechanical sources tend to behave in a predictable manner, being aggravated by movements. Musculoskeletal lesions are often aggravated by activities such as bending, twisting and lifting and altered postures (Ashby 1977, Mollica et al 1986, Goodman & Snyder 1995). As discussed earlier, this is too simplistic a rule to be adhered to, for example, some non-musculoskeletal disorders can behave in the same way. All the clinical features associated with disc changes, including abnormal movement patterns, may occur in tumours of the vertebrae and a conclusion should not be drawn before all the information has been analysed. Symptoms that appear not to show a predictable response to mechanical mechanisms are unlikely to be of mechanical origin (Magarey 1994). This may indicate neoplastic or inflammatory disorder, symptoms of central initiation, autonomic disorder or an affective disorder (Zusman 1992, Magarey 1994). Symptoms made worse by taking a deep breath, coughing and sneezing can often indicate a disc prolapse or pathology in the thoracic region. In some conditions, where the gastrointestinal system is suspected, patients may complain that their symptoms are aggravated by certain foods or even groups of foods. If a patient can tolerate a normal diet then food intolerance is unlikely to be contributing to their symptoms.

In assessing the irritability of a patient’s symptoms, identifying not just the aggravating factors but the time frame in which the aggravation is felt is also important, for example, whether it is felt immediately or comes on some time after the activity. This information will help the therapist decide how much of the physical examination can be undertaken (see below for details on questions relating to irritability).
Easing features and irritability

Questions: 24-25
Rationale: Aids the assessment of the irritability of the condition and, hence, how much of the physical examination can be conducted.

Musculoskeletal lesions generally can be relieved by the patient adopting pain easing positions or moving around (Mollica et al 1986). This is also true of some gastrointestinal and non-musculoskeletal pathologies (Goodman & Snyder 1995). In cases of severe nerve root irritation, pain of an inflammatory or organic nature may seem to be unremitting. The time taken for the symptoms to ease will add to the information about the extent of their irritability.

With a patient who describes symptoms that are irritated in a matter of minutes and last for several hours, it would be unwise to subject them to a complete examination on their first attendance as this may flare the symptoms. In these instances an assessment may need to be curtailed or certain examination procedures omitted until the next attendance. Where the symptoms appear to be non-irritable, a full examination may be completed.

Pattern of pain and symptoms

Questions: 26-34 & 43
Rationale: Establishes severity of the pain and its possible nature.

Patients with benign musculoskeletal disorders generally find relief with rest and are more comfortable in the morning. Mechanical pain may wake the patient at night, as can neoplastic and inflammatory disease. Turning over in bed can irritate a troublesome spinal joint or disc and so a patient may have a preferred side on which to lie. The frequency of their waking, how long it takes to get back to sleep and what relieves their symptoms may
indicate the severity of their symptoms. A patient who complains of severe unremitting night pain, pacing the floor to find relief and sleeping in a chair should indicate to a clinician the possibility of a sinister pathology, including inflammatory disorders (Simeone & Lawner 1992, Goodman & Snyder 1995).

Spinal stiffness and discomfort on waking which takes several hours to ease may be indicative of the presence of an inflammatory process. Discogenic pain can be severe at night and in the morning. However, due to gravitational effects and compression on the disc, the water in the disc is lost and the symptoms decrease. Pain that is better in the morning but increases during the day may be due to attrition of the zygapophyseal joints. In some instances this pathology benefits from gentle activity and is aggravated by prolonged periods of immobility.

The daily pattern of pain provides information about what restrictions the pain imposes on a patient and the predictability of the disorder. The pattern of the disorder provides further information regarding any precautions or contraindications that may need to be considered. Pain that is worsening may indicate pain of inflammatory or neoplastic origin.

**Bowel habit**

**Questions:** 35-37

**Rationale:** Helps identify potential gastrointestinal disorders.

Alteration in bowel habit since the onset of symptoms, for instance, constipation or diarrhoea or a combination of both, often indicates a bowel function disorder, as does pain being relieved by opening the bowels. Bowel habit is usually unchanged in patients presenting with musculoskeletal conditions, except in some cases of a large disc protrusion which may present with cord or cordae equina signs. One must be aware of the fact that pain relieving medication can contain codeine which causes constipation.
History of present condition

Questions: 38-39
Rationale: Establishing the onset of symptoms and any previous episodes, noting previous treatments and outcomes.

The history of the problem can determine the mechanism of injury, if appropriate, and any predisposing factors. With some musculoskeletal injuries the onset can be assigned to a particular event, for example, joint or disc lesion can be attributed to lifting an object or a fall. Other spinal lesions can arise because of a succession of micro-traumas to the soft tissues around the joints of the spine, for instance, long periods of sitting or standing, or where the nature of the work is repetitive. In these circumstances a patient may be unable to identify a particular time or event that triggered their pain and feel that their problem came on gradually.

Patients with gastrointestinal pathology may recall a particular bout of gastroenteritis or a course of medication that triggered their symptoms. Equally, the onset may be insidious, having no particular trigger and developing gradually over a period of time. It is important to establish the link, if any, between previous episodes and this current presentation (Maitland 1988). The duration and progressive nature of the symptoms should alert the clinician to possible sinister pathology.

Previous treatment and outcomes

Question: 40-42 & 50
Rationale: Gives information about previous history, avenues of investigation and its outcome.

Details of previous episode of this problem, treatment and its outcome will be valuable in deciding which treatments may be effective.
**General health and medication**

**Question:** 44-49

**Rationale:** Aids the overall picture of the health of a patient. Intake of medication can indicate the severity of the pain and other health problems that may be contributing to the one being investigated.

The taking of oral steroids for conditions such as rheumatoid arthritis, polymyalgia rheumatica and respiratory complaints is an important consideration when dealing with spinal conditions. Intake of certain dosages of steroids over a period as short as two months can lead to osteoporosis. The thoracic and lumbar spine as well as the neck of the femur, particularly in females, appears to be particularly prone to this condition.

Osteoporosis, in its advanced stages, leads to spinal deformities, including kyphosis of the thoracic spine due to wedging of the vertebrae and loss of vertebral height due to vertebral collapse. These changes to the spine are most prevalent in the post-menopausal female but not exclusively so, and can be the source of thoracic and abdominal symptoms.

Anti-coagulant medication, including aspirin, reduces clotting ability and care must be taken, therefore, with any firm techniques. Intake of analgesics may indicate the severity of the condition and care must be taken with an examination as the medication may mask the severity and irritability of the condition.

Weight loss, gain and fluctuation are often features of a disorder of the gastrointestinal system, but can be associated with a musculoskeletal lesion, where severe pain causes the patient to become less active. Weight loss for no known reason can indicate serious pathology.
Urinary problems may be present where there is sufficient pressure on the nerve root from a disc lesion to impair the function of the bladder. Patients with urinary retention should be referred to a specialist without delay. Autonomic dysfunction such as faecal and urinary incontinence must be thoroughly investigated as this may indicate a serious pathology.

*Past medical history*

Questions: 51-56

Rationale: Completes the picture of a patient's health and identifies other contributing factors to the present problem.

Incidents of trauma, for instance, bad falls or car accidents, are important as these can create stress on the whole of the spinal column and its surrounding soft tissues. Details of any surgery are noted as well any major illnesses. Surgery for cancer is particularly important as the thoracic spine is the commonest site for spinal secondaries. Previous episodes of back pain are important as a potential source of abdominal pain.

*Physical examination*

A physical examination allows the therapist to obtain a complete clinical picture on which to base a diagnosis and treatment plan. It was essential in the physical examination, as in the history-taking, that the testing methods were laid down clearly at the outset.

These examination procedures are well recognised as standard techniques as set out by Maitland and Butler (Maitland 1988, Butler 1994).
Testing procedures included:

- Observation of standing posture.
- Movements of the lumbar and thoracic spine.
- Neurodynamics.
- Muscle testing.
- Palpation of the costal cartilages anteriorly, thoracic and lumbar spines and sacro-iliac joints (thoracic levels one to lumbar five, plus the sacro-iliac joints).

(See Appendix III for complete physical examination procedures.)

At the outset of the examination procedure it was established whether or not a patient’s symptoms were present so as to judge the effect of the testing procedures. The physical examination was designed to identify which, if any, of the testing procedures initiated or aggravated a patient’s symptoms. Examination procedures would only be taken to the point where a patient’s symptoms were provoked or slightly increased. Due to the irritability, severity and nature of the problem the examination may, therefore, have to be limited.

At the start of each section instructions were set down for the physiotherapist with regard to informing the patient of the procedures about to be undertaken and the testing position for the patient to adopt. The therapist asked the appropriate questions depending upon whether or not a patient was experiencing their abdominal pain at the time of the assessment.
Observation of standing posture

Question: 1-4
Rationale: Gives information of the alignment of the spine and an overview of the musculature.

Observation of the posture and willingness to move is essential when looking at the musculoskeletal system. The posture is assessed in standing so that the whole body posture, including lower body and lower alignment, is observed. Ideally, the outline of the body should exhibit symmetry, but many 'normals' have some asymmetries. Scoliosis and/or shift may be present where there is a spinal deformity due to osteoarthritic changes, loss of vertebral height due to osteoporosis, unequal leg length, paralysis of spinal musculature and disc prolapse. Scoliosis may be present where an osteoid osteoma is present (Dixon 1980, Kirwan et al 1984). The scoliosis in this instance is concave to the affected side. Scoliosis is the most frequent clinical and skeletal manifestation of neurofibromatosis (Onimus et al 1986). Other causes of scoliosis include anomalies of facet formation (Grieve 1994b).

Spasm of the erector spinae muscles may indicate an acutely inflamed area or provide protection for the inflamed viscera. These muscles may be overactive due to dysfunction of the deeper layers of dorsal musculature (Jull 1997). Swelling of an area can indicate that an inflammatory reaction is present due to trauma, inflammatory disease or fluid retention.

Movements of lumbar and thoracic spine

Questions: 5-38
Rationale: Indicates whether movements of the spine precipitate or aggravate a patient's symptoms.

By testing the range of movements of the spine, limiting factors of their range are checked, for example, abdominal pain, back pain or stiffness. Stiffness of the spine is noted as excessive loss of mobility which may be due
to osteoarthritic changes or shortening of the soft tissues, which can lead to pain.

Neurodynamic testing

Question: 39-54
Rationale: Identifies whether stretching neural structures initiates or aggravates a patient's symptoms.

With damage to the spine, the meninges (dura, arachnoid and pia) plus the surrounding tissues, including muscle and fibrous tissue, connective tissue components within the nerve (epineurium, perineurium and endoneurium) blood supply and conducting elements of the nervous system, all suffer insult. All these soft tissues have the potential, when damaged, to produce noxious stimuli.

When performing a tension test the therapist must:

☐ Be aware of expected normal responses.

☐ Know all the details of a patient's symptoms.

☐ Know the symptoms in the starting position.

☐ Carefully monitor the symptoms throughout. One must be able to identify if it is a patient's symptoms that are reproduced or whether it is normal neural discomfort or soft tissue tension discomfort from performing the procedure.

These tests may be omitted due to the irritability of the symptoms or the presence of certain pathologies.
Muscle testing (abdominals)

Question: 55
Rationale: Gives information as to whether a lesion in the abdominal muscle is responsible for a patient's symptoms.

Combined active abdominal contraction with palpation of any localised areas of pain is a useful procedure for detecting abdominal wall lesion (Gallegos & Hobsley 1992).

Palpation of the costal cartilages (hooking manoeuvre)

Question: 56-57
Rationale: Helps identify if the costal cartilages are responsible for a patient's symptoms.

Costal pain can be caused by slipping of the rib tips, often termed "slipping rib syndrome". The examiner's fingers are curled under a patient's anterior rib margins and pull them anteriorly. An audible click may be heard or the patient may complain of their symptoms. This is performed on both left and right sides with the asymptomatic side being tested first if applicable (Heinz & Zavala 1977).

Palpation of thoracic and lumbar vertebrae: levels thoracic 1 to lumbar 5 including the sacro iliac joints

Question: 58-372
Rationale: Identifies any vertebral level that may be responsible for a patient's symptoms.

Passive accessory intervertebral movement examination allows analysis between the feel of tissue resistance and texture, a patient's range of movement and symptoms. Pressure is exerted on the appropriate vertebra and the patient is asked to indicate when the pressure provokes or increases
their abdominal pain or whether there is local tenderness only. If their symptoms are reproduced the direct involvement of the structure can be assumed.

Where local symptoms are provoked that differ from the presenting problem, these may still be relevant. The ability of the spinal structures to refer pain to the abdomen is known and this local tenderness may indicate a link between the spine and the presenting symptoms. The therapist records whether each vertebra offers any abnormal resistance (hypomobility) to passive movement. It is essential to remember that a structure may present hypomobility but may have no relevance to the presenting problem (Magarey 1994).

The therapist tests the joint through its full range or to the point where resistance stops them or the patient indicates that the pressure is bringing on their abdominal pain or local tenderness. They were instructed never to push through spasm, which may indicate an acutely inflamed joint.

Areas to be tested included:

- Central posterior-anterior pressures, thoracic 1 to lumbar 5.
- Unilateral posterior costotransverse joint, thoracic 1 to thoracic 10, left and right sides.
- Unilateral posterior costovertebral joint, thoracic 11 and thoracic 12, left and right sides.
- Rib angles, thoracic 2 to thoracic 10, left and right sides.
- Unilateral posterior zygapophyseal joints joint, lumbar 1-5, left and right sides.
Stage 2: Establishing face validity

Once the data collection tools had been drafted fifteen physiotherapists were asked to comment on them for their appropriateness. They were commenting on the draft research tools initially developed as set out earlier (pages 104-120). An introductory paragraph outlined the sort of patients that these tools would be used on. They were asked to comment freely on any aspect; question appropriateness, clarity, wording and instructions for completion were all tested at this stage. The physiotherapists were asked to add any questions they felt would be useful for this study.

The physiotherapists selected to screen the data collection tools were those with experience in assessing and treating musculoskeletal disorders in out-patient or General Practice (GP) settings. Physiotherapists who had completed a post-graduate qualification in musculoskeletal assessment and treatment, such as the Manipulative Association of Chartered Physiotherapists (MACP) qualification, were specifically targeted. These were selected from the MACP Directory, as well as colleagues with the appropriate qualifications. Physiotherapists were telephoned initially to explain the nature of the request and to determine their willingness to participate. They were then sent the questionnaires with a return date and a stamped addressed envelope for return of the questionnaires and comments sheets. Their feedback comments are set out in Chapter Nine Results (pages 148-149). In the light of this feedback the tools were amended.

☐ Sacroiliac joint left and right side.
History-taking Questionnaire

The following questions were added in the light of comments made by the physiotherapists:

☐ “Do you get any areas of pins and needles?” for indication on the body chart.

☐ A question was added to determine the nature of the work:
   “4. If yes, is it manual or office based?”

☐ Questions regarding description and status of pain:
   “9. Is it dull?”
   “17. Does the sharpness of the pain change?”
   “43. Is your pain ....
      Getting better  Staying the same  Getting worse

☐ Patients were given the opportunity to add details of surgery:
   “54. Have you ever had any surgery?
      If Yes, please say which operations...............................

Question 32 regarding abdominal pain first thing in the morning was moved to link with other questions on the 24 hour pattern of pain

Physical examination

The following procedures were added in the light of comments made by the physiotherapists:

☐ Sacro-iliac testing:
   P-A techniques on right and left sacro-iliac joints.
In the light of this feedback on the drafts the first working models were ready for use with the preliminary sample of subjects and appear in Appendix I, II and III.

**Stages 3a & b: Preliminary sample**

One of the aims at this stage was to evaluate the research instruments in the field so that further refinement could be made. It gave the opportunity to identify any problems with the questions and assessment procedures. Question clarity and wording, instructions for completion and procedural matters would all be tested. In addition, marginal questions would also be tested for their value to the study, as was the ability of the research instruments to aid the clinician in diagnosing a patient with abdominal pain of musculoskeletal origin.

**Subjects in the preliminary sample**

The initial part of this study was part of a larger research project conducted by Dr J.O. Hunter, Consultant Physician, Department of Gastroenterology, at Addenbrooke's NHS Trust Hospital, Cambridge, designed to establish the precise cause for unexplained abdominal pain known as "irritable bowel syndrome".

Patients would normally have been referred to the out-patient gastroenterology department by their General Practitioner or by another medical consultant. They would have had abdominal pain for at least two months, with or without a change in bowel habit, for which no objective pathological cause could be found. In the initial stage patients were assessed and investigated by experienced clinicians to exclude any pathological disease. All patients aged over 40 years had a barium enema to exclude any neoplastic disease.
Those who appeared not to have any such disease were, with their consent, enrolled in the study. A total of 60 patients were recruited. They were prepared to participate in a series of procedures, including an assessment by a physiotherapist, to test different aspects of IBS.

They were informed that the project would help in the diagnosis of abdominal disorders based on the symptoms with which a patient presents. It was emphasised that participation or otherwise would not affect their treatment. The precise nature of the protocols was not divulged. Warnings and potential risks of the assessments and investigations were explained. All patients in the study were to be followed up for one year to ensure there was no serious gastro-intestinal manifestation.

**Those excluded**

The study excluded patients with known gastro-intestinal disease, for example, ulcerative colitis and Crohn's disease, or any neoplastic disease. Patients with known cordae equina signs were also excluded. Patients would be excluded from the musculoskeletal assessment research if they were unable to complete a self-administered questionnaire due to language or comprehension difficulties.

**Confidentiality**

Patients were assured that all the information gathered would be treated in the strictest confidence. No information was divulged to other parties, except for those concerned with the present medical problem being investigated.

All examination procedures had been passed by the District Ethical Committee before commencement of any field work.
Stage 3a: Physician assessment

Patients were assessed initially by senior physicians. This comprised history-taking and physical assessment, including sigmoidoscopy. The physician was at liberty to use whichever order and format of questioning he chose. They then recorded their impression of the cause of each patient's symptoms in the medical notes before any further investigations were carried out.

Stage 3b: Musculoskeletal assessment

The physiotherapist, Valerie King, undertaking the assessments in this stage was experienced in assessing and treating musculoskeletal conditions, in particular spinal disorders, and had completed postgraduate training in this field. She had knowledge of the concepts of referred pain and muscular pain, of the format of questioning, of reasoning behind the choice of questions and of the examination procedures. She also had previous experience in treating patients referred from the gastroenterological department with abdominal pain due to musculoskeletal disorders.

In this stage the physiotherapist was intentionally not informed of the physician's diagnosis for each patient.

History-taking

Each patient completed the self-administered history-taking questionnaire (Appendix I) and then, after no more than one week had elapsed, saw the physiotherapist who used the structured interview questionnaire (Appendix II) to obtain a history.
Physical assessment procedures

The physical examination was undertaken at the same appointment as the structured interview questionnaire, after an interval for the physiotherapist to assimilate the information gathered during the structured interview. Instructions for the physiotherapist were printed on the physical examination assessment sheet, alongside the specific instructions for completion of the examining procedures. Although patient consent had been obtained at the onset of the trial, additional verbal consent was requested for the examination procedures after informing the patient of the proceedings and the risks. Risks of the assessment were small if the exclusion criteria were followed. The patient was warned that, during the examination, they may feel some discomfort around the spine and the muscles and it may irritate their symptoms but that it should be minimal and may persist for only 12-24 hours.

The physiotherapists had access to the information provided by the history-taking questionnaire. This enabled them to determine how "irritable" and "severe" a patient's symptoms were and so the physical examination could be adjusted accordingly; certain examination procedures could be omitted in the light of this information but no others could be added.

If at any time a patient did not wish for the examination to proceed they were told they could inform the physiotherapist. They were assured that this would not affect any treatment that may be appropriate.

Stage 4: Diagnoses

To undertake meaningful analysis of the data it was essential to record and compare the diagnosis given to each patient following their assessments.
Using the information recorded in the medical notes during the initial assessment and examination (Stage 3a), the physician was asked to choose between two categories of diagnosis.

The diagnosis was chosen from the following categories.

- Symptoms of musculoskeletal origin "Positive".
- Symptoms not of musculoskeletal origin "Negative".

The physiotherapist was asked to choose between the same two categories of diagnosis following completion of the history-taking and physical assessment.

The two diagnoses were then compared (Appendix X) and the history-taking questions were analysed as to their ability to act as predictors of abdominal pain of musculoskeletal origin.

**Stage 5: Expert panel review of history-taking questionnaire**

As one of the main aims of the study was to establish a questionnaire that could be used in a self-administered format, the preliminary study was designed to identify a concise set of questions to extract the most relevant information. It consisted of 56 items but, as a self-administered instrument, this can be too long for a respondent. Boredom and fatigue can affect the answers given and the number of questions answered.

Obviously, some questions would be more discriminating than others in providing clues for a diagnosis. Selection of and concentration on these 'best' items would be of value in diagnosis and decision making. While it cannot
be proven which questions are the most appropriate, asking a panel of experts is an accepted method in helping identify those that are most valid.

Two panels of experts were chosen for this stage and they were asked to evaluate which questions they considered to be the most relevant when trying to establish whether or not abdominal pain may have a musculoskeletal cause. The panels were similar in that they would come across this group of patients in the course of their clinical duties.

One group consisted of sixteen physiotherapists working in an out-patients setting. Those chosen had completed post-graduate training in the assessment and treatment of musculoskeletal complaints, particularly spinal conditions. They would have a knowledge of the concepts of referred pain and muscular pain, of the format of questioning, of reasoning behind the choice of questions and of the examination procedures.

In an ideal situation the physiotherapists would have been of equal experience but this was not possible in some instances. Physiotherapy out-patients department managers were contacted and the nature of the study and the type of experience required explained to them; they then recommended the appropriate person. All those working at Addenbrooke’s NHS Trust Hospital who met the criteria were chosen, whilst an additional number who also met the criteria were selected from the local area. Explanation and instructions for completion were printed on the front sheet for each panel member.

It was emphasised that patients would have gone through an initial medical screening to rule out any serious pathology, so topics concerning general health and weight would have already been covered.

The second expert panel comprised five doctors who were working in gastroenterological out-patients clinics. This comprised the total number of 128.
doctors working at senior registrar level and above in Addenbrooke’s NHS Trust Hospital dealing with patients with irritable bowel syndrome. They would also have had some experience with patients presenting with abdominal pain of musculoskeletal origin. The same explanation and instructions were provided as those for the physiotherapist panel.

Both panels were asked to rate the relevancy of each question in determining whether or not a patient’s abdominal symptoms had a musculoskeletal origin (Appendix IV). They were asked to choose from the following categories:

- Very Relevant.
- Relevant.
- Not Relevant.

They were also asked to add any comments about the wording of the questions or to add any questions they thought appropriate. The modal scores of the responses were recorded (Appendix VI).

**Stage 6: Expert panel review of physical assessment procedures**

The physical examination procedures were presented to the same group of physiotherapists that comprised the review panel in Stage 5. They were asked to comment on the procedures they considered to be the most relevant (Appendix V) -- using the same scale as in Stage 5 -- and to add comments about the questions or the questionnaire in general. The modal score for each procedure was recorded (Appendix VII). This iterative approach was designed as a filtering process to produce a set of procedures that were, in the opinion of this expert panel, the most relevant when assessing a patient with abdominal pain to determine whether it had a musculoskeletal origin.
Chapter Seven

Method: Main Field Work

Stage 7: Refinement of the research instruments

History-taking questionnaire and physical examination procedures

From the information gathered from applying the questionnaires and examination procedures to the preliminary sample of subjects (Stages 3a and 3b), comments gathered from the physiotherapists and doctors in Stages 5 and 6, and using the researcher's professional judgment, a new self-administered history-taking questionnaire and a new set of physical examination procedures were developed. For complete details of refined questionnaires refer to Appendix VIII and Appendix IX.

Stage 8: Re-application of research instruments

The refined questionnaires and procedures were then used with a second group of patients to test the research instruments tools for their:

- Reliability.
- Sensitivity.
- Specificity.
- Ability to act as a predictor of the presence of disease.
Subjects for application of refined history-taking questionnaire and physical examination procedures

Subjects recruited for this stage were different individuals from those included in the preliminary sample.

Subjects included/excluded

Subjects were recruited from the gastroenterology clinics. These subjects would have been referred to the out-patient gastroenterology department by their General Practitioner or by another medical consultant. They would have had abdominal pain for at least two months, with or without a change in bowel habit, for which no objective pathological cause could be found. In the initial stages patients were assessed and investigated by a senior clinician to exclude any pathological disease. All patients aged over 40 years had a barium enema to exclude any neoplastic disease.

Those who appeared not to have any such disease were recruited, with their consent, to the study. A total of 60 patients was recruited over a six month period. They were informed that the study would help in the diagnosis of abdominal disorders based on their symptoms. It was emphasised that participation or otherwise would not affect any future treatment. They were advised that the study involved completion of a symptom questionnaire and that a similar questionnaire would be sent to them by post in approximately two weeks time.

Confidentiality

Patients were assured that all the information gathered would be treated in the strictest confidence. No information was divulged to other parties, except for those concerned with the present medical problem being investigated.
Stage 8a: Physician assessment

Patients were assessed initially by senior physicians. This comprised history-taking and physical assessment, including sigmoidoscopy. The physician was at liberty to use whichever order and format of questioning he chose. They then recorded their impression of the cause of the patient's symptoms in the medical notes before any further investigations were carried out.

Stage 8b: Musculoskeletal assessment

*Self-administered history-taking questionnaire*

Each patient was asked to complete the questionnaire indicating any areas of pain and answering the questions applicable to their symptoms. Within two weeks of completing the questionnaire they were asked to complete an identical one. This was sent by post with a stamped addressed envelope for return.

Prior to this being sent each patient was telephoned to check if there had been any change in their medication or if they had undergone any treatment. If they answered in the affirmative then they were excluded from the follow-up questionnaire.

*Physical examination procedures by physiotherapist*

The nature of the study and its risks were explained to each patient as in the preliminary study. Instructions for the physiotherapist were the same as those set out earlier (see page 125). The physiotherapist had access to the history-taking questionnaire completed by the patient.
Stage 9: Comparison of physician and physiotherapist diagnoses

It was essential to record the two separate diagnoses so that meaningful analysis could be made at a later stage. Using the information recorded in the medical notes during the initial examination (Stage 8a) the physician was asked to choose between the same two categories of diagnosis as those used with the preliminary sample:

- Category 1: Symptoms of musculoskeletal origin “Positive”.
- Category 2: Symptoms not of musculoskeletal origin “Negative”.

The physiotherapist was asked to choose between the same two categories of diagnosis following a patient’s completion of the history-taking questionnaire and conducting a physical examination (Stage 8b). They were not informed of the diagnosis made by the physician. The two diagnoses were compared (Appendix XI) and the results used to determine measures of specificity, sensitivity, prevalence and predictive values. The two self-administered questionnaires were also analysed for the extent of agreement.

Stage 10: Comparison of pain areas

When patients attend for an initial consultation, some of the first questions a clinician asks are: “Do you have any pain?”; “Show me where you feel the pain”; and “Do you have pain anywhere else?” From this information initial hypotheses can be made about the underlying structures causing the pain and what structures can be referring pain to that area.

As part of the screening procedure it was considered that there may be value in evaluating whether there were distinctive areas of pain that were more common among those patients whose abdominal pain appeared to have a
musculoskeletal element. If a pattern of pain areas emerged this would be a useful indicator for a clinician when trying to decide the origin of a patient's symptoms. For comparative purposes a body chart was divided into sections as shown in Figure 20, and then cross-referenced with the details given by each patient.

Figure 20: Body chart used in preliminary study and main field work. Key to areas: 1. Upper abdomen; 2. Lower abdomen; 3. Chest; 4. Lower (lumbar) spine; 5. Middle (thoracic spine); 6. Upper (cervical) spine; 7. Upper and lower limbs; 8. Skull.

**Stage 11: Establishment of a scoring system**

A key aim of the study was to establish whether certain questions or groups of questions in the history-taking questionnaire and procedures in the physical examination could act as diagnostic predictors, that is, they could predict the presence of abdominal pain of musculoskeletal origin. Thus, once the physician and physiotherapist diagnoses had been made, differences in responses between the positive and negative groups could be examined.
Once the history-taking questionnaire and physical examination procedures were agreed following the preliminary sample and expert panel reviews, a scoring system for data analysis was developed. This was based upon the researcher's professional judgement, evidence in the literature and comments by the expert panels. It was recognised at the outset that clusters of questions and examination procedures would fall into a category either of 'scoring' or 'non-scoring'. Certain history-taking questions were seen as more discriminating than others in diagnosing patients.

**Scoring the history-taking**

Questions in the history-taking questionnaire used in the main field work were categorised into three groups.

**Group 1**

Those answered in the positive give a good indication that symptoms are of musculoskeletal origin. The more "Yes" responses in this group the greater the likelihood that the symptoms will be of musculoskeletal origin. The criteria for inclusion and the questions included are shown in Tables 5 and 6 respectively.

**Table 5. Criteria for inclusion in Group 1.**

<table>
<thead>
<tr>
<th>Criteria for inclusion</th>
<th>Group 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Those with <em>kappa</em> scores considered to show &quot;very good&quot; to &quot;moderate agreement&quot; (Appendix VIII and pages 160-161).</td>
<td></td>
</tr>
<tr>
<td>Those rated as &quot;Very Relevant&quot; or &quot;Relevant&quot; by the expert panels.</td>
<td></td>
</tr>
<tr>
<td>Those directly related to mechanical activities or events aggravating or precipitating the patient's abdominal pain.</td>
<td></td>
</tr>
</tbody>
</table>
Table 6. Questions included in Group 1.

Question 6. Does coughing, sneezing or taking a deep breath make your pain feel worse?
Question 7. Do activities such as bending, sitting, lifting, twisting or turning over in bed make your pain feel worse?
Question 21. Was the start of your symptoms in anyway connected with a fall, an accident, or lifting something?

Group 2

Those answered in the positive which give a good indication that symptoms are not of musculoskeletal origin. The more “Yes” responses in this group the greater the likelihood that the symptoms are not of musculoskeletal origin. The criteria for inclusion and the questions included are shown in Tables 7 and 8 respectively.

Table 7. Criteria for inclusion in Group 2.

Those with kappa scores considered to show “very good” to “moderate agreement” (Appendix VIII and pages 160-161).
Those rated as “Very Relevant” or “Relevant” by the expert panels.
Those related to non-mechanical factors (i.e. not movements) aggravating the patient’s abdominal pain.

Table 8. Questions included in Group 2.

Question 8. Does eating certain foods make your pain feel worse?
Question 18. Has there been any change in your bowel habit since the onset of your symptoms?
Question 19. Do you ever get a bloated feeling in your stomach?
Question 24. Has your weight changed since your symptoms began?
Group 3

Those questions which add information to the background of the condition, but which do not play a significant part in diagnosis. The criteria for inclusion and the questions included are shown in Tables 9 and 10 respectively.

Table 9. Criteria for inclusion in Group 3.
Those with kappa scores considered to show "very good" to "moderate agreement" (Appendix VIII and pages 160-161). Those rated as "Very Relevant" or "Relevant" by the expert panels.

Table 10. Questions included in Group 3.
Question 1. Do you get abdominal pain?
Question 3. Does your abdominal pain feel sharp?
Question 4. Does your abdominal pain feel like an ache?
Question 9. Does lying down or sitting ease your pain?
Question 10. Does walking ease your pain?
Question 11. Does using any form of heat ease your pain?
Question 12. Does taking tablets ease your pain?
Question 13. Would you say that nothing that you do or take eases your pain?
Question 14. How long does your pain take to ease?
Question 15. Does your pain keep you awake at night?
Question 16. When you are sleeping do you find lying in one position eases your pain better than another?
Question 17. Does your pain get worse as the day goes on?
Question 20. When your symptoms started did they come on suddenly?
Question 22. Do you ever get any back pain?
Question 23. Does your back feel stiff first thing in the morning?
Question 25. Have you ever used steroid tablets for medical reasons?
Question 26. Do you suffer from rheumatoid arthritis?

Questions in Groups 1 and 2 were classed as 'scoring' ones and those in Group 3 as 'non-scoring' ones.
Physical examination

The procedures in the physical examination were categorised into two groups.

**Group 1**

Those answered in the positive give an indication of abdominal symptoms of musculoskeletal origin. The criteria for inclusion and the procedures included are shown in Tables 11 and 12 respectively.

**Table 11. Criteria for inclusion in Group 1.**

Those rated as "Very relevant" or "Relevant" by the expert panels (Appendix VII).

Those relating directly to reproducing the patient's symptoms

**Table 12. Physical examination procedures used in Group 1.**

Spinal movement tests: Q2a, 3a, 4a, 5a, 6a, 7a, 8a, 9a, and 10a.

Neurodynamic tests: Q11, 12, 13, 14, 15, 16, 17, 18, 19.

Abdominal muscle testing: Q20a and b.

Test of costal cartilage: Q22a or b.


The more "Yes" responses to the procedures in this group the greater the likelihood that the symptoms will be of musculoskeletal origin.

**Group 2**

Other questions that add information to the whole picture of the symptoms. These may be useful if a clear picture does not emerge from the scoring questions (Group 1). The criteria for inclusion and the questions included are shown in Tables 13 and 14 respectively overleaf.
Table 13. Criteria for inclusion in Group 2.
Those rated as “Very relevant” or “Relevant” by the expert panels (Appendix VII).

Table 14. Physical examination procedure used in Group 2.
Scoliosis or shift of the spine: Q1.

Group 1 questions and procedures were classed as ‘scoring’ ones and Group 2 as ‘non-scoring’.

Stage 12: Identification of questions and procedures to act as predictors

Analysis using the scoring system established in Stage 11 was undertaken to determine which questions and procedures could be used as diagnostic predictors of abdominal pain of musculoskeletal origin.
Chapter Eight

Data analysis

Once the preliminary sample and main field work had been completed, the data was analysed from five perspectives. These were to:

1. Identify which questions in the history-taking and which procedures in the physical examination could act as predictors of the diagnosis of abdominal pain of musculoskeletal origin.

2. Measure the reliability of the history-taking questionnaire.

3. Assess the ability of a physiotherapist to reach the same diagnosis as a clinician on the presence of abdominal pain of musculoskeletal origin.

4. Determine the predictive value of the history-taking questionnaire and the prevalence of abdominal pain of musculoskeletal origin.

5. Decide if the areas of pain described by 'positive' patients differ significantly from those described by 'negative' patients.

Relevancy: Modal Scores

In Stages 5 and 6 panels of experts were asked to judge the relevance of the history-taking questions and the examination procedures prepared for the study. Modal scores were used to determine this: The mode in a series of scores is the most commonly occurring score in that set of data. Thus, there may be more than one mode in a set of data. Its value lies primarily in its
ability to determine “which one response occurs most often” (Hicks 1988). One of the drawbacks of this method, particularly with the small samples used in this study, is that several values may occur equally frequently (Coolican 1994).

**Reliability**

Stages 3b and 8b gathered data after the application of questionnaires and examination procedures. One of the aims of the study was to determine the extent of agreement between the two sets of scores and the performance of the questionnaire over a period of time. It was understood that, technically, reliability and validity are not properties of an instrument itself, as they depend on many other factors besides the instrument. Thus, for this study, it is the reliability of the outcome that is discussed (Suen & Ary 1989).

When looking at reliability (agreement) of the responses from the questionnaire in all stages of the study a kappa statistic ($k$) has been used (Suen & Ary 1989). This is defined as the “chance corrected proportional agreement” (Altman 1995) and is a flexible index that discounts expected chance agreements and can accommodate separate events using two or more observers. Kappa can be seen as the ratio of actual non-chance agreements divided by total possible non-chance agreements. Kappa is appropriate in this context as it deals with categorical data and discounts chance agreements.

Kappa has a maximum value of 1.00 when agreement is perfect, while a value of zero indicates no agreement better than chance and negative values are values that are worse than would be expected by chance. Negative values would be regarded as representing very poor agreement and may represent a situation when there is actual disagreement between observed data. Negative kappa values may also occur when there is random fluctuation of the data due to small sample sizes. No absolute definitions of
interpretation of scores between zero and one exist but Altman proposes the following guidelines as shown in Table 15.

**Table 15. Interpreting kappa scores (Altman 1995).**

<table>
<thead>
<tr>
<th>Value of $k$</th>
<th>Strength of agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.20</td>
<td>Poor</td>
</tr>
<tr>
<td>0.21-0.40</td>
<td>Fair</td>
</tr>
<tr>
<td>0.41-0.60</td>
<td>Moderate</td>
</tr>
<tr>
<td>0.61-0.80</td>
<td>Good</td>
</tr>
<tr>
<td>0.81-1.00</td>
<td>Very good</td>
</tr>
</tbody>
</table>

*Sensitivity, specificity, predictive value and prevalence*

Once the assessments of the preliminary sample had been completed (Stage 3a and 3b) diagnoses from those assessments were recorded (Stage 4), signal detection theory principles were used to measure the performance of the physiotherapist in detecting cases of abdominal pain of musculoskeletal origin. This performance was judged against the diagnosis of the physician which was used as the 'gold standard'.

Detection theory can be used to determine how accurate the observer is in recognising signs, or signals, and can be used to discriminate between two objects. Detection theory measures the discrepancy between the two and can be seen as a technique for understanding error (Gigerenzer & Murray 1987, Macmillan & Creelman 1991, Altman 1995).

When identifying signals or information it is important to remember that different types of errors exist: 'misses', for example, can represent where a clinician fails to detect a fracture on an X-ray while 'false alarms' arise where a clinician detects a fracture when in fact there is none. Correct recognition of a fracture can be called a 'hit', while 'correct rejection' refers to recognising correctly that the fracture does not exist (Macmillan & Creelman 1991).
“One interval design” describes the simplest correspondence experiment, where two stimuli are presented and the observer has to decide from which class it comes. Often these are termed “Yes/No” experiments and they measure the ability to discriminate, that is, to tell the two stimuli apart (Macmillan & Creelman 1991).

Signal detection principles are used to measure the observer’s sensitivity. Sensitivity measures the observer’s ability to discriminate (Gigerenzer & Murray 1987). The sensitivity of a test measures its ability to detect true cases and is defined as the number of ‘true positives’ as a percentage of the total of patients with the disease.

The specificity of a test measures its ability to detect disease-free individuals and is defined as the number of ‘true negatives’ divided by the total without the disease (Gigerenzer & Murray 1987).

It is important to remember that, when measuring specificity and sensitivity, it is done in relation to the diagnosis. However, it is not always known if that diagnosis is correct. These measurements relate to a test’s ability to predict the diagnosis rather than a patient’s true disease status; the diagnosis itself could be incorrect (Altman 1995).

This study, therefore, was concerned with evaluating a physiotherapist’s ability to predict the diagnosis rather than a patient’s true disease status. Sensitivity and specificity measures do not assess the accuracy of the test in a clinically useful way, that is, they do not address the proportion of patients with abnormal test results that are truly abnormal. Conversely, this is also one of the advantage of these measures. Unless it is known that the diagnosis is almost always correct, it is suggested that the test be evaluated on patients with the same prevalence of disease as those for whom the test will be used in the future (Altman 1995).
The whole point of a diagnostic test is to use it to make a diagnosis. Thus, the ability of the test to give the correct diagnosis, be it positive or negative, must be evaluated. *Predictive value measures* give a direct assessment of the usefulness of testing procedures in clinical practice:

- **Positive predictive value** is the proportion of patients with positive test results who are correctly diagnosed.

- **Negative predictive value** is the proportion of patients with negative test results who are correctly diagnosed.

Measures of predictive value are only useful in two instances: for analysing a study sample, rather than for universal application (Altman 1995); and when the actual presence of the disease is known, that is, the *prevalence of abnormality*. This is defined as "the proportion of patients with the abnormality" (Altman 1995). A low prevalence score indicates that the disease is uncommon. This has consequences for the study as it adversely affects the degree of confidence that can be placed on a positive result indicating a patient with disease.

Calculations to determine the specificity, sensitivity, predictive value and prevalence were completed using the categories shown in Table 16.

*Table 16. Category definitions.*

<table>
<thead>
<tr>
<th>Notation</th>
<th>Label</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>True positive</td>
<td>Correctly recognises presence of disease</td>
</tr>
<tr>
<td>b</td>
<td>False positive</td>
<td>Believes disease is present when it is not</td>
</tr>
<tr>
<td>c</td>
<td>False negative</td>
<td>Fails to recognise presence of disease</td>
</tr>
<tr>
<td>d</td>
<td>True negative</td>
<td>Correctly decides that disease is not present</td>
</tr>
</tbody>
</table>

The data is tabulated in a stimulus response matrix as shown in Table 17 overleaf.
Table 17. Formulae for calculating specificity, sensitivity, predictive value and prevalence.

<table>
<thead>
<tr>
<th></th>
<th>Present</th>
<th>Absent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Positive</td>
<td>a</td>
<td>b</td>
<td>a+b</td>
</tr>
<tr>
<td>Result Negative</td>
<td>c</td>
<td>d</td>
<td>c+d</td>
</tr>
<tr>
<td>Total</td>
<td>a+c</td>
<td>b+d</td>
<td>n</td>
</tr>
</tbody>
</table>

- Sensitivity: \(\frac{a}{a+c}\)
- Specificity: \(\frac{d}{b+d}\)
- Positive predictive value: \(\frac{a}{a+b}\)
- Negative predictive value: \(\frac{d}{c+d}\)
- Prevalence: \(\frac{(a+c)}{n}\)

Ideally, a test should have high sensitivity and high specificity. One without the other is of little value (Bourke et al 1985). However, sensitivity and specificity are not usually independent values; as one increases the other may decrease (Bourke et al 1985).

The analysis used at Stage 4 was repeated at Stage 9, after the application of the refined history-taking questionnaire, and again at Stage 12, where questions that could be used as predictors were identified.

**Predictors**

In some stages further analysis to confirm the ability of certain questions to act as predictors was completed using the likelihood ratio test and probability values.
Likelihood ratio test

This procedure forms the basis for evaluating the null hypothesis where the data is categorical. It is believed that a likelihood ratio test (LRT) is less affected by small sample sizes than the usual Pearson chi-square test. This test is used to analyse contingency tables such as the ones used in this study to determine those questions that can act as predictors (Howell 1992).

Probability values

The probability (p) value is "the probability of having observed our data (or more extreme data) when the null hypothesis is true" (Altman 1995). A p value indicates how probable it is that the results from the experiment are due to random errors and not to the real and consistent relationship predicted in the hypothesis. By definition probability lies between zero and one; something that cannot happen has a probability of zero and something that is certain to happen has a probability of one.

Therefore, the smaller the p value the smaller the possibility that random error or chance factors can account for the results. By implication, the smaller the possibility that the results are due to random error the greater the possibility that they are due to the relationship predicted in the hypothesis. With a small p value a null hypothesis can be rejected with confidence (Hicks 1988, Altman 1995).

The test of a null hypothesis is whether or not p lies below a selected cut-off point. Typically, scores below 0.05 are known as statistically significant; below a lower level (such as 0.01) as highly significant; and above 0.05 as not significant.
Pain Areas

Pain areas were analysed on patients where there was agreement of diagnosis by the physician and physiotherapist. For comparative purposes a body chart was divided into sections, and then cross-referenced with the details given by each patient.
Chapter Nine

Results

**Establishing face validity (Stage 2)**

The history-taking and physical examination questionnaires were sent to physiotherapists who were asked to comment on their appropriateness for assessing patients whose abdominal pain possibly had a musculoskeletal origin. Table 18 shows their responses.

**Table 18. Physiotherapists' written comments on initial draft of tools to be used in preliminary study.**

- "May need more details of description of pain."
- "Open ended questions would allow the patient to give clearer details of symptoms. You may need to probe for further details which closed questions don't allow for."
- "The questionnaires are very long particularly the physical examination procedures. Patients may find them difficult to complete. The physical examination procedures sheets seem very cumbersome and unwieldy. I'm not sure physiotherapists would find it 'user friendly'."
- "Need to ask what type of work for instance sedentary/manual."
- "All the questions seem to be appropriate but do you need to know exactly what foods aggravate their symptoms?"
- "Indicate on body chart areas of pins and needle to indicate possible nerve root irritation."
- "There seem to be a lot of questions and testing procedures but all are pretty similar to ones we already ask. Most of them seem OK. The physical examination would take a long time to complete. Couldn't the physio just examine the parts she thought were relevant?"
- "It would be helpful to know if their symptoms are getting better, staying the same or getting worse."

... /continued over
"The order of questions 23, 24, 32 and 34 seems to be mixed up, they should be together to allow continuity, otherwise the questions seem to be OK."

"The physical examination appears to be long winded but I suppose you have to cover all those areas."

Although there seem to be a lot of physical examination tests you should really include S-I joint testing for completeness as this can sometimes produce low abdominal pain otherwise the questions seem to be relevant. It sounds like an interesting project, I would be interested in the results."

"Is it relevant whether they are in full or part time work?"

"You may need more details on surgery and general health."

"You may need details of any treatment of back pain and probably more information about back pain in general."

"It seems a long questionnaire but I suppose it includes all the details that we normally ask when we are assessing patients."

"You may need more room for details on the body-chart but it seems you have quite a lot of details already."

In the light of these comments the draft tools were amended and the working models used for the preliminary study can be found in Appendix I, II and III. These versions were used for the preliminary study.

**Diagnosis of preliminary sample subjects: sensitivity, specificity, predictive value and prevalence (Stage 4)**

Diagnoses data were gathered to complete further analysis. The diagnoses were categorised from the following options:

- **"Positive"** indicated symptoms of musculoskeletal origin.
- **"Negative"** indicated symptoms not of musculoskeletal origin.
Summary of diagnosis

In this group of 60 patients, there was agreement between the physician and the physiotherapist that eight (13.3 per cent) patients had abdominal symptoms of musculoskeletal origin ("positive") and agreement that 42 (70 per cent) did not. There was disagreement between the physician and the physiotherapist in the remaining ten (16.6 per cent) cases. In eight of these the physiotherapist thought the patients were "positive" whereas the physician thought they were "negative".

In order to assess the ability of the physiotherapist to detect the presence of abdominal pain of musculoskeletal origin, the two diagnoses were compared (Table 19). After careful consideration it was decided that, for this study, the diagnosis of the physician involved in the study would be adopted as the 'gold standard'. At the time it was felt that the physician had the best all round knowledge to assess these subjects. He had the expertise to exclude serious visceral pathology and an all round knowledge of both visceral and musculoskeletal pathologies to be able to hypothesise the cause of the symptoms. With hindsight the choice of one physician's diagnosis as the 'gold standard' was, perhaps, not the most appropriate and other options to strengthen the 'gold standard' are set out in the discussion in Chapter Ten.

The comparison of diagnoses and the calculation of sensitivity, specificity, predictive value and prevalence of the disease are shown in Tables 19 and 20 respectively.

Table 19. Comparison of diagnoses.

<table>
<thead>
<tr>
<th>n=60</th>
<th>Test result</th>
<th>Physician Diagnosis</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>Physiotherapist</td>
<td>Positive</td>
<td>8 (a)</td>
<td>8 (b)</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Negative</td>
<td>2 (c)</td>
<td>42 (d)</td>
</tr>
<tr>
<td>Total</td>
<td>10 (a+c)</td>
<td>50 (b+d)</td>
<td>60 (n)</td>
</tr>
</tbody>
</table>
### Table 20. Calculation of diagnoses measures.

<table>
<thead>
<tr>
<th>Term</th>
<th>Formula</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>( \frac{a}{a+c} ), that is, ( \frac{8}{8+2} )</td>
<td>0.80</td>
</tr>
<tr>
<td>Specificity</td>
<td>( \frac{d}{b+d} ), that is, ( \frac{42}{8+42} )</td>
<td>0.84</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>( \frac{a}{a+b} ), that is, ( \frac{8}{8+8} )</td>
<td>0.50</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>( \frac{d}{c+d} ), that is, ( \frac{42}{2+42} )</td>
<td>0.95</td>
</tr>
<tr>
<td>Prevalence of disease</td>
<td>( \frac{a+c}{n} ), that is, ( \frac{(8+2)}{60} )</td>
<td>0.16</td>
</tr>
<tr>
<td>Total correct predictions</td>
<td>( \frac{a+d}{n} ), that is, ( \frac{(8+42)}{60} )</td>
<td>0.83</td>
</tr>
</tbody>
</table>

### Comments

No absolute definitions exist for the interpretation of sensitivity, specificity and predictive scores, but scores above 0.50 can be regarded as good as they represent scores better than chance, whereas scores below 0.50 can be regarded as poor as they are worse than chance (Prevost 1999). Table 20 shows sensitivity and specificity measures that are good, with the detection of the "positive" subjects at 0.80 and "negative" subjects at 0.84. Positive predictive value is low at 0.50, that is, only half of those that the physiotherapist diagnosed as being positive actually were so. The ability to detect negative cases was much better with a value of 0.95. The total of correct predictions was considered good at a value of 0.83. The prevalence of the disease was low in this sample at 0.16, as expected from results of a pilot study (Hunter 1987). However, with such small numbers of "positive" patients, sensitivity and positive predictive values may be highly variable and so only limited interpretation is possible.

**Expert panel review of preliminary study history-taking questionnaire (Stage 5)**

In this stage expert panels of doctors and physiotherapists were asked to decide which history-taking questions they felt were the most relevant. Initially, it was envisaged that the modal scores could be used to determine the questions to be included in the refined history-taking questionnaire;
however, due to the small number of choices available and the relatively small membership of the panels this was not feasible and as discussed below other factors had to be taken into consideration.

Criteria for inclusion in the refined history-taking questionnaire

All questions regarded by the panels as “Very Relevant” were included. Where there was agreement by the panels that a question was “Not Relevant” it was not included.

Where a difference of opinion existed between the panel members, the decision to include a question was made after consideration of the comments by the panel of experts, evidence in the literature and using the researcher’s professional judgement. The researcher has several years’ experience assessing and treating patients referred with abdominal pain of unknown origin. Two other questions were added in the light of comments by the panel. These are indicated in Table 21 by the heading ‘New question’. Table 21 represents those questions that, after consideration of the points explained above, comprised the refined history-taking questionnaire.

Table 21. Questions selected for the refined questionnaire.

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.</td>
<td>Does your abdominal pain feel sharp?</td>
</tr>
<tr>
<td>11.</td>
<td>Does your abdominal pain feel like an ache?</td>
</tr>
<tr>
<td>12.</td>
<td>Is your abdominal pain there all the time?</td>
</tr>
<tr>
<td>14.</td>
<td>Does your abdominal pain feel deep inside you?</td>
</tr>
<tr>
<td>16.</td>
<td>Do you ever get a bloated feeling in your stomach?</td>
</tr>
<tr>
<td>17.</td>
<td>Does coughing, sneezing or taking a deep breath make your pain feel worse?</td>
</tr>
<tr>
<td>21.</td>
<td>Does eating certain foods make your pain feel worse?</td>
</tr>
<tr>
<td>23.1.</td>
<td>Do activities such as sitting make your pain feel worse.</td>
</tr>
<tr>
<td>23.5</td>
<td>Do activities such as lifting make your pain feel worse?</td>
</tr>
<tr>
<td>24.1</td>
<td>Does sitting ease your pain?</td>
</tr>
</tbody>
</table>

.../continued over
Table 21.../continued

24.2. Does walking ease your pain?
24.3 Does lying down ease your pain?
24.4. Does taking tablets ease your pain?
24.5. Would you say that nothing you do or take eases your pain?
24.6. Does using any form of heat ease your pain?

25. How long does your pain take to ease? *Remember: tick one only*
   - Less than 1 hour
   - 1-12 hours
   - 12-24 hours
   - More than one day
   - Pain never eases

26. Does your pain keep you awake at night?
27. When you are sleeping do you find lying in one position eases your pain better than another?
30. Does your back feel stiff first thing in the morning?
33. Does your pain get worse as the day goes on?
35/36/37. Has there been any change in your bowel habit since the start of your symptoms?
39. When your symptoms started did they come on suddenly?
47/48. Has your weight changed since your symptoms began?
46. Have you ever used steroids for medical reasons?
51. Do you suffer from rheumatoid arthritis?
55. Do you ever get back pain?

New question: Does twisting or turning over in bed make your symptoms worse?
New question: Was the start of your symptoms in any way connected with a fall, an accident, or lifting something?

Comments on results

The questions in Table 22 (overleaf) covering patients’ descriptions of their pain were considered to be “Very Relevant” by most physiotherapists, yet the doctors were divided between those who felt they were “Very Relevant” or “Relevant” and those who did not feel they were relevant.
Table 22. Pain descriptor questions.

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q9. Is your pain dull?</td>
</tr>
<tr>
<td>Q10. Is your pain sharp?</td>
</tr>
<tr>
<td>Q11. Is your pain like an ache?</td>
</tr>
<tr>
<td>Q12. Is it there all the time?</td>
</tr>
<tr>
<td>Q13. Does it come and go?</td>
</tr>
<tr>
<td>Q14. Does it feel deep inside you?</td>
</tr>
<tr>
<td>Q15. Does it feel on the surface?</td>
</tr>
<tr>
<td>Q16. Do you feel bloated?</td>
</tr>
<tr>
<td>Q17. Does the sharpness of the pain change?</td>
</tr>
<tr>
<td>Q18. How long can you be free of pain?</td>
</tr>
</tbody>
</table>

The questions in Table 23 regarding aggravating and easing factors drew the most “Very Relevant” responses from both groups.

Table 23. Aggravating and easing factors.

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q23. What other things make the pain worse?</td>
</tr>
<tr>
<td>Q24. What eases the pain?</td>
</tr>
<tr>
<td>Q34. Is the pain aggravated by certain things that you do?</td>
</tr>
<tr>
<td>Q27. Do you find lying in one position better than another?</td>
</tr>
</tbody>
</table>

Questions giving information about the pattern of the pain (Table 24) are all considered as “Very Relevant” by the physiotherapists; however there was less agreement in the doctors’ panel. One possible reason for this is that asking questions about the behaviour of symptoms has become an established part of the routine questioning used by physiotherapists when assessing musculoskeletal conditions.

Table 24. Pain pattern questions.

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q30. Do you feel stiff first thing in the morning?</td>
</tr>
<tr>
<td>Q31. How long does it take to ease?</td>
</tr>
<tr>
<td>Q32. Do you feel pain first thing in the morning?</td>
</tr>
</tbody>
</table>

.../continued over
Table 24.../continued

Q33. Does the pain get worse/better/stay the same as the day goes on?
Q35. Does the pain get easier as the day goes on?

Question 38. "How long ago did the pain start?" is seen as "Very Relevant" and "Relevant" by the physiotherapists but is regarded as "Not Relevant" by the doctors. However, both groups are happy to include details of previous treatment and previous episodes, as in Question 40. "Have you had any previous episodes of this pain?" and Question 41. "Have you had any previous treatment for this pain?"

Questions regarding medication, Question 44. "Are you taking any medication for the pain?" and Question 45. "Are you taking any medication for other problems?" elicits a conflicting response from the doctors although the physiotherapists feel they are relevant. However, recording the use of anticoagulants was not considered to be "Relevant" by all the doctors, but there was a conflict of opinion among the physiotherapists. The question regarding weight, Question 47. "Does your weight remain steady?" appears to be relevant to the physiotherapists but not to doctors (see comments below). The relevance of bowel function, as in Question 35a "Does opening your bowels make any difference to your pain?" and Question 36. "Do you suffer from constipation?" are seen as "Very Relevant" or "Relevant" by all. However, Question 37. "Do you suffer from diarrhoea?" elicits a conflicting response from the doctors, but is seen as "Relevant" by the physiotherapists.

Questions regarding trauma and surgery, Question 52. "Have you had any bad falls?", Question 53. "Have you had any car accidents?" and Question 54. "Have you had any surgery?" elicit a mixed response from the doctors, yet both are regarded as "Relevant" by the physiotherapists.

Further questions regarding the identification of pain areas, as shown in Table 25 (overleaf), are seen as relevant by both groups.
Table 25. Pain areas.

Question 57. Show me where you feel your worst pain?
Question 58. Do you have any other area of pain?
Question 59. Do you have any areas of pins and needles?

Tables 26 and 27 show the verbal and written comments of the expert panelists when reviewing the questions for their relevance.

Table 26. Verbal comments.

“Yes, I ask all these questions ... I'm not sure why.”

“These are all good questions, could add for female patients, does the pain change during the course of the menstrual cycle?”

“When it comes down to thinking about what are the relevant questions to a particular topic it's not so easy. I just normally ask them as part of the routine assessment.”

Table 27. Written comments.

“Too many leading questions, e.g. questions relating to weight.”

“The sequence of questions appears to have no logic to it.”

“Need to establish type of work, i.e. sitting versus labourer.”

In questions relating to the description of pain it is “important to determine quality and severity.”

In relation to questions concerning bowel habit need to establish evidence of “inflammatory bowel, ulcerative colitis, etc.”

Need to identify any “previous abdominal surgery.”

“Need to enquire about sympathetic involvement related to a possible ‘T4 Syndrome’ with abdominal pain, cold, clammy, etc.”

“Sorry but all the questions seem relevant! Although there seems a lot when many of them are displayed on a body chart I'm sure they'll be quite clear.”

“I think the number of questions could be limited by asking more open questions.”

“I think many of the questions are leading.”

.../continued over
In relation to the need to identify aggravating factors: “Is the pain affected by
1. going up and down stairs
2. rolling over in bed
3. sitting
4. walking
5. twisting.”

“Tried to limit questions relating to MSK pain. Presume this will be part of medical assessment and where other questions, e.g. bowel habit, weight etc. will be documented.”

“Does the pain increase with movement or any particular position?”

“May need to get an idea of onset in more detail ie related to trauma or fall, etc”

**Researcher’s review of panel evaluations**

When assessing potential musculoskeletal disorders physiotherapists often follow a recognised pattern of questioning. Although these are not set in tablets of stone it has become accepted widely as good practice for assessing musculoskeletal disorders. I feel that most of the respondents, particularly the physiotherapists, see the questions as ones they ask and, therefore, as relevant without actually asking themselves: “does this question give information that would lead me to diagnose whether this patient’s abdominal pain is of musculoskeletal origin?” Many of the questions relate to possible contraindications to certain types of treatment and some give indications as to how much of the physical examination may be tolerated, but may not be particularly useful in hypothesising about the cause of the condition.

One physiotherapist said: “Yes, I ask all these questions”; and a doctor said: “These are all good questions” and promptly ticked them all. I feel that some of the panel members failed to view the questions in light of the instructions on the front sheet.
Expert panel review of physical examination procedures
(Stage 6)

Criteria for inclusion

In this stage experienced physiotherapists were asked to decide which physical examination procedures they felt were the most relevant when assessing patients to detect if a patient's abdominal pain has a musculoskeletal origin. Again, it was envisaged to use modal scores to determine the procedures that should be included in the refined physical examination. This was not, however, feasible and other factors had to be taken into consideration.

All procedures seen as "Very Relevant" by the panel were included. Where there was agreement that a procedure was "Not Relevant" it was excluded.

Where there was a difference of opinion among the panel members regarding the relevance of the procedures, comments made by the physiotherapists, evidence in the literature and the researcher's professional judgement were used to determine whether the procedure should be included. For instance, many of the physiotherapists did not feel that testing an abdominal contraction was relevant but with the incidence of myofascial lesions and the evidence reported in the literature it was decided to include it. The testing procedure for the abdominal musculature followed the guidelines set out by Gallegos and Hobsley (1992). Table 28 outlines those procedures selected for the refined physical examination.

Table 29. Procedures selected for the refined physical examination.

1. Observation of standing posture: Is there any scoliosis or shift in the spine?
2. Range of movement of the lumbar spine:
   Flexion.

.../continued over
Table 28 .../continued

Left lateral flexion.
   Right lateral flexion.
   Extension.
3. Range of movement of thoracic spine:
   Right and left rotation.
   Right and left side flexion
   Flexion
   Extension
4. Neural testing.
5. Abdominal muscle testing.
6. Costal cartilage testing (hooking manoeuvre).
7. Palpation of the lumbar and thoracic spine.

Re-application of research instruments: postal questionnaires (Stage 8)

Having completed a self-administered history-taking questionnaire at their first attendance in clinic, the patients were sent a repeat questionnaire in the post within two weeks. Patients were telephoned prior to being sent a second questionnaire to ascertain whether they had changed medication or commenced treatment since the completion of the initial questionnaire. If they had done so then they were excluded from the follow-up questionnaire. One subject had changed medication, so a total of 59 subjects were sent a follow-up questionnaire.

Postal returns of questionnaires are notoriously poor in spite of measures being taken to counteract this, such as stamped addressed envelopes and using follow-up letters to remind people to complete questionnaires (Scott 1961, McGibbon 1997b). In this study, however, 38 patients (65 per cent) returned these, which can be regarded as a good response rate.
Re-application of research instruments: refined history-taking questionnaire Kappa scores (Stage 8)

The refined history-taking questionnaire was completed by each patient at their first attendance; completion of a follow-up questionnaire was dependent upon whether a patient had changed medication or undergone any treatment since then. Thus, 38 of the 59 patients completed the follow-up questionnaire as their situation remained unchanged. The two sets of symptom data enabled agreement between responses to be measured. Kappa scores were calculated to determine what agreement existed between the scores. To ensure consistency in the data analysis only those respondents who answered "Yes" to Question 1 on both occasions were used for kappa analysis in questions 2-26. If the answers were "No" on both occasions, that is, they were not experiencing any pain, or a combination of "Yes" and "No", then they were not included in the kappa calculation for questions 2-17, but data from questions 18-26 were analysed in this group. The results are summarised in Tables 29, 30 and 31. The full results are shown in Appendix XIII.

Table 29. Questions that showed "good" and "very good" agreement.

8. Does eating certain foods make your pain feel worse?
12. Does taking tablets ease your pain?
13. Would you say that nothing that you do or take eases your pain?
15. Does your pain keep you awake at night?
16. When you are sleeping do you find lying in one position eases your pain better than another?
18. Has there been any change in your bowel habit since the start of your symptoms?
19. Do you ever get a bloated feeling in your stomach?
20. When your symptoms started did they come on suddenly?
21. Was the start of your symptoms in any way connected with a fall, an accident, or lifting something? *
Table 29 .../continued
22. Do you ever get back pain?
23. Does your back feel stiff first thing in the morning?
24. Has your weight changed since your symptoms began? *
25. Have you ever used steroids for medical reasons?
26. Do you suffer from rheumatoid arthritis?
* indicates "very good" agreement.

Table 30. Questions that showed "fair" and "moderate" agreement.
3. Does your abdominal pain feel sharp?
6. Does coughing, sneezing or taking a deep breath make your pain feel worse?
7. Do activities such as bending, sitting, lifting, twisting or turning over in bed make your pain feel worse?
9. Does lying down or sitting ease your pain?
10. Does walking ease your pain?
11. Does using any form of heat ease your pain?
14. How long does your pain take to ease?
17. Does your pain get worse as the day goes on?

Table 31. Questions that showed "poor" agreement.
2. Is your abdominal pain there all the time?
4. Does your abdominal pain feel like an ache?
5. Does your abdominal pain feel deep inside you?

**Diagnosis of main field work subjects: sensitivity, specificity, predictive value and prevalence (Stage 9)**

In this stage the ability of the physiotherapists to detect cases of abdominal pain of musculoskeletal origin was tested. A physician and a physiotherapist were asked to decide between one of two diagnoses after consideration of the history-taking details:
Symptoms of musculoskeletal origin ("positive").

Symptoms not of musculoskeletal origin ("negative").

There was agreement of diagnoses in 56 cases (93.3 per cent); of these, in five cases (8.9 per cent) there was agreement that the abdominal symptoms were of musculoskeletal origin ("positive"). In 51 cases (85 per cent) there was agreement that symptoms were not of musculoskeletal origin ("negative"). In four cases (6.7 per cent) there was disagreement about the diagnosis. In two of these cases the physiotherapist thought the patient was "positive", whereas the physician thought the patient was "negative" (Table 32).

The analytical approach that was used for the preliminary sample was repeated (pages 142-145). Calculations of sensitivity, specificity, negative and positive predictive value, prevalence of disease and total correct prediction are shown in Tables 32 and 33.

Table 32. Comparison of diagnoses.

<table>
<thead>
<tr>
<th></th>
<th>Test result</th>
<th>Physician Diagnosis</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Physiotherapist</td>
<td>5 (a)</td>
<td>2 (b)</td>
<td>7 (a+b)</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>2 (c)</td>
<td>51 (d)</td>
<td>53 (c+d)</td>
</tr>
<tr>
<td>Total</td>
<td>7 (a+c)</td>
<td>53 (b+d)</td>
<td>60 (n)</td>
</tr>
</tbody>
</table>

Table 33: Calculation of diagnoses measures.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Formula</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>( \frac{a}{a+c} ), that is, ( \frac{5}{5+2} )</td>
<td>0.71</td>
</tr>
<tr>
<td>Specificity</td>
<td>( \frac{d}{b+d} ), that is, ( \frac{51}{2+51} )</td>
<td>0.96</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>( \frac{a}{a+b} ), that is, ( \frac{5}{5+2} )</td>
<td>0.71</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>( \frac{d}{c+d} ), that is, ( \frac{51}{2+51} )</td>
<td>0.96</td>
</tr>
<tr>
<td>Prevalence of disease</td>
<td>( \frac{a+c}{n} ), that is, ( \frac{5+2}{60} )</td>
<td>0.11</td>
</tr>
<tr>
<td>Total correct predictions</td>
<td>( \frac{a+d}{n} ), that is, ( \frac{5+51}{60} )</td>
<td>0.93</td>
</tr>
</tbody>
</table>
Comments

The ability of the physiotherapist to detect “negative” patients is good at 0.96. However, the ability to detect “positive” patients is less accurate at 0.71, although it represents a marked improvement from the preliminary study which recorded 0.50. A similar trend appears with the positive predictive values. The total correct predictions is very good at 0.93. As discussed earlier, the prevalence of the disease is low and this means that the sensitivity and positive predictive values may be highly variable.

Comparison of pain areas in positive and negative patients (Stage 10)

Pain areas, as recorded by the patient on the body charts in the history-taking questionnaires (Stage 3b and 3b), were used alongside the diagnosis of that patient to determine if particular patterns of pain exist for abdominal pain of musculoskeletal origin. Only in cases where there was agreement of diagnoses between the physician and the physiotherapist were the details of pain areas used. Tables 34 and 35 show the areas of pain indicated by the subjects.

Table 34. Areas of pain recorded by all subjects.

<table>
<thead>
<tr>
<th></th>
<th>Group 1 Negative</th>
<th>Group 2 Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain only</td>
<td>60</td>
<td>2</td>
</tr>
<tr>
<td>Abdominal and back pain</td>
<td>27</td>
<td>11</td>
</tr>
<tr>
<td>Abdominal, chest and limb pain</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 35. Subjects recording particular areas of pain.

<table>
<thead>
<tr>
<th></th>
<th>Group 1 Negative (n = 93)</th>
<th>Group 2 Positive (n = 13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest</td>
<td>7 (6.6%)</td>
<td>0</td>
</tr>
<tr>
<td>Lower abdomen</td>
<td>44 (41.5%)</td>
<td>12 (85.7%)</td>
</tr>
<tr>
<td>Upper abdomen</td>
<td>38 (35.8%)</td>
<td>4 (28.5%)</td>
</tr>
<tr>
<td>Back</td>
<td>14 (13.2%)</td>
<td>10 (71.4%)</td>
</tr>
<tr>
<td>Upper/lower limbs</td>
<td>2 (1.8%)</td>
<td>0</td>
</tr>
<tr>
<td>Headaches</td>
<td>1 (0.9%)</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Per cents total more than 100 as categories are not exclusive.

Comments

From the results shown in Table 34 one can see that just over a half of the ‘negative’ subjects recorded abdominal pain alone, with a quarter recording abdominal and back pain and a small percentage recording abdominal, chest and limb pain. This contrasts with the ‘positive’ group where only two subjects recorded abdominal pain alone, with the majority recording abdominal and back pain. It has previously been noted that a musculoskeletal cause to abdominal pain should be suspected where abdominal pain is accompanied by dorso-lumbar pain (Mollica 1986). Although the number of ‘positive’ patients is small in this study and, therefore, interpretation of these results should be treated with caution, it appears that the majority of ‘positive’ patients show this pattern of abdominal pain accompanied with back pain, thus supporting Mollica’s observations (Mollica 1986).

Table 35 (above) shows a breakdown of the particular areas of pain noted on the body chart. It is interesting to note that the ‘negative’ group record many other areas of pain as well as abdominal pain, which is consistent with the observations of patients with IBS by other authors (Whorwell et al 1986, Sloth & Jorgensen 1988, Prior et al 1989), whereas the ‘positive’ group record only abdominal and back pain. However, the cause of these associated pains
and the precise link to the abdominal pain and symptoms in patients with IBS has never been investigated.

Future work with larger numbers of positive patients would propose, as suggested by Mollica, that a musculoskeletal component to abdominal pain may be suspected where their abdominal pain is accompanied by dorso-lumbar pain. Further work could also establish the precise nature of the back pain and clarify the link between abdominal pain in patients with IBS and their accompanying pain and symptoms.

**Developing a scoring system for the history-taking questionnaire and the physical examination (Stage 11)**

A scoring system was developed for the refined questionnaire and examination procedures based on the current literature, the researcher’s professional judgement, data from the expert panels concerned with the relevance of questions and procedures (Appendix VI and VII) and the kappa values for the refined history-taking questionnaire (Appendix XIII). Three categories of questions (Groups 1, 2 and 3) were identified and the criteria for inclusion into each group are set out in the method (Pages 135-137).

Questions were identified as being useful in predicting whether or not abdominal symptoms are of musculoskeletal origin.

**Scoring history-taking**

For the history-taking questionnaire the following were identified as ‘scoring’ questions:

**Group 1:** “Yes” responses to questions 6, 7 and 21 (Table 36; overleaf) were indicators that the symptoms are of musculoskeletal origin (“positive”).
Table 36. Group 1 history-taking questions

Q6. Does coughing, sneezing or taking a deep breath make your pain feel worse?
Q7. Do activities such as bending, sitting, lifting, twisting or turning over in bed make your pain feel worse?
Q21. Was the start of your symptoms in any way connected with a fall, an accident or lifting something?

Respondents would need to have at least one positive answer in this group and the greater the number of positive responses the better the indicator.

Group 2: “Yes” responses to questions 8, 18, 19 and 24 (Table 37) were indicators that the symptoms are not of musculoskeletal origin (“negative”).

Table 37. Group 2 history-taking questions

Q8. Does eating certain foods make your pain feel worse?
Q18. Has there been any change in your bowel habit since the start of your symptoms?
Q19. Do you ever get a bloated feeling in your stomach?
Q24. Has your weight changed since your symptoms began?

Respondents would need to have at least one positive response in this group and, again, the greater the number of positive responses in this group the better the indicator.

Group 3: The remaining questions (Table 38; overleaf) add to the overall information but remain neutral as far as being indicators are concerned. Where no obvious pattern emerges or there is a mixture of information regarding the nature of the problem the remaining questions are useful in adding information to the clinical picture.
Table 38. Group 3 history-taking questions.

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. Do you get abdominal pain?</td>
</tr>
<tr>
<td>Q3. Does your abdominal pain feel sharp?</td>
</tr>
<tr>
<td>Q4. Does your abdominal pain feel like an ache?</td>
</tr>
<tr>
<td>Q9. Does lying down or sitting ease your pain?</td>
</tr>
<tr>
<td>Q10. Does walking ease your pain?</td>
</tr>
<tr>
<td>Q11. Does using any form of heat ease your pain?</td>
</tr>
<tr>
<td>Q12. Does taking tablets ease your pain?</td>
</tr>
<tr>
<td>Q13. Would you say that nothing that you do or take eases your pain?</td>
</tr>
<tr>
<td>Q14. How long does your pain take to ease?</td>
</tr>
<tr>
<td>Q15. Does your pain keep you awake at night?</td>
</tr>
<tr>
<td>Q16. When you are sleeping do you find lying in one position eases your pain better than another?</td>
</tr>
<tr>
<td>Q17. Does your pain get worse as the day goes on?</td>
</tr>
<tr>
<td>Q20. When your symptoms started did they come on suddenly?</td>
</tr>
<tr>
<td>Q22. Do you ever get any back pain?</td>
</tr>
<tr>
<td>Q23. Does your back feel stiff first thing in the morning?</td>
</tr>
<tr>
<td>Q25. Have you ever used steroid tablets for medical reasons?</td>
</tr>
<tr>
<td>Q26. Do you suffer from rheumatoid arthritis?</td>
</tr>
</tbody>
</table>

Scoring the physical examination

From the refined physical examination (Appendix IX) the following examination procedures (Table 39) formed Group 1 and were used as 'scoring' procedures.

Table 39. Group 1 physical examination procedures

<table>
<thead>
<tr>
<th>Procedure Type</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinal movement tests</td>
<td>Q2a, 3a, 4a, 5a, 6a, 7a, 8a, 9a, and 10a.</td>
</tr>
<tr>
<td>Neurodynamic tests</td>
<td>Q11, 12, 13, 14, 15, 16, 17, 18, 19.</td>
</tr>
<tr>
<td>Abdominal muscle testing</td>
<td>Q20a &amp; b.</td>
</tr>
<tr>
<td>Test of costal cartilage</td>
<td>Q22a or b.</td>
</tr>
</tbody>
</table>
All these procedures were testing to see if they reproduced or aggravated the patient's symptoms (Appendix IX contains the full detail of these procedures). A positive response ("Yes") to any one of these examination procedures would be an indicator that the symptoms may be of musculoskeletal origin. Respondents would need to have at least one positive response in this group and the greater the number of positive responses the greater likelihood of a positive diagnosis.

Group 2 consisted of the remaining procedure -- Q1. "Is there any scoliosis or shift of the spine?" -- which adds to the overall information but is neutral as far as being an indicator of abdominal pain of musculoskeletal origin.

**Identifying questions that act as predictors of abdominal pain of musculoskeletal origin (Stage 12)**

One of the aims of the study was to see if certain questions could act as predictors of abdominal pain of musculoskeletal origin. Data from the refined history-taking questionnaire, including the reliability analysis (Appendix XIII), the identification of scoring questions (Stage 11) and the diagnoses from the main field work (Appendix XI), were observed. Attention was focused particularly on the responses of the subjects where there was agreement of the diagnosis of abdominal pain of musculoskeletal origin. One cluster of questions was identified initially, termed 'Factor 1', which appeared to be a possible predictor of abdominal pain of musculoskeletal origin.

**Factor 1**

The cluster of questions and responses which formed Factor 1 are shown in Table 40, overleaf.
Table 40. Factor 1 questions and responses.

"Yes" response to Question 6. "Does coughing, sneezing or taking a deep breath make your pain feel worse?"

and/or

"Yes" response to Question 7. "Do activities such as bending, sitting, lifting, twisting or turning over in bed make your pain feel worse?"

and

"No" response to Question 18. "Has there been any change in your bowel habit since the start of your symptoms?

Further observation of the data identified a second cluster of questions, which was termed 'Factor 2', which may act as predictors of abdominal pain of musculoskeletal origin. Factor 2 differs from Factor 1 in that it contains two additional questions as well as the original cluster used in 'Factor 1'.

Factor 2

Table 41 shows the cluster of questions and responses forming Factor 2.

Table 41. Factor 2 questions and responses.

"Yes" response to: Question 6. "Does coughing, sneezing or taking a deep breath make your pain feel worse?"

and/or

"Yes" response to Question 7. "Do activities such as bending, sitting, lifting, twisting or turning over in bed make your pain feel worse?"

and

"No" response to Question 18. "Has there been any change in your bowel habit since the start of your symptoms?"

and

"No" response to Question 8. "Does eating certain foods make your pain feel worse?"

and

"No" response to Question 24. "Has your weight changed since your symptoms began?"
Factor 1 and Factor 2 were then analysed to determine their ability to predict abdominal pain being of musculoskeletal origin (Tables 42-45).

**Table 42. Predictive values of Factor 1.**

<table>
<thead>
<tr>
<th>n=57</th>
<th>Actual diagnosis of origin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Musculoskeletal</td>
</tr>
<tr>
<td>Prediction of cause</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
</tr>
</tbody>
</table>

**Table 43. Calculation for Factor 1.**

- Sensitivity: \( \frac{a}{a+c} \), that is, \( \frac{4}{4+2} \) = 0.67
- Specificity: \( \frac{d}{b+d} \), that is, \( \frac{43}{8+43} \) = 0.84
- Positive predictive value: \( \frac{a}{a+b} \), that is, \( \frac{4}{4+8} \) = 0.33
- Negative predictive value: \( \frac{d}{c+d} \), that is, \( \frac{43}{2+43} \) = 0.96

**Table 44: Predictive values of Factor 2.**

<table>
<thead>
<tr>
<th>n=57</th>
<th>Actual diagnosis of origin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Musculoskeletal</td>
</tr>
<tr>
<td>Prediction of cause</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
</tr>
</tbody>
</table>

**Table 45: Calculation for Factor 2.**

- Sensitivity: \( \frac{a}{a+c} \), that is, \( \frac{4}{4+2} \) = 0.67
- Specificity: \( \frac{d}{b+d} \), that is, \( \frac{49}{2+49} \) = 0.96
- Positive predictive value: \( \frac{a}{a+b} \), that is, \( \frac{4}{4+2} \) = 0.67
- Negative predictive value: \( \frac{d}{c+d} \), that is, \( \frac{49}{2+49} \) = 0.96

This was followed by analysis to assess the following hypotheses:

1. **Null hypothesis (H01): Factor 1 is no better at predicting “Positive” patients than chance.**
2. Null hypothesis (H02): Factor 2 is no better at predicting “Positive” patients than Factor 1.

A likelihood ratio test was used to measure the hypotheses (Table 46).

<table>
<thead>
<tr>
<th>Table 46. Likelihood ratio test for hypotheses.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1 versus chance: 39.01-31.64 = 7.37, 1 degree of freedom p &lt; 0.01</td>
</tr>
<tr>
<td>Factor 2 versus Factor 1: 31.64-24.51 = 7.13, 1 degree of freedom p &lt; 0.01</td>
</tr>
</tbody>
</table>

Thus, the null hypothesis (HO1) can be rejected and it can be concluded that Factor 1 is significantly better at predicting “positive” patients than guessing. Furthermore, the null hypothesis (H02) can be rejected and it can be concluded that Factor 2 is significantly better at predicting “positive” patients than Factor 1.

Due to the small numbers of “positive” patients and to determine the probability of falsely rejecting the null hypotheses exact p values were calculated (Table 47).

<table>
<thead>
<tr>
<th>Table 47: Exact p values for hypotheses testing.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1 versus chance p = 0.015</td>
</tr>
<tr>
<td>Factor 2 versus Factor 1 p = 0.0005</td>
</tr>
</tbody>
</table>

Comment

These p values indicate that the null hypotheses HO1 and HO2 can be rejected with confidence.
Chapter Ten

Discussion

Introduction

The work has centered around patients presenting with abdominal pain for which no pathological cause can be found, often described as Irritable Bowel Syndrome. This study focused on identifying a cluster of questions that may be useful in identifying abdominal symptoms that come from the musculoskeletal system. They may be used by clinicians in a face-to-face interview and possibly, in the future, in a computer-assisted history-taking format prior to seeing the clinician. It has also identified procedures for physiotherapists to use that may be valuable for examining the same group of patients.

The existence of abdominal pain due to musculoskeletal disorders has previously been reported (Carnett 1926, Mennell 1966, Ashby 1977, Maigne 1986, Mollica et al 1986, Jorgensen & Fossgreen 1990) and experimental evidence has supported this (Kellgren 1938, 1939, Lewis 1939, Hockaday & Whitty 1967, McCall et al 1979, Cervero 1986, 1987, Tattersall & Cervero 1987). By identifying a group of patients with abdominal pain due to musculoskeletal lesions, this work reinforces the evidence.

Modal scores: History-taking questionnaire and physical examination procedures

Modal scores were considered initially to be a useful means of determining those questions and procedures considered to be relevant by an expert panel. It emerged that, for some questions, there was no outright consensus on the part of the panel. It may have to be accepted that, in some instances, there is
a difference of opinion as to what is seen as a relevant question. The optimum number of experts on the panel is a subject for consideration; there needs to be a sufficient number to get a representative sample of views. In future work a larger sample may be appropriate, with experts recruited from other hospitals to improve generalisability. However, it should be recognised that a larger panel may not necessarily improve the situation regarding the relevance of questions; indeed, it may make matters worse by reinforcing the difference of opinion.

In order to determine the relevancy of a question additional information had to be considered by the experts. Another factor appeared to be that, although the instructions regarding the aim of the exercise were clear, some panel members regarded every question as "Very Relevant", possibly because it was something they asked routinely rather than applying it to the particular topic in question. This became apparent in either the verbal comments to the researcher or the written comments made by the reviewers. Alterations to the wording of the instructions or face-to-face explanation may improve this.

Lack of familiarity with patients presenting with abdominal pain may also have led to the physiotherapists regarding the testing of active abdominal contraction only as "Relevant" rather than "Very Relevant". The decision to include it was based on the strong evidence in the literature about its importance (Carnett 1926, The Lancet 1991, Thomson et al 1991, Bourne 1992, Gallegos & Hobsley 1992, Sharpstone & Colin-Jones 1994). The procedure format adopted for this was the same as that proposed by Gallegos and Hobsley (1992).

**Postal questionnaire**

While the ideal situation would have been for a patient to attend the hospital on a further occasion to complete the repeat questionnaire, a lack of funding
for reimbursement of patients' travel and parking costs, together with the geographical nature of this catchment area, meant that this was not feasible. A postal questionnaire was felt to be the best alternative. The problems associated with using postal questionnaires, including poor response rate, were accepted. Telephone calls were made to encourage patients to return their questionnaires leading to a sixty five per cent return rate. This can be considered to be good.

Diagnosis: Sensitivity, specificity, predictive value and prevalence

One of the aims of the study was to test one physiotherapist's ability to distinguish between those patients with abdominal symptoms diagnosed as being of musculoskeletal origin by a clinician, denoted as "Positive", and those whose symptoms had another cause, denoted as "Negative". It is recognised that this study is addressing the issue of one physiotherapist's diagnostic ability compared to the diagnosis made by one physician working with one specific group of patients in the same hospital and, therefore, the results should not be considered to represent a consensus of opinion. With this in mind, the following results must be viewed as 'standalone data' and are not generalisable to other physicians, physiotherapists, or groups of patients in other hospitals. For further discussion of this issue see "Recommendations for further work" (pages 182-186).

The physiotherapist's ability to detect "Negative" cases (specificity) was good at 0.84 in Stage 3, increasing to 0.96 in Stage 8. The ability to detect "Positive" patients (sensitivity) was less successful at only 0.80 in Stage 3, falling to 0.71 in Stage 8.

The proportion of patients with a "positive" test who were correctly diagnosed, a "positive predictive value", with the first set is low at 0.50 (Stage 3), that is, only half of those that the physiotherapist diagnosed as
being positive actually were positive against the study's 'gold standard' of the physician's diagnosis. This improves with the second set to 0.71 (Stage 8).

The proportion of patients with negative tests who are correctly diagnosed, a "negative predictive value", was much better, with 0.95 being detected in both stages. The total of correct predictions was considered acceptable at 0.83 in Stage 3, which improved to 0.93 in Stage 8.

The overall improvement of the physiotherapist in detecting patients between Stage 3 and Stage 8 is probably due to increased exposure to this type of patient. Despite this increased exposure the ability to predict "positive" patients actually fell, whilst detecting negative patients improved. Part of the reason for this may be due to the fact that the diagnosis decision was presented as a "black or white" choice; in reality medical diagnosis is rarely this straight-forward and further investigations and analysis would often take place before reaching a diagnosis. For the purposes of this study a definite choice from one of two opposite diagnoses were acceptable; for future work it would be interesting to allow a "contributing to the condition" option.

In this study certain symptoms suggested clearly that the cause was not musculoskeletal, for example, altered bowel habit since the onset of their abdominal symptoms, abdominal bloating and symptoms aggravated by foods. Also, certain symptoms indicated that there was a musculoskeletal cause. These included pain aggravated by coughing, sneezing, deep breath, bending, twisting and turning movements.

Other cases were less clear: some patients had pre-existing vertebral and muscle dysfunction and this may have led to signs being misinterpreted. For some patients the irritability and severity of their condition limited the scope of the physical examination. Once all the investigations of the complete study had been collated it became clear that the physiotherapist had
classified some patients as "positive" who had abdominal pain due to food intolerance.

On reviewing the physiotherapist's case notes for patients where the physiotherapist thought them "positive" but the physician thought "negative", movement in general, and movements of the spine in particular, appeared to aggravate a patient's symptoms, which probably led the physiotherapist to a "positive" diagnosis.

As discussed in the literature many visceral conditions can be aggravated by certain movements, which has in the past been seen as a hallmark of musculoskeletal disorders. It is important to remember that two conditions can co-exist, for example, vertebral and muscle dysfunction which may result in abdominal pain and visceral disease giving abdominal pain.

It is easy to misinterpret spinal symptoms that are referred from the viscera as being of musculoskeletal origin. Further investigation and analysis of the link between the musculoskeletal and abdominal symptoms may lead to improved scores in diagnosing "positive" patients. Further knowledge of other causes of IBS, including symptoms due to food intolerance, may also help with the interpretation of symptoms.

With hindsight the appropriateness of using one physician's diagnosis as the 'gold standard' has to be reconsidered. It is accepted that the physician is an expert in ruling out serious visceral pathology and detecting visceral causes of abdominal pain. However, as this study was concerned with identification of subjects with musculoskeletal causes of abdominal pain, it should be considered whether the physician's expertise is the most valid benchmark to use. As discussed earlier the results are not generalisable to other physicians, physiotherapists, groups of patients or other hospitals when comparing one physiotherapist's diagnosis with that of one physician. Therefore, the 'gold standard' needs to be reinforced. It would not
necessarily improve with the recruitment of additional physicians with similar specialist skills; this would make the results more generalisable but does not bring musculoskeletal expertise. It would be more appropriate to recruit experts from musculoskeletal fields together with experts in visceral disease, for example, a rheumatologist or orthopaedic expert who specialises in musculoskeletal and spinal pathology would strengthen the 'gold standard'. Another option may be the combination of the original physician plus other physicians and a specialist musculoskeletal-trained physiotherapist who would have an in-depth knowledge of musculoskeletal pathology and presentation. Other alterations to the design to enhance generalisability would be the recruitment of additional physiotherapists with postgraduate training in musculoskeletal assessment to assess the subjects.

With both parts of the study, the prevalence of the disease was low — 0.16 and 0.11 respectively — as was expected considering the results of a pilot completed prior to the preliminary sample study (Hunter 1987). However, with such small numbers of positive patients, sensitivity and positive predictive values may be highly variable and so only limited interpretation is possible. Increasing the sample size or changing the entry criteria could lead to an improvement in the numbers of "positive" patients.

Reliability of history-taking questionnaire

The poor reliability of responses to Question 1 is probably due to the wording used in the introduction to the survey:

"These questions are all connected with your present symptoms. Please put a tick in the appropriate box."

"Present" may imply at this very moment rather than their most recent experience. This ambiguity may be resolved by removing the word "present"
and the question rephrased as “Do you tend to get abdominal pain?” or “Do you ever get abdominal pain?”

In addition, some respondents answered the question differently on each occasion. Again, this may be due to the interpretation of the introduction and was compounded by the time span of two weeks between the first and second questionnaire. A shorter time span may be preferable, but not too short otherwise a patient may remember the answer they gave on the previous occasion.

Questions 4 and 5, “Does your abdominal pain feel like an ache” and “Does your abdominal pain feel deep inside you?”, both concerned with descriptions of pain, show poor reliability. Descriptions of pain are always difficult to classify and people’s perception of their symptoms can change day to day. As discussed above the respondent may be describing their symptoms at the time of completion. This problem may also be overcome by an alteration in the wording, for example, by changing it to “Does your abdominal pain tend to feel like an ache?”

The reliability of the questions increases as a patient moves from those regarding descriptions of their symptoms (Questions 1-17), to questions where they are asked to recognise facts about the pattern and onset of their symptoms, for example, with Questions 18 to 26 the kappa scores show good and very good agreement, whereas the earlier questions show a mixture of good, moderate and poor agreement.

It is interesting to note that the questions in ‘Factor 2’, which may act as a predictor of abdominal symptoms of musculoskeletal origin, include two questions that show ‘Very Good’ agreement: “Does eating certain foods make your pain feel worse?” and “Has your weight changed since your symptoms began?”. One shows ‘Good’ agreement: “Has there been any change in your bowel habit since the start of your symptoms?” and two showed ‘Moderate’
agreement: "Does coughing, sneezing or taking a deep breath make your pain feel worse?" and "Do activities such as bending, sitting lifting, twisting, or turning over in bed make your pain feel worse?".

In this study the reliability measures were determined from two applications of the self-administered history-taking questionnaire to the same subjects. With this in mind the results should be interpreted with caution. Measures to determine the robustness of the questions and the questionnaire as a whole should be undertaken in future. This can be achieved by placing similar types of questions with slight alterations in wording within the questionnaire. Although this disrupts the logical sequence of questions, as discussed earlier (pages 91-92) it is one way to test the robustness of the questions.

Ideally, the questionnaire should be applied on several occasions to the same subject, in the same environment, at the same time of day and for there to have been no change in their symptoms. However, it is recognised that pain and accompanying symptoms in many conditions can change within the day, from day to day, and week to week. All measures of pain are subjective and there can be many influences on the patients responses when dealing with descriptions of pain. One has to accept that variations of these descriptions will occur even if the actual symptoms do not change. As shown in the reliability data (Appendix XIII), descriptions of pain show poor reliability whereas more factual data, for example, "Has there been a change in your weight since the onset of your symptoms?" shows 'Very Good' reliability.

The influence of this variation on the final diagnosis needs to be considered. Thus, the test of the questionnaires' robustness is the extent to which the diagnosis can withstand some variation in responses. Perfect reliability of individual questions is the ideal but for some questions this is probably not a realistic expectation. The function of each question is to contribute to the generation of a hypothesis for the diagnosis, rather than using solely the
response from any single question. Therefore, it may be possible to allow for a degree of variation in the response to some questions.

**Scoring questions as predictors**

Even after the questionnaire and procedures were refined in the light of the expert panels' views the researcher believed that there were certain questions and procedures that were more discriminating in diagnosing this complaint than others. Thus, a cluster of questions and procedures was 'earmarked', based on experience and the literature evidence as well as on the comments from the panels.

From analysis of the overall results it is clear that sensitivity and positive predictive values are low. As discussed earlier this may be due to the sample size and/or entry criteria. However, by focusing on the cluster of questions a much clearer picture is revealed. The $p$ values indicate that Factor 1 ("Yes" response to symptoms aggravated by cough, sneeze, deep breath, bend, twist, turn and "No" to change in bowel habit) is significant and that Factor 2 (Factor 1 plus symptoms not aggravated by food and no weight change, no feeling of bloating) is highly significant. Thus, the positive predictive value shows a marked improvement when using Factor 2 and, overall, the calculations related to Factor 2 indicate that its components are valuable indicators of abdominal pain of musculoskeletal origin.

**Relating this study to current practice**

This work breaks new ground by identifying a core set of questions that help to diagnose patients with abdominal symptoms due to musculoskeletal lesions. There are also grounds to consider that certain examination procedures could also be useful as predictors and this is one area that warrants further investigation. Until now, there has been a relatively high degree of chance and reliance on the particular experience of a
physiotherapist in diagnosing musculoskeletal conditions relating to abdominal pain. This need no longer be the case.

In the light of this study's findings, the researcher believes that doctors and physiotherapists should be made aware of the following points:

1. The incidence of musculoskeletal causes of abdominal pain in this patient group is small (0.13). However, it is an important sub-group as, while remaining undetected, these patients are a drain on valuable NHS resources with repeated clinic visits and expensive investigations. This cause should, therefore, be considered as a valid diagnosis early in an assessment of a patient presenting with abdominal pain.

2. Certain questions are useful in predicting the presence of abdominal pain of musculoskeletal origin.

3. The questions are suitable for presenting to patients in a self-administered format or could be incorporated into the face-to-face history-taking component on a patient's first attendance at clinic.

4. Where a pattern of answers emerges, then patients should be referred for assessment by a trained physiotherapist. This is non-invasive and relatively inexpensive.

Areas of pain

Although a greater percentage of the "Positive" patients record back pain as well as abdominal pain it is difficult to ascertain whether the two are linked. There are no details of the length of time the patients have suffered back pain, nor any relationship to the abdominal pain. With a small number of
positive patients used in this study, however, definitive findings cannot be supported. In the future a larger sample size or altering the entry criteria may be useful.

Jorgensen & Fossgreen (1990) have also noted that a higher percentage of patients with functional upper abdominal pain have back pain as well when compared to a control group. It is unclear whether this back pain could contribute to their abdominal pain or is a result of the 'viscero-somatic' reflexes as described by Cervero (Cervero & Tattersall 1985, Cervero 1986, 1987). It is also known that patients with IBS suffer from non-colonic symptoms, including back pain, more often than a group of controls (Whorwell et al. 1986). However, Jorgensen & Fossgreen (1990) have suggested there is as yet no conclusive evidence that back pain is connected to abdominal pain.

In the clinical situation, though, it is essential to record all areas of pain however negligible. As the literature has shown the spine is capable of referring pain to the abdomen. If this area is neglected then the real cause of the pain may be missed and the patient may be discharged or embark on a "merry-go-round" of investigations to no avail; neither of which is satisfactory.

Recommendations for further work

Project design, sample size, 'gold standard' and generalisability

With the benefit of hindsight changes would be made to the project design and these changes could be implemented in future studies. As has been noted in the results, the small prevalence of disease meant that only limited conclusions could be drawn from some of the statistical data. In order to improve the number of positive patients a larger sample should be used. Alternatively, a case-controlled study could be developed where all the
patients referred to the physiotherapy department with suspected abdominal symptoms of musculoskeletal origin are included in the study as well as selecting an appropriate control group. The disadvantages of case-controlled studies related to the possible biases in comparison of cases and controls are recognised (Altman 1995). Another way of increasing the prevalence would be the recruitment of subjects through a multi-centre trial. This would make the results more generalisable to other physicians, physiotherapists and hospitals.

As has been previously discussed above the use of one physician as the 'gold standard' was perhaps not the most appropriate and measures should be taken to strengthen it in the future. This could involve the combination of several gastroenterologists and a rheumatologist to add musculoskeletal expertise or several gastroenterologists and a physiotherapist trained in musculoskeletal assessment.

To improve the generalisability several physiotherapists could be recruited to administer the questionnaires, conduct the physical examinations and appraise the information to determine the diagnosis. A multi-centre trail which utilises several different physiotherapists, physicians and rheumatologists would also improve generalisability

**Questionnaire design**

Careful consideration must be given to the wording in the questionnaires, including the instructions for completion. This may necessitate the instructions being printed at the top of every sheet.

**Reliability of the physical examination**

The reliability of the examination procedures identified as being useful has not been established and further work is recommended. This would involve
the recruitment of two physiotherapists to undertake the examination procedures on the same group of patients on two separate occasions.

Screening with a self-administered questionnaire

The success of the self-administered history-taking questionnaire in terms of patient acceptability and providing important data means that it could be used in clinics as part of a screening process for this group of patients. It may also be useful in the GP setting, so that referral for physiotherapy can be made at an early stage. Where necessary, a minimum of investigations may be needed for certain groups of patients to rule out serious pathology.

The existence of a musculoskeletal lesion causing abdominal pain must first be recognised more widely within the medical profession, otherwise the value of the screening will not be realised.

Role of computer-based interviewing

The self-administered format of questioning could be used in a computer interview situation in an out-patients setting or, perhaps, in a GP clinic or health centre. It has been shown that in some fields of medicine patients have favourable attitudes towards this style of interviewing.

This approach has the following advantages:

- It records more items than are found in the medical records made by a physician.

- There is a high agreement when the data is compared to physician-recorded histories.
In some cases, patients are more truthful with a computer than they would be to a physician.


Computer interviewing techniques are untested in this field but have the potential to be useful methods of collecting this type of patient data. It may include a greater range of questions other than those aimed at predicting the presence of abdominal symptoms due to a musculoskeletal lesion.

Training of physiotherapists

Physiotherapists can be trained to recognise the possibility of such a diagnosis in this patient group and to incorporate the history-taking questions that may act as predictors of abdominal pain of musculoskeletal origin into their assessments where appropriate.

Identifying particular musculoskeletal components

This study has concentrated on developing diagnostic tools for abdominal symptoms due to musculoskeletal lesions as a generic disorder rather than identifying particular components that may be responsible.

Thus, a logical extension of this work would be to examine whether specific causes can be identified and, therefore, whether treatment regimes with outcome measures can be established.

The nature of back pain in patients with abdominal pain

Further work is needed to ascertain the precise link of back pain in patients with abdominal pain. For example, investigating the physiotherapist’s
ability to determine whether vertebral symptoms are of a referred nature from the viscera and when they are of local origin.

Summary

It is acknowledged that, for the majority of patients with abdominal pain, there is a visceral cause and so, in the first instance, serious visceral pathology must be excluded. However, it is clear that the clinician needs to consider the musculoskeletal system as a source of abdominal pain, ideally at an early stage.

It has been shown that some questions are more discriminating than others when it come to diagnosing abdominal pain of musculoskeletal origin and clinicians need to be encouraged to incorporate them in their initial assessment of patients with such pain. It has been suggested that: “When all investigations are negative in patients whose symptoms persist, there is frequently a mechanical or structural basis for those symptoms, even though the linkage seems tenuous” (Stoddard 1983). Thus, early assessment of the musculoskeletal system by a trained physiotherapist is recommended. Early referral will lead to prompt and appropriate treatment. This has the potential for freeing up valuable NHS resources as well as providing a more satisfactory outcome for the patient.

For patients where the cause of their abdominal pain is not obvious it is unacceptable that they are left with a diagnosis of Irritable Bowel Syndrome without the musculoskeletal system being assessed. This study shows that musculoskeletal assessment has a vital role to play in diagnosing cases where abdominal pain has a musculoskeletal origin.
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Appendix I

Questionnaire used in preliminary study
(patent)

ABDOMINAL PAIN STUDY

We should be grateful if you would complete the questionnaire attached to this letter of introduction.

The information you give us will help us to better understand your particular problems, and lead to the determination of more effective treatments, where possible.

All details will remain confidential, and will only be known to the medical staff involved with the diagnosis and treatment of your symptoms.

In addition, the data you provide will also be analysed as part of a detailed study concerning the causes of symptoms similar to yours.

However, your name and other identifying information will be removed before it is included in the study.

If you have any queries, please ask the senior physiotherapist.

Thank you.
ABDOMINAL PAIN STUDY
Patient's Assessment Form

Please read the questions carefully and put a tick in the appropriate box. If none are suitable and there is no box marked "none" write your answer in the space provided after the question.

Thank you.

1. What is your full name ................................

.................................................................

2. Please tick the appropriate box

MALE [ ] 1 [ ]
FEMALE [ ] 2

3. Which age range are you in?

18-25 YRS [ ] 1
26-40 YRS [ ] 2 [ ]
41-55 YRS [ ] 3
56-70 YRS [ ] 4
71+ [ ] 5

4. Are you in full or part-time employment?

YES [ ] 1 [ ]
NO [ ] 2

5. If yes, please indicate whether it is manual or office-based

MANUAL [ ] 1 [ ]
OFFICE [ ] 2

6. Do you have any spare time activities?

YES [ ] 1 [ ]

If yes, please say which ones

.................................................................

.................................................................

7. Do you play any sports?

YES [ ] 1 [ ]

NO [ ] 2
Body Chart

Q8. This section asks you to indicate where on average you get your pain.

A. Indicate on the body chart any areas of pain by using cross-hatching, ie.

B. If you experience any pins & needles indicate where on the body chart by using dots ie.

C. If you feel that any area of the skin is extra sensitive to touch indicate where on the body chart by using crosses ie.

Please turn over
The next set of questions are all about your **ABDOMINAL** pain.

### Questions about Abdominal Pain

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>1</th>
<th>2</th>
<th>No</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Is it dull?</td>
<td>YES</td>
<td>1</td>
<td></td>
<td>NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>10. Is it sharp?</td>
<td>YES</td>
<td>1</td>
<td></td>
<td>NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>11. Is it like an ache?</td>
<td>YES</td>
<td>1</td>
<td></td>
<td>NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>12. Is it there all the time?</td>
<td>YES</td>
<td>1</td>
<td></td>
<td>NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>13. Does it come and go?</td>
<td>YES</td>
<td>1</td>
<td></td>
<td>NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>14. Does it feel deep inside you?</td>
<td>YES</td>
<td>1</td>
<td></td>
<td>NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>15. Does it feel like it is on the surface?</td>
<td>YES</td>
<td>1</td>
<td></td>
<td>NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>16. Does it make you feel bloated?</td>
<td>YES</td>
<td>1</td>
<td></td>
<td>NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>17. Does the sharpness of the pain change?</td>
<td>YES</td>
<td>1</td>
<td></td>
<td>NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>18. How long can you be free of pain?</td>
<td>NEVER</td>
<td>1</td>
<td></td>
<td>ONE DAY</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ONE WEEK</td>
<td>3</td>
<td></td>
<td>ONE MONTH</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>19. How bad do you think your symptoms are?</td>
<td>MILD</td>
<td>1</td>
<td></td>
<td>MODERATE</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SEVERE</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Is the pain made worse by coughing and sneezing?</td>
<td>YES</td>
<td>1</td>
<td></td>
<td>NO</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
21. Is the pain made worse by eating foods?
   YES [ ] 1
   NO [ ] 2

22. If your answer is yes, please indicate which foods (You may choose more than one item)
   22.1 FATS [ ] 1
   22.2 DAIRY [ ] 1
   22.3 MEAT [ ] 1
   22.4 SPICY [ ] 1
   22.5 CITRUS [ ] 1
   22.6 WHEAT [ ] 1
   22.7 OTHERS [ ] 1
   22.8 N/A [ ] 2

23. Which of the following activities make the pain worse? (You may choose more than one item)
   23.1 SITTING [ ] 1
   23.2 STANDING [ ] 1
   23.3 LYING [ ] 1
   23.4 WALKING [ ] 1
   23.5 LIFTING [ ] 1
   23.6 NONE OF THESE [ ] 2

24. What can you do to ease the pain when it is bad? (You may choose more than one item)
   24.1 SITTING [ ] 1
   24.2 WALKING AROUND [ ] 1
   24.3 LYING DOWN [ ] 1
   24.4 TABLETS [ ] 1
   24.5 NOTHING EASES [ ] 2
   24.6 HEAT [ ] 1
   24.7 OTHERS [ ] 2

25. Once you have the pain how long will it take to ease?
   LESS THAN 1 HOUR [ ] 1
   1-12 HOURS [ ] 2
   12-24 HOURS [ ] 3
   MORE THAN ONE DAY [ ] 4

26. Do you wake at night because of the pain?
   EVERY NIGHT [ ] 1
   OCCASIONALLY [ ] 2
   NEVER WAKE [ ] 3

27. Do you find lying in one position better than another?
   YES [ ] 1
   NO [ ] 2
28. If yes, is it easier on your .....  
28.1 LEFT SIDE [ ] 1  
28.2 RIGHT SIDE[ ] 1  
28.3 FRONT [ ] 1  
28.4 BACK [ ] 1  
28.5 N/A [ ] 2  

29. Are you taking any medication to help you sleep?  
YES [ ] 1  
NO [ ] 2  

30. Do you feel any stiffness in your back first thing in the morning?  
YES [ ] 1  
NO [ ] 2  

31. If yes, how long does it take to ease?  
LESS THAN 1 HOUR [ ] 1  
1-12 HOURS [ ] 2  
12-24 HOURS [ ] 3  
DOES NOT EASE [ ] 4  
N/A [ ] 5  

32. Do you feel your ABDOMINAL pain first thing in the morning?  
YES [ ] 1  
NO [ ] 2  

33. Would you say that the pain gets worse as the day goes on?  
YES [ ] 1  
NO [ ] 2  

34. Is your pain aggravated by certain things that you do?  
YES [ ] 1  
NO [ ] 2  

35. Is your pain made easier by opening your bowels?  
YES [ ] 1  
NO [ ] 2  

36. Do you suffer from constipation?  
YES [ ] 1  
NO [ ] 2  

37. Do you suffer from diarrhoea?  
YES [ ] 1  
NO [ ] 2
38. How long ago did the pain start?
   1 MONTH [ ] 1
   2-6 MONTHS [ ] 2
   7-12 MONTHS [ ] 3 [ ]
   1-5 YEARS [ ] 4
   OVER 5 YEARS [ ] 5

39. Did your pain come on suddenly?
   YES [ ] 1 [ ]
   NO [ ] 2

40. Have you had any previous episodes of this particular pain?
   YES [ ] 1 [ ]
   NO [ ] 2

41. Have you had any treatment for this pain so far?
   YES [ ] 1 [ ]
   NO [ ] 2

42. If yes, was it successful?
   YES [ ] 1 [ ]
   NO [ ] 2
   N/A [ ] 3

43. Is your pain ....

GETTING BETTER STAYING THE SAME GETTING WORSE
[ ] 1 [ ] 2 [ ] 3 [ ]

44. Are you taking any medication for the pain?
   YES [ ] 1 [ ]
   NO [ ] 2

45. Are you taking any medication for any other problems?
   YES [ ] 1 [ ]
   NO [ ] 2

If yes, please say which tablets you are taking

..................................................
..................................................

46. Have you ever taken steroid tablets consistently for more than 2 months?
   YES [ ] 1 [ ]
   NO [ ] 2
47. Does your weight remain steady?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

48. If no, in what way has it altered?
   GONE UP [ ] 1 [ ]
   GONE DOWN [ ] 2 [ ]
   N/A [ ] 3 [ ]

49. Do you have any problems passing water?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

50. Have you ever had physiotherapy treatment for your pain?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

51. Do you suffer from any of the following? (You may choose more than one item)
   DIABETES [ ] 1 [ ]
   EPILEPSY [ ] 2 [ ]
   RHEUMATOID ARTHRITIS [ ] 3 [ ]
   NONE [ ] 4 [ ]

52. Have you ever had any bad falls?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

53. Have you ever had any car accidents?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

54. Have you ever had any surgery?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

   If yes, please say which operations
   ........................................
   ........................................

55. Have you ever had any back pain?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]
56. Are you seeing your GP or any other consultant for anything else at the moment?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>[ ] 1</td>
</tr>
<tr>
<td>NO</td>
<td>[ ] 2</td>
</tr>
</tbody>
</table>

Please return this questionnaire either to the clinic receptionist or in the envelope provided (if you were given one with the form.)

THANK YOU
Appendix II

Questionnaire used in preliminary study (physiotherapist)

ABDOMINAL PAIN STUDY
Physiotherapist's Assessment Form

Please read the questions carefully and ask them ONLY as they are written; do not reword the questions or ask any additional ones as they will distort the study. Questions and instructions which appear in italics are for you follow or to answer alone; they are not to be put to the patient.

Please put a tick in the appropriate box. If none are suitable and there is no box marked "none" write your answer in the space provided after the question.

Thank you

1. Is the patient ...
   MALE [ ] 1 [ ]
   FEMALE [ ] 2

2. How old are you? (Tick box corresponding to age group)
   18-25 YRS [ ] 1
   26-40 YRS [ ] 2 [ ]
   41-55 YRS [ ] 3
   56-70 YRS [ ] 4

3. Are you in full or part time employment?
   YES [ ] 1 [ ]
   NO [ ] 2

4. If yes, is it manual or office-based?
   MANUAL [ ] 1 [ ]
   OFFICE [ ] 2

5. Do you have any spare time activities?
   YES [ ] 1 [ ]
   NO [ ] 2

6. If yes, what are they? .........................

7. Do you play any sports?
   YES [ ] 1 [ ]
   NO [ ] 2

Please turn over

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**Body Chart**

8. Tell the patient "The next set of questions are all about your pain"  
*ASK THE PATIENT*

A. "Show me on yourself where you feel any pain"

*Indicate this on the body chart using crossed hatching, ie.*

B. "Do you get any areas of pins and needles?"

*If they answer "yes", "show me where" and indicate where on the body chart using dots, ie.*

C. "Do you have any areas of the skin that feel extra sensitive"

*If they answer "yes", "Show me where" and indicate where on the body chart using crosses, ie.*
Tell the patient “The next set of questions are all about your abdominal pain.”

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Is your pain dull?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Is it sharp?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Is it like an ache?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Is it there all the time?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Does it come and go?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Does it feel deep inside you?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Does it feel like it is on the surface?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Does it make you feel bloated?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Does the sharpness of the pain change?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. How long can you be free of pain?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. How bad do you think your symptoms are?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Is the pain made worse by coughing and sneezing?</td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option</th>
<th>Yes</th>
<th>No</th>
</tr>
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<tr>
<td>NEVER</td>
<td></td>
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<tr>
<td>ONE DAY</td>
<td></td>
<td></td>
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<tr>
<td>ONE WEEK</td>
<td></td>
<td></td>
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<tr>
<td>ONE MONTH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MILD</td>
<td></td>
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<tr>
<td>MODERATE</td>
<td></td>
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<tr>
<td>SEVERE</td>
<td></td>
<td></td>
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<tr>
<td>YES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
21. Is the pain made worse by eating foods?

YES [ ] 1 [ ]
NO [ ] 2

22. If your answer is yes, please say which foods (You may choose more than one item)

22.1 FATS [ ] 1 [ ]
22.2 DAIRY [ ] 1 [ ]
22.3 MEAT [ ] 1 [ ]
22.4 SPICY [ ] 1 [ ]
22.5 CITRUS [ ] 1 [ ]
22.6 WHEAT [ ] 1 [ ]
22.7 OTHERS [ ] 1 [ ]
22.8 N/A [ ] 2 [ ]

23. Which of the following activities make the pain worse? (You may choose more than one item)

23.1 SITTING [ ] 1 [ ]
23.2 STANDING [ ] 1 [ ]
23.3 LYING [ ] 1 [ ]
23.4 WALKING [ ] 1 [ ]
23.5 LIFTING [ ] 1 [ ]
23.6 NONE OF THESE [ ] 2 [ ]

24. What can you do to ease the pain when it is bad? (You may choose tick more than one item)

24.1 SITTING [ ] 1 [ ]
24.2 WALKING AROUND [ ] 1 [ ]
24.3 LYING DOWN [ ] 1 [ ]
24.4 TABLETS· [ ] 1 [ ]
24.5 NOTHING EASES [ ] 2 [ ]
24.6 HEAT [ ] 1 [ ]
24.7 OTHERS [ ] 2 [ ]

25. Once you have the pain how long will it take to ease?

LESS THAN 1 HOUR [ ] 1 [ ]
1-12 HOURS [ ] 2 [ ]
12-24 HOURS [ ] 3 [ ]
MORE THAN ONE DAY [ ] 4 [ ]

26. Do you wake at night because of the pain?

EVERY NIGHT [ ] 1 [ ]
OCCASIONALLY [ ] 2 [ ]
NEVER WAKE [ ] 3 [ ]

27. Do you find lying in one position better than another?

YES [ ] 1 [ ]
NO [ ] 2 [ ]
28. If yes, is it easier on your ....
   28.1 LEFT SIDE [ ] 1 [ ]
   28.2 RIGHT SIDE [ ] 1 [ ]
   28.3 FRONT [ ] 1 [ ]
   28.4 BACK [ ] 1 [ ]
   28.5 N/A [ ] 2 [ ]

29. Are you taking any medication to help you sleep?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

30. Do you feel any stiffness in your back first thing in the morning?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

31. If yes, how long does it take to ease?
   LESS THAN 1 HOUR [ ] 1 [ ]
   1-12 HOURS [ ] 2 [ ]
   12-24 HOURS [ ] 3 [ ]
   DOES NOT EASE [ ] 4 [ ]
   N/A [ ] 5 [ ]

32. Do you feel your ABDOMINAL pain first thing in the morning?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

33. Would you say that the pain gets worse as the day goes on?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

34. Is your pain aggravated by certain things that you do?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

35. Is your pain made easier by opening your bowels?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

36. Do you suffer from constipation?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

37. Do you suffer from diarrhoea?
   YES [ ] 1 [ ]
   NO [ ] 2 [ ]

38. How long ago did the pain start?
   1 MONTH [ ] 1 [ ]
   2-6 MONTHS [ ] 2 [ ]
   7-12 MONTHS [ ] 3 [ ]
   1-5 YEARS [ ] 4 [ ]
   OVER 5 YEARS [ ] 5 [ ]
39. Did your pain come on suddenly?
   YES [ ] 1 [ ]
   NO [ ] 2

40. Have you had any previous episodes of this particular pain?
   YES [ ] 1 [ ]
   NO [ ] 2

41. Have you had any treatment for this pain so far?
   YES [ ] 1 [ ]
   NO [ ] 2

42. If yes, was it successful?
   YES [ ] 1 [ ]
   NO [ ] 2
   N/A [ ] 3

43. Is your pain ....

GETTING BETTER STAYING THE SAME GETTING WORSE
[ ] 1 [ ] 2 [ ] 3 [ ]

44. Are you taking any medication for the pain?
   YES [ ] 1 [ ]
   NO [ ] 2

45. Are you taking any medication for any other problems?
   YES [ ] 1 [ ]
   NO [ ] 2

If yes, which tablets are you taking ...........

..........................................

46. Have you ever taken steroid tablets consistently for more than 2 months?
   YES [ ] 1 [ ]
   NO [ ] 2

47. Does your weight remain steady?
   YES [ ] 1 [ ]
   NO [ ] 2

48. If no, in what way has it altered?
   UP [ ] 1 [ ]
   DOWN [ ] 2
   N/A [ ] 3
49. Do you have any problems passing water?
YES [ ] 1 [ ]
NO [ ] 2

50. Have you ever had physiotherapy treatment for your pain?
YES [ ] 1 [ ]
NO [ ] 2

51. Do you suffer from any of the following? (You may tick more than one item)
DIABETES [ ] 1
EPILEPSY [ ] 2 [ ]
RHEUMATOID ARTHRITIS [ ] 3
NONE [ ] 4

52. Have you ever had any bad falls?
YES [ ] 1 [ ]
NO [ ] 2

53. Have you ever had any car accidents?
YES [ ] 1 [ ]
NO [ ] 2

54. Have you ever had any surgery? YES [ ] 1 [ ]
NO [ ] 2

If yes, what was the surgery for ...............

...........................................................

55. Have you ever had any back pain?
YES [ ] 1 [ ]
NO [ ] 2

56. Are you seeing your GP or any other consultant for anything else at the moment?
YES [ ] 1 [ ]
NO [ ] 2

Thank You.
Appendix III

Examination procedure used in preliminary study

PHYSICAL ASSESSMENT

Instructions for physiotherapist

Thank you for your cooperation please read these instructions carefully

1. Please read the history-taking information to determine the irritability of the patients’ symptoms. You may omit any tests you do not feel suitable, but under no circumstances must you add any tests. After assessing the patient you are asked to choose one of two diagnosis.
   • Abdominal pain of musculoskeletal origin
   • Abdominal pain not of musculoskeletal origin
   Space will be provided at the end of the questionnaire to enter your diagnosis.

2. Instructions for you are printed in italics. Please ask the questions as they are written, and tick the appropriate box for the answer.

3. Where an * appears, please ask the appropriate question as determined by whether the patient has their pain at the time of the assessment.

4. If a test is omitted please tick the box indicated N/A.

5. CONSENT and WARNINGS. Read the following to the patient. "We are going to do some tests on your spine and muscles to see if they are the source of your problems. We need to see if any of the tests bring on or make your symptoms worse. You may experience some discomfort after the assessment, this is usually short lived, approximately for 24 hours and is usually due to pressure on the spine. If at any time you wish me to stop the tests, you must let me know. This will not affect any treatment that may be appropriate for you".

Please turn over
Tell the patient "We are now going to look at the spine and muscles. Please could you undress to your underwear."

"Firstly, I am going to look at the posture of the back. Please stand with your back towards me."

Observe standing posture. Is there any:
1. SCOLIOSIS [Y] [N] [ ]
2. SPASM [Y] [N] [ ]
3. SWELLING [Y] [N] [ ]

4. Ask "Have you got your pain at the moment?" [Y] [N] [ ]

Range of movement -- lumbar spine

"Now I am going to check the movements of the spine. Please stand relaxed with your arms by your sides with your feet slightly apart"

Flexion

Instruct patient "Stand with your hands on the front of your thighs. Sliding your hands down your legs bend down as far as you can go"

Ask "What stops you going any further...
5. is it your abdominal pain? [Y] [N] [ ]
6. is it stiffness?" [Y] [N] [ ]

* "Does that movement...
7. * make your pain worse? [Y] [N] [N/A] [ ]
8. * bring on your pain?" [Y] [N] [N/A] [ ]

Left Lateral Flexion

Instruct the patient "Slide your left hand down the side of your leg as far as you can"

Ensure the patient keeps in midline, and that they don't tip either forwards or backwards.
Ask "What stops you going any further..."
9. is it your abdominal pain? [Y]1 [N]2 [ ]
10. is it stiffness?" [Y]1 [N]2 [ ]

* "Does that movement...
11. * make your pain worse? [Y]1 [N]2 [N/A] 3 [ ]
12. * bring on your pain?" [Y]1 [N]2 [N/A] 3 [ ]

Right Lateral Flexion

Instruct the patient "Slide your right hand down the side of your leg as far as you can"

Ensure the patient keeps in midline, and that they don't tip either forwards or backwards.

Ask "What stops you going any further..."
13. is it your abdominal pain? [Y]1 [N]2 [ ]
14. is it stiffness?" [Y]1 [N]2 [ ]

* "Does that movement...
15. * make your pain worse? [Y]1 [N]2 [N/A] 3 [ ]
16. * bring on your pain?" [Y]1 [N]2 [N/A] 3 [ ]

Extension

Instruct patient "Put the backs of your hands on the backs of your legs. Now slide your hands down the backs of your legs as far as you can."

Ask "What stops you going any further..."
17. is it your abdominal pain? [Y]1 [N]2 [ ]
18. is it stiffness?" [Y]1 [N]2 [ ]

* "Does that movement...
20. * bring on your pain?" [Y]1 [N]2 [N/A] 3 [ ]

Thoracic mobility

Tell the patient "I am now going to test the movement of the middle part of your back. Please sit on the bed with your arms crossed."
Ensure that the patient sits with their thighs well supported on the plinth and with their arms folded across the chest.
Flexion

Instruct the patient "Bend forwards from the waist."

* "Does that movement...
21.* bring on your abdominal pain? [Y]1 [N]2 [N/A] 3 [ ]
22.* make your pain worse?" [Y]1 [N]2 [N/A] 3 [ ]
23. "Does your spine feel stiff?" [Y]1 [N]2 [ ]

Left side flexion

Instruct the patient "Bend over to the left side."

* "Does that movement...
24.* bring on your abdominal pain? [Y]1 [N]2 [N/A] 3 [ ]
25.* make your pain worse?" [Y]1 [N]2 [N/A] 3 [ ]
26. "Does your spine feel stiff?" [Y]1 [N]2 [ ]

Right side flexion

Instruct the patient "Bend over to the right side."

* "Does that movement...
27.* bring on your abdominal pain? [Y]1 [N]2 [N/A] 3 [ ]
28.* make your pain worse?" [Y]1 [N]2 [N/A] 3 [ ]
29. "Does your spine feel stiff?" [Y]1 [N]2 [ ]

Left rotation

Instruct the patient "Turn your whole trunk (body) to the right side."

* "Does that movement...
30.* bring on your abdominal pain? [Y]1 [N]2 [N/A] 3 [ ]
31.* make your pain worse?" [Y]1 [N]2 [N/A] 3 [ ]
32. "Does your spine feel stiff?" [Y]1 [N]2 [ ]

Right rotation

Instruct the patient "Turn your whole trunk (body) to the left side."
* "Does that movement...  
33.* bring on your abdominal pain? [Y]1 [N]2 [N/A] 3 [ ]  
34.* make your pain worse?" [Y]1 [N]2 [N/A] 3 [ ]  
35. "Does your spine feel stiff?" [Y]1 [N]2 [ ]  

**Extension**  

_Instruct the patient "Bend backwards."_  

* "Does that movement...  
36.* bring on your abdominal pain? [Y]1 [N]2 [N/A] 3 [ ]  
37.* make your pain worse?" [Y]1 [N]2 [N/A] 3 [ ]  
38. "Does your spine feel stiff?" [Y]1 [N]2 [ ]  

**Dural tests**  

_Including right leg_  

"I am going to put a stretch on the nerves. Please tell me if any of the movements bring on your pain or make your pain worse"  

_Ensure the patient is sitting on the plinth, with their hands resting behind them back on the plinth._  

_Stop testing at the point pain is brought on or made worse._  

_Instruct patient to ...  

"Tuck your chin onto your chest. Does that ...  
39.* bring on your abdominal pain [Y]1 [N]2 [N/A] 3 [ ]  
40.* make your abdominal pain worse? [Y]1 [N]2 [N/A] 3 [ ]  

"Now bend forwards from the waist. Does that ...  
41.* bring on your abdominal pain [Y]1 [N]2 [N/A] 3 [ ]  
42.* make your abdominal pain worse? [Y]1 [N]2 [N/A] 3 [ ]  

"Now lift your right foot off the ground and straighten your knee. Does that ...  
43.* bring on your abdominal pain [Y]1 [N]2 [N/A] 3 [ ]  
44.* make your abdominal pain worse? [Y]1 [N]2 [N/A] 3 [ ]
"Now pull your toes up towards you. Does that ...
45.* bring on your abdominal pain  [Y]1 [N]2 [N/A] 3 [ ]
46.* make your abdominal pain worse? [Y]1 [N]2 [N/A] 3 [ ]

Including left leg

"Tuck your chin onto your chest. Does that ...
47.* bring on your abdominal pain  [Y]1 [N]2 [N/A] 3 [ ]
48.* make your abdominal pain worse? [Y]1 [N]2 [N/A] 3 [ ]

"Now bend forwards from the waist. Does that ...
49.* bring on your abdominal pain  [Y]1 [N]2 [N/A] 3 [ ]
50.* make your abdominal pain worse? [Y]1 [N]2 [N/A] 3 [ ]

"Now lift your left foot off the ground and straighten your knee. Does that ...
51.* bring on your abdominal pain  [Y]1 [N]2 [N/A] 3 [ ]
52.* make your abdominal pain worse? [Y]1 [N]2 [N/A] 3 [ ]

"Now pull your toes up towards you. Does that ...
53.* bring on your abdominal pain  [Y]1 [N]2 [N/A] 3 [ ]
54.* make your abdominal pain worse? [Y]1 [N]2 [N/A] 3 [ ]

Active Abdominal contraction

Ask the patient to lie on their back. Ensure that one pillow is supporting their head.

Instruct patient "Bend your knees so that your feet are flat on the bed. Place your hands on your thighs and lift your head and shoulders off the bed

55. "Does that movement bring on your abdominal pain?"  
   [Y]1 [N]2  [ ]

Palpation of costal cartilage

"I am now going to press on your ribs. Please tell me if it reproduces your abdominal pain"

Palpate anterior costal cartilage at T9, T10 level at mid clavicle level

56. Left  [Y]1 [N]2  [ ]
57. Right  [Y]1 [N]2  [ ]
Palpation

Palpate -- from T1 to L5 including sacroiliac joint, through the full range or to the point pain or resistance stops you -- NEVER PUSH THROUGH SPASM

Palpate --

Central posterior anterior pressure T1-L5

Unilateral posterior costo transverse joint T1-T10 left and right sides

Unilateral posterior costo vertebral joint T11 and T12 left and right sides

Rib angles T2-T10 left and right sides

Transverse pressures left and right side T1-T12

Unilateral posterior costo vertebral joint L1-L5 left and right sides

PSIS left side

PSIS right side

P-A centrals thoracic and lumbar spine

Instruct patient "I am going to press on your spine. Please lie on your front and turn your head to one side."

Ensure patient is lying prone with their arms by their sides. Use one pillow or none as the patient prefers. Indicate whether pain or stiffness is felt.
T1:
58. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
59. ... feel tender locally? [Y]1 [N]2 [ ]
60. Is there any stiffness [Y]1 [N]2 [ ]

T2:
61. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
62. ... feel tender locally? [Y]1 [N]2 [ ]
63. Is there any stiffness [Y]1 [N]2 [ ]

T3:
64. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
65. ... feel tender locally? [Y]1 [N]2 [ ]
66. Is there any stiffness [Y]1 [N]2 [ ]

T4:
67. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
68. ... feel tender locally? [Y]1 [N]2 [ ]
69. Is there any stiffness [Y]1 [N]2 [ ]

T5:
70. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
71. ... feel tender locally? [Y]1 [N]2 [ ]
72. Is there any stiffness [Y]1 [N]2 [ ]

T6:
73. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
74. ... feel tender locally? [Y]1 [N]2 [ ]
75. Is there any stiffness [Y]1 [N]2 [ ]

T7:
76. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
77. ... feel tender locally? [Y]1 [N]2 [ ]
78. Is there any stiffness [Y]1 [N]2 [ ]

T8:
79. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
80. ... feel tender locally? [Y]1 [N]2 [ ]
81. Is there any stiffness [Y]1 [N]2 [ ]

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T9:
82. "Does that ... bring on your pain?" [Y] 1 [N] 2 [ ]
83. ... feel tender locally? [Y] 1 [N] 2 [ ]
84. Is there any stiffness [Y] 1 [N] 2 [ ]

T10:
85. "Does that ... bring on your pain?" [Y] 1 [N] 2 [ ]
86. ... feel tender locally? [Y] 1 [N] 2 [ ]
87. Is there any stiffness [Y] 1 [N] 2 [ ]

T11:
88. "Does that ... bring on your pain?" [Y] 1 [N] 2 [ ]
89. ... feel tender locally? [Y] 1 [N] 2 [ ]
90. Is there any stiffness [Y] 1 [N] 2 [ ]

T12:
91. "Does that ... bring on your pain?" [Y] 1 [N] 2 [ ]
92. ... feel tender locally? [Y] 1 [N] 2 [ ]
93. Is there any stiffness [Y] 1 [N] 2 [ ]

L1:
94. "Does that ... bring on your pain?" [Y] 1 [N] 2 [ ]
95. ... feel tender locally? [Y] 1 [N] 2 [ ]
96. Is there any stiffness [Y] 1 [N] 2 [ ]

L2:
97. "Does that ... bring on your pain?" [Y] 1 [N] 2 [ ]
98. ... feel tender locally? [Y] 1 [N] 2 [ ]
99. Is there any stiffness [Y] 1 [N] 2 [ ]

L3:
100. "Does that ... bring on your pain?" [Y] 1 [N] 2 [ ]
101. ... feel tender locally? [Y] 1 [N] 2 [ ]
102. Is there any stiffness [Y] 1 [N] 2 [ ]

L4:
103. "Does that ... bring on your pain?" [Y] 1 [N] 2 [ ]
104. ... feel tender locally? [Y] 1 [N] 2 [ ]
105. Is there any stiffness [Y] 1 [N] 2 [ ]
L5:
106. "Does that ... bring on your pain?" [Y]1 [N]2
107. ... feel tender locally? [Y]1 [N]2
108. Is there any stiffness [Y]1 [N]2

Thoracic spine - T1-10 costo-transverse joints
left side

T1:
109. "Does that ... bring on your pain?" [Y]1 [N]2
110. ... feel tender locally? [Y]1 [N]2
111. Is there any stiffness [Y]1 [N]2

T2:
112. "Does that ... bring on your pain?" [Y]1 [N]2
113. ... feel tender locally? [Y]1 [N]2
114. Is there any stiffness [Y]1 [N]2

T3:
115. "Does that ... bring on your pain?" [Y]1 [N]2
116. ... feel tender locally? [Y]1 [N]2
117. Is there any stiffness [Y]1 [N]2

T4:
118. "Does that ... bring on your pain?" [Y]1 [N]2
119. ... feel tender locally? [Y]1 [N]2
120. Is there any stiffness [Y]1 [N]2

T5:
121. "Does that ... bring on your pain?" [Y]1 [N]2
122. ... feel tender locally? [Y]1 [N]2
123. Is there any stiffness [Y]1 [N]2

T6:
124. "Does that ... bring on your pain?" [Y]1 [N]2
125. ... feel tender locally? [Y]1 [N]2
126. Is there any stiffness [Y]1 [N]2

T7:
127. "Does that ... bring on your pain?" [Y]1 [N]2
128. ... feel tender locally? [Y]1 [N]2
129. Is there any stiffness [Y]1 [N]2
T8:
130. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
131. ... feel tender locally? [Y]1 [N]2 [ ]
132. Is there any stiffness [Y]1 [N]2 [ ]

T9:
133. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
134. ... feel tender locally? [Y]1 [N]2 [ ]
135. Is there any stiffness [Y]1 [N]2 [ ]

T10:
136. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
137. ... feel tender locally? [Y]1 [N]2 [ ]
138. Is there any stiffness [Y]1 [N]2 [ ]

Thoracic spine - T1-10 costo-transverse joints right side

T1:
139. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
140. ... feel tender locally? [Y]1 [N]2 [ ]
141. Is there any stiffness [Y]1 [N]2 [ ]

T2:
142. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
143. ... feel tender locally? [Y]1 [N]2 [ ]
144. Is there any stiffness [Y]1 [N]2 [ ]

T3:
145. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
146. ... feel tender locally? [Y]1 [N]2 [ ]
147. Is there any stiffness [Y]1 [N]2 [ ]

T4:
148. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
149. ... feel tender locally? [Y]1 [N]2 [ ]
150. Is there any stiffness [Y]1 [N]2 [ ]

T5:
151. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
152. ... feel tender locally? [Y]1 [N]2 [ ]
153. Is there any stiffness [Y]1 [N]2 [ ]
T6:
154. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
155. \_ feel tender locally? [Y]1 [N]2 [ ]
156. Is there any stiffness [Y]1 [N]2 [ ]

T7:
157. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
158. \_ feel tender locally? [Y]1 [N]2 [ ]
159. Is there any stiffness [Y]1 [N]2 [ ]

T8:
160. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
161. \_ feel tender locally? [Y]1 [N]2 [ ]
162. Is there any stiffness [Y]1 [N]2 [ ]

T9:
163. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
164. \_ feel tender locally? [Y]1 [N]2 [ ]
165. Is there any stiffness [Y]1 [N]2 [ ]

T10:
166. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
167. \_ feel tender locally? [Y]1 [N]2 [ ]
168. Is there any stiffness [Y]1 [N]2 [ ]

Thoracic spine -- costo vertebral joints right and left side

Left side:

T11:
169. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
170. \_ feel tender locally? [Y]1 [N]2 [ ]
171. Is there any stiffness [Y]1 [N]2 [ ]

T12:
172. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
173. \_ feel tender locally? [Y]1 [N]2 [ ]
174. Is there any stiffness [Y]1 [N]2 [ ]
Right side:

T11:
175. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
176. ... feel tender locally? [Y]1 [N]2 [ ]
177. Is there any stiffness [Y]1 [N]2 [ ]

T12:
178. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
179. ... feel tender locally? [Y]1 [N]2 [ ]
180. Is there any stiffness [Y]1 [N]2 [ ]

Thoracic spine -- rib angles left side

T2:
181. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
182. ... feel tender locally? [Y]1 [N]2 [ ]
183. Is there any stiffness [Y]1 [N]2 [ ]

T3:
184. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
185. ... feel tender locally? [Y]1 [N]2 [ ]
186. Is there any stiffness [Y]1 [N]2 [ ]

T4:
187. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
188. ... feel tender locally? [Y]1 [N]2 [ ]
189. Is there any stiffness [Y]1 [N]2 [ ]

T5:
190. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
191. ... feel tender locally? [Y]1 [N]2 [ ]
192. Is there any stiffness [Y]1 [N]2 [ ]

T6:
193. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
194. ... feel tender locally? [Y]1 [N]2 [ ]
195. Is there any stiffness [Y]1 [N]2 [ ]

T7:
196. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
197. ... feel tender locally? [Y]1 [N]2 [ ]
198. Is there any stiffness [Y]1 [N]2 [ ]

T8:
199. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
200. ... feel tender locally? [Y]1 [N]2 [ ]
201. Is there any stiffness [Y]1 [N]2 [ ]

T9:
202. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
203. ... feel tender locally? [Y]1 [N]2 [ ]
204. Is there any stiffness [Y]1 [N]2 [ ]

T10:
205. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
206. ... feel tender locally? [Y]1 [N]2 [ ]
207. Is there any stiffness [Y]1 [N]2 [ ]

Thoracic spine -- rib angles right side

T2:
208. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
209. ... feel tender locally? [Y]1 [N]2 [ ]
210. Is there any stiffness [Y]1 [N]2 [ ]

T3:
211. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
212. ... feel tender locally? [Y]1 [N]2 [ ]
213. Is there any stiffness [Y]1 [N]2 [ ]

T4:
214. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
215. ... feel tender locally? [Y]1 [N]2 [ ]
216. Is there any stiffness [Y]1 [N]2 [ ]

T5:
217. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
218. ... feel tender locally? [Y]1 [N]2 [ ]
219. Is there any stiffness [Y]1 [N]2 [ ]

T6:
220. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
221. ... feel tender locally? [Y]1 [N]2 [ ]

238
222. Is there any stiffness

T7:

223. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
224. feel tender locally? [Y]1 [N]2 [ ]
225. Is there any stiffness

T8:

226. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
227. feel tender locally? [Y]1 [N]2 [ ]
228. Is there any stiffness

T9:

229. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
230. feel tender locally? [Y]1 [N]2 [ ]
231. Is there any stiffness

T10:

232. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
233. feel tender locally? [Y]1 [N]2 [ ]
234. Is there any stiffness

Thoracic spine -- transverse pressures left side

T1:

235. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
236. feel tender locally? [Y]1 [N]2 [ ]
237. Is there any stiffness

T2:

238. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
239. feel tender locally? [Y]1 [N]2 [ ]
240. Is there any stiffness

T3:

241 "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
242. feel tender locally? [Y]1 [N]2 [ ]
243. Is there any stiffness

T4:

244. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
245. feel tender locally? [Y]1 [N]2 [ ]
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<th>Question</th>
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<td>Is there any stiffness?</td>
<td>Y</td>
<td>N</td>
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<td><strong>T5:</strong></td>
<td>&quot;Does that ... bring on your pain?&quot;</td>
<td>Y</td>
<td>N</td>
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<td>247.</td>
<td></td>
<td>Y</td>
<td>N</td>
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<td>248.</td>
<td>feel tender locally?</td>
<td>Y</td>
<td>N</td>
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<td>249.</td>
<td>Is there any stiffness?</td>
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<td>N</td>
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<td>250.</td>
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<td>Y</td>
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<td>251.</td>
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<td>252.</td>
<td>Is there any stiffness?</td>
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<td>N</td>
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<td>N</td>
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<td>253.</td>
<td></td>
<td>Y</td>
<td>N</td>
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<td>feel tender locally?</td>
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<td>N</td>
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<tr>
<td>255.</td>
<td>Is there any stiffness?</td>
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<td>N</td>
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<td>N</td>
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<td>256.</td>
<td></td>
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<td>N</td>
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<td>257.</td>
<td>feel tender locally?</td>
<td>Y</td>
<td>N</td>
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<td>258.</td>
<td>Is there any stiffness?</td>
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<td>N</td>
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<td>Y</td>
<td>N</td>
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<td>259.</td>
<td></td>
<td>Y</td>
<td>N</td>
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<tr>
<td>260.</td>
<td>feel tender locally?</td>
<td>Y</td>
<td>N</td>
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<td>261.</td>
<td>Is there any stiffness?</td>
<td>Y</td>
<td>N</td>
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<td>&quot;Does that ... bring on your pain?&quot;</td>
<td>Y</td>
<td>N</td>
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<td>262.</td>
<td></td>
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<td>N</td>
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<td>263.</td>
<td>feel tender locally?</td>
<td>Y</td>
<td>N</td>
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<td>264.</td>
<td>Is there any stiffness?</td>
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<td>N</td>
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<td>Y</td>
<td>N</td>
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<td>265.</td>
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<td>feel tender locally?</td>
<td>Y</td>
<td>N</td>
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<td>267.</td>
<td>Is there any stiffness?</td>
<td>Y</td>
<td>N</td>
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<td><strong>T12:</strong></td>
<td>&quot;Does that ... bring on your pain?&quot;</td>
<td>Y</td>
<td>N</td>
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<td>268.</td>
<td></td>
<td>Y</td>
<td>N</td>
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<td>269.</td>
<td>feel tender locally?</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>270.</td>
<td>Is there any stiffness?</td>
<td>Y</td>
<td>N</td>
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Thoracic spine -- transverse pressures right side

**T1:**
271. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
272. ... feel tender locally? [Y]1 [N]2 [ ]
273. Is there any stiffness [Y]1 [N]2 [ ]

**T2:**
274. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
275. ... feel tender locally? [Y]1 [N]2 [ ]
276. Is there any stiffness [Y]1 [N]2 [ ]

**T3:**
277. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
278. ... feel tender locally? [Y]1 [N]2 [ ]
279. Is there any stiffness [Y]1 [N]2 [ ]

**T4:**
280. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
281. ... feel tender locally? [Y]1 [N]2 [ ]
282. Is there any stiffness [Y]1 [N]2 [ ]

**T5:**
283. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
284. ... feel tender locally? [Y]1 [N]2 [ ]
285. Is there any stiffness [Y]1 [N]2 [ ]

**T6:**
286. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
287. ... feel tender locally? [Y]1 [N]2 [ ]
288. Is there any stiffness [Y]1 [N]2 [ ]

**T7:**
289. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
290. ... feel tender locally? [Y]1 [N]2 [ ]
291. Is there any stiffness [Y]1 [N]2 [ ]

**T8:**
292. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
293. ... feel tender locally? [Y]1 [N]2 [ ]
294. Is there any stiffness [Y]1 [N]2 [ ]

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Loughborough University

Valerie King

Do not write in this column

T9:
295. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
296. ... feel tender locally? [Y]1 [N]2 [ ]

297. Is there any stiffness [Y]1 [N]2 [ ]

T10:
298. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
299. ... feel tender locally? [Y]1 [N]2 [ ]

300. Is there any stiffness [Y]1 [N]2 [ ]

T11:
301. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
302. ... feel tender locally? [Y]1 [N]2 [ ]

303. Is there any stiffness [Y]1 [N]2 [ ]

T12:
304. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
305. ... feel tender locally? [Y]1 [N]2 [ ]

306. Is there any stiffness [Y]1 [N]2 [ ]

Lumbar spine -- unilaterals left side

L1:
307. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
308. ... feel tender locally? [Y]1 [N]2 [ ]

309. Is there any stiffness [Y]1 [N]2 [ ]

L2:
310. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
311. ... feel tender locally? [Y]1 [N]2 [ ]

312. Is there any stiffness [Y]1 [N]2 [ ]

L3:
313. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
314. ... feel tender locally? [Y]1 [N]2 [ ]

315. Is there any stiffness [Y]1 [N]2 [ ]

L4:
316. "Does that ... bring on your pain?" [Y]1 [N]2 [ ]
317. ... feel tender locally? [Y]1 [N]2 [ ]
318. **Is there any stiffness**

**L5:**
319. "Does that...bring on your pain?"  [Y]1 [N]2  [ ]
320. .. feel tender locally?  [Y]1 [N]2  [ ]
321. **Is there any stiffness**  [Y]1 [N]2  [ ]

**Lumbar spine -- unilaterals right side**

**L1:**
322. "Does that ...bring on your pain?"  [Y]1 [N]2  [ ]
323. .. feel tender locally?  [Y]1 [N]2  [ ]
324. **Is there any stiffness**  [Y]1 [N]2  [ ]

**L2:**
325. "Does that ...bring on your pain?"  [Y]1 [N]2  [ ]
326. .. feel tender locally?  [Y]1 [N]2  [ ]
327. **Is there any stiffness**  [Y]1 [N]2  [ ]

**L3:**
328. "Does that ...bring on your pain?"  [Y]1 [N]2  [ ]
329. .. feel tender locally?  [Y]1 [N]2  [ ]
330. **Is there any stiffness**  [Y]1 [N]2  [ ]

**L4:**
331. "Does that ...bring on your pain?"  [Y]1 [N]2  [ ]
332. .. feel tender locally?  [Y]1 [N]2  [ ]
333. **Is there any stiffness**  [Y]1 [N]2  [ ]

**L5:**
334. "Does that ...bring on your pain?"  [Y]1 [N]2  [ ]
335. .. feel tender locally?  [Y]1 [N]2  [ ]
336. **Is there any stiffness**  [Y]1 [N]2  [ ]

**Lumbar spine -- transverse pressures left side**

**L1:**
337. "Does that ...bring on your pain?"  [Y]1 [N]2  [ ]
338. .. feel tender locally?  [Y]1 [N]2  [ ]
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<td>340. &quot;Does that ...bring on your pain?&quot;</td>
<td>[Y]1 [N]2</td>
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<td>341. ... feel tender locally?</td>
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<td>L3:</td>
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<td>342. Is there any stiffness</td>
<td>[Y]1 [N]2</td>
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<td>343. &quot;Does that ...bring on your pain?&quot;</td>
<td>[Y]1 [N]2</td>
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<td>344. ... feel tender locally?</td>
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<td>345. Is there any stiffness</td>
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<td>346. &quot;Does that ...bring on your pain?&quot;</td>
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<td>350. ... feel tender locally?</td>
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<td>Lumbar spine -- transverse pressures right side</td>
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<td>L1:</td>
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<td>354. Is there any stiffness</td>
<td>[Y]1 [N]2</td>
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<td>355. &quot;Does that ...bring on your pain?&quot;</td>
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<td>357. Is there any stiffness</td>
<td>[Y]1 [N]2</td>
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<td>358. &quot;Does that ...bring on your pain?&quot;</td>
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<td>360. Is there any stiffness</td>
<td>[Y]1 [N]2</td>
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L4:
361. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
362. ... feel tender locally? [Y]1 [N]2 [ ]
363. Is there any stiffness [Y]1 [N]2 [ ]

L5:
364. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
365. ... feel tender locally? [Y]1 [N]2 [ ]
366. Is there any stiffness [Y]1 [N]2 [ ]

Sacroiliac joints -- right and left sides

Left side:

S-1:
367. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
368. ... feel tender locally? [Y]1 [N]2 [ ]
369. Is there any stiffness [Y]1 [N]2 [ ]

Right side:

S-1:
370. "Does that ...bring on your pain?" [Y]1 [N]2 [ ]
371. ... feel tender locally? [Y]1 [N]2 [ ]
372. Is there any stiffness [Y]1 [N]2 [ ]

"Thank you, you may get dressed now"

Diagnosis: Physiotherapist only:
Please tick the appropriate box

☐ Abdominal pain of musculoskeletal origin
☐ Abdominal pain not of musculoskeletal origin.

Thank you
Appendix IV

Questionnaire given to physiotherapists and doctors to determine the relevance of the history-taking questions

MUSCULOSKELETAL CAUSES OF ABDOMINAL PAIN

Thank-you for taking the time to complete this questionnaire. We are trying to determine the MOST relevant questions to be asked when assessing patients with ABDOMINAL pain to determine whether it has a musculoskeletal origin.

Please reflect on the questions set out on the pages overleaf and indicate by a tick in the box which best describes how relevant you think the question is in determining whether a patient’s pain has a musculoskeletal origin. Think along the lines that if you were short of time which questions would you ask.

We are asking you to decide whether you think the question is:

- VERY RELEVANT
- RELEVANT
- NOT RELEVANT

Please tick one box only.

Please turn over the page.
1. What is your name?  
2. What sex are you?  
3. How old are you?  
4. Are you working?  
5. Is your job physical or sedentary?  
6. Do you have any spare time activities?  
7. Do you play any sports?  
8. Do you smoke?  
9. Is your pain dull?  
10. Is your pain sharp?  
11. Is your pain like an ache?  
12. Is it there all the time?  
13. Does it come and go?  
14. Does it feel deep inside you?  
15. Does it feel on the surface?  
16. Do you feel bloated?  
17. Does the sharpness of the pain change?  
18. How long can you be free of pain?  
19. How bad do you think your symptoms are?  
20. Is the pain made worse by coughing and sneezing?  
21. Is the pain made worse by eating certain foods?  
22. If yes, indicate which foods?  
23. What other things make the pain worse?

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<table>
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<tr>
<th>Question</th>
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<th>Relevant</th>
<th>Not Relevant</th>
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<td>41. Have you had any previous treatment for this pain?</td>
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<tbody>
<tr>
<td>42. If yes, was it successful?</td>
<td></td>
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<tr>
<td>43. Is your pain getting better/staying the same/getting worse?</td>
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<tr>
<td>44. Are you taking any medication for the pain?</td>
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<tr>
<td>45. Are you taking any medication for other problems?</td>
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<tr>
<td>46. Have you taken any steroid tablets?</td>
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<tr>
<td>46a. Have you ever taken anticoagulants?</td>
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<td>47. Does your weight remain steady?</td>
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<td>48. If no, in what way has it altered, up or down?</td>
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<tr>
<td>49. Do you have any problems passing water?</td>
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<tr>
<td>50. Have you had any physiotherapy treatment for your pain?</td>
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<tr>
<td>51. Do you suffer from diabetes, epilepsy, rheumatoid arthritis?</td>
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<tr>
<td>51a. How would you describe your general health?</td>
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<tr>
<td>52. Have you had any bad falls?</td>
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<td>53. Have you had any car accidents?</td>
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<td>54. Have you had any surgery?</td>
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<td>55. Have you had any back pain?</td>
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<tr>
<td>56. Are you seeing your GP or any other consultant for anything else at the moment?</td>
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<tr>
<td>57. Show me where you feel your worst pain?</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>58. Do you have any other areas of pain?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>59. Do you have any areas of numbness or pins and needles?</td>
<td></td>
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</tbody>
</table>

Thank you
Appendix V

Questionnaire given to physiotherapists to determine the most relevant physical examination procedures

MUSCULOSKELETAL CAUSES OF ABDOMINAL PAIN

We are trying to determine which examination procedures are the most relevant when trying to establish whether a patient's abdominal pain is of musculoskeletal origin.

We are asking you to decide whether you think the examination procedure is:

VERY RELEVANT
RELEVANT
NOT RELEVANT

Please tick one box only.

Please turn over the page.
<table>
<thead>
<tr>
<th></th>
<th>Very Relevant (1)</th>
<th>Relevant (2)</th>
<th>Not Relevant (3)</th>
<th>Do not write in this column</th>
</tr>
</thead>
</table>
| 1. Assessment of posture for:  
a. Spasm  
b. Scoliosis  
c. Shift |               |              |                  |                             |
| 2. Range of movement of lumbar spine |               |              |                  |                             |
| 3. Range of movement of thoracic spine |               |              |                  |                             |
| 4. Neuromeningeal testing 'slump' |               |              |                  |                             |
| 5. Active abdominal contraction |               |              |                  |                             |
| 6. Palpating costal cartilages |               |              |                  |                             |
| 7. Palpation of thoracic and lumbar spine:  
a. Central posterior-anterior T1-L5 | | | | |
| b. Unilateral costotransverse joint T1-T10 left and right sides | | | | |
| c. Unilateral costovertebral joint T11 and T12 left and right side | | | | |
| d. Rib angles T2-T10 left and right Side | | | | |
| e. Transverse pressures left and right sides T1-T12 | | | | |
| f. Unilateral facet joint L1-L5 left and right side | | | | |
| g. Posterior superior sacro-iliac joint left and right sides | | | | |
Appendix VI

Relevance of history-taking questions: modal scores

Key: 1 = Very relevant  2 = Relevant  3 = Not relevant

<table>
<thead>
<tr>
<th>Question</th>
<th>Doctors score (n=5)</th>
<th>Modal score</th>
<th>Physiotherapists score (n=16)</th>
<th>Modal score</th>
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<tbody>
<tr>
<td>1. What is your name?</td>
<td>3,3,3,3,3</td>
<td>3</td>
<td>3,3,3,3,3,2,3,1,2,3,1,3,3,2,3,2,3</td>
<td>3</td>
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<tr>
<td>2. What sex are you?</td>
<td>1,2,3,3,3</td>
<td>3</td>
<td>2,3,2,2,3,1,1,1,2,3,1,2,2,3,2</td>
<td>2</td>
</tr>
<tr>
<td>3. How old are you?</td>
<td>1,2,2,3,2</td>
<td>2</td>
<td>2,3,2,1,2,1,2,2,1,2,3,1,2,3,2</td>
<td>2</td>
</tr>
<tr>
<td>4. Are you working?</td>
<td>2,3,2,3,2</td>
<td>2</td>
<td>2,3,1,2,1,1,2,1,2,1,3,1,2,1</td>
<td>1</td>
</tr>
<tr>
<td>5. Is your job physical or sedentary?</td>
<td>1,2,1,2,2</td>
<td>2</td>
<td>2,2,1,2,2,1,1,2,1,1,1,1,1,1,2,1</td>
<td>1</td>
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<tr>
<td>6. Do you have any spare time activities?</td>
<td>2,3,2,3,2</td>
<td>2</td>
<td>2,2,2,2,2,1,2,1,2,2,1,2,1,2,1,2</td>
<td>2</td>
</tr>
<tr>
<td>7. Do you play any sports?</td>
<td>1,2,1,1,2</td>
<td>1</td>
<td>2,2,2,2,2,1,2,1,2,1,2,1,2,2,1</td>
<td>2</td>
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<tr>
<td>8. Do you smoke?</td>
<td>2,3,3,3,2</td>
<td>3</td>
<td>2,3,2,2,3,3,3,1,3,1,2,3,2,3,2</td>
<td>2</td>
</tr>
<tr>
<td>9. Is your pain dull?</td>
<td>1,1,3,2,2</td>
<td>1, 2</td>
<td>2,2,1,2,2,1,1,1,1,1,1,2,1,1,1</td>
<td>1</td>
</tr>
<tr>
<td>10. Is your pain sharp?</td>
<td>1,3,1,2,1</td>
<td>1</td>
<td>2,2,1,2,2,1,1,1,1,1,1,1,2,1,1</td>
<td>1</td>
</tr>
<tr>
<td>11. Is your pain like an ache?</td>
<td>1,3,1,2,2</td>
<td>1, 2</td>
<td>2,2,1,2,2,1,1,1,1,1,1,1,1,2,1,1</td>
<td>1</td>
</tr>
<tr>
<td>12. Is it there all the time?</td>
<td>1,2,1,2,1</td>
<td>1</td>
<td>2,2,1,1,1,1,1,1,1,1,1,1,1,1,1</td>
<td>1</td>
</tr>
<tr>
<td>13. Does it come and go?</td>
<td>1,3,2,1,1</td>
<td>1</td>
<td>2,2,1,1,1,1,1,1,1,1,1,1,1,1,1</td>
<td>1</td>
</tr>
<tr>
<td>14. Does it feel deep inside you?</td>
<td>1,2,2,2,1</td>
<td>2</td>
<td>2,2,1,1,1,1,1,2,1,1,1,1,1,1,1,1</td>
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</tbody>
</table>

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<table>
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<th>Modal score</th>
<th>Physiotherapists</th>
<th>Modal score</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. Does it feel on the surface?</td>
<td>1, 1, 2, 3, 3</td>
<td>1, 3</td>
<td>2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1</td>
<td>1</td>
</tr>
<tr>
<td>16. Do you feel bloated?</td>
<td>2, 3, 2, 1, 3</td>
<td>2, 3</td>
<td>2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1</td>
<td>1</td>
</tr>
<tr>
<td>17. Does the sharpness of the pain change?</td>
<td>1, 1, 2, 3, 3</td>
<td>1, 3</td>
<td>2, 2, 1, 2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1</td>
<td>1</td>
</tr>
<tr>
<td>18. How long can you be free of pain?</td>
<td>1, 1, 3, 3, 2</td>
<td>1, 3</td>
<td>2, 2, 1, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1</td>
<td>1</td>
</tr>
<tr>
<td>19. How bad do you think your symptoms are?</td>
<td>3, 3, 3, 2, 3</td>
<td>3</td>
<td>3, 2, 2, 3, 2, 3, 3, 2, 3, 3, 2, 3, 3, 1, 1</td>
<td>3.2</td>
</tr>
<tr>
<td>20. Is the pain made worse by coughing, sneezing or taking a deep breath?</td>
<td>1, 2, 1, 2, 1</td>
<td>1</td>
<td>2, 1, 2, 2, 1, 1, 1, 2, 1, 1, 1, 1, 2, 1, 1</td>
<td>1</td>
</tr>
<tr>
<td>21. Is the pain made worse by eating certain foods?</td>
<td>2, 1, 3, 2, 1</td>
<td>1, 2</td>
<td>2, 1, 1, 1, 1, 1, 1, 3, 2, 1, 3, 1, 1, 2, 3, 1, 1</td>
<td>1</td>
</tr>
<tr>
<td>22. If yes, indicate which foods?</td>
<td>3, 3, 3, 3, 3</td>
<td>3</td>
<td>2, 2, 2, 1, 1, 1, 3, 3, 3, 3, 2, 1, 3, 1, 3, 3, 1</td>
<td>1, 3</td>
</tr>
<tr>
<td>23. What other things make the pain worse?</td>
<td>2, 1, 1, 1, 1</td>
<td>1</td>
<td>2, 1, 1, 1, 2, 1, 2, 1, 1, 1, 1, 2, 2, 2, 2</td>
<td>1, 2</td>
</tr>
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<td>23a. How quickly does the pain come on?</td>
<td>3, 1, 3, 2, 1</td>
<td>1, 3</td>
<td>2, 2, 1, 1, 1, 2, 1, 1, 2, 2, 1, 1, 2, 2, 2</td>
<td>1</td>
</tr>
<tr>
<td>24. What eases the pain?</td>
<td>2, 1, 1, 2, 1</td>
<td>1</td>
<td>2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 2</td>
<td>1</td>
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<tr>
<td>25. How long will the pain take to ease?</td>
<td>2, 3, 1, 2, 3</td>
<td>2, 3</td>
<td>2, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 1, 2</td>
<td>1</td>
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<tr>
<td>26. Do you wake at night because of the pain?</td>
<td>1, 2, 3, 2, 1</td>
<td>1, 2</td>
<td>2, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1</td>
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<td>Physiotherapists Modal score</td>
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<td>27. Do you find lying in one position better than another?</td>
<td>2,1,1,2,1 1</td>
<td>2,2,2,1,1,1,1,1,1,1,1,1,1,1,1,1 1</td>
<td></td>
<td></td>
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<tr>
<td>28. Is it easier on your left, right, front or back?</td>
<td>2,2,3,2,2 2</td>
<td>2,2,3,2,2,2,1,3,3,2,2,1,3,3,3,3 2,3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29. Are you taking any medication to help you sleep?</td>
<td>2,3,3,3,2 3</td>
<td>2,2,2,2,1,2,1,1,1,2,2,3,3,1,1,1 1,2</td>
<td></td>
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<td>30. Do you feel stiff first thing in the morning?</td>
<td>1,2,1,1,2 1</td>
<td>2,1,2,1,1,1,1,1,1,1,1,1,1,2,1,1 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31. How long does it take to ease?</td>
<td>1,2,2,1,3 1,2</td>
<td>2,2,2,1,1,1,1,1,1,1,2,1,1,1,1,1 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32. Do you feel pain first thing in the morning?</td>
<td>3,1,2,1,3 1,3</td>
<td>1,2,1,1,1,1,1,1,2,1,1,1,1,1,1 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33. Does the pain get worse/better/the same as the day goes on?</td>
<td>2,1,3,2,1 1,2</td>
<td>2,1,2,1,2,1,2,2,1,1,1,1,1,2,1 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34. Is the pain aggravated by certain things you do?</td>
<td>2,1,1,1,2 1</td>
<td>2,1,2,1,1,1,1,1,1,1,1,1,1,1,1 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35. Does the pain get easier as the day goes on?</td>
<td>1,3,1,2,3 1,3</td>
<td>2,2,2,1,1,1,1,1,1,3,1,2,2,1,1,1 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35a. Does opening your bowels make any difference to your pain?</td>
<td>2,2,2,2,3 2</td>
<td>2,1,2,1,1,1,1,2,3,2,1,1,2,2,3,2 1,2</td>
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<td>Q.</td>
<td>Doctors Modal Score</td>
<td>Physiotherapists Modal Score</td>
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<tr>
<td>36. Do you suffer from constipation?</td>
<td>1,2,3,1,2</td>
<td>2,2,2,1,1,1,2,1,1,3,2,1,1,1,1,1</td>
<td></td>
<td></td>
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<tr>
<td>37. Do you suffer from diarrhoea?</td>
<td>1,2,3,2,3</td>
<td>2,2,2,1,1,1,2,1,2,3,3,2,1,1,1,2</td>
<td></td>
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<tr>
<td>38. How long ago did the pain start?</td>
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<tr>
<td>39. Did it come on suddenly/gradually?</td>
<td>2,2,3,1,1</td>
<td>2,2,2,2,2,1,1,1,1,1,1,1,1,1,1,1</td>
<td></td>
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<tr>
<td>40. Have you had any previous episodes of this pain?</td>
<td>2,1,2,2,2</td>
<td>2,2,2,2,2,1,2,1,1,1,1,1,1,2,1,1,1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41. Have you had any previous treatment for this pain?</td>
<td>1,2,3,1,2</td>
<td>2,2,2,2,2,2,1,1,1,1,1,2,2,2,2,1</td>
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</tr>
<tr>
<td>42. If yes, was it successful?</td>
<td>1,3,2,1,2</td>
<td>2,2,2,2,2,2,1,2,1,1,1,2,2,2,1,1,1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43. Is your pain getting better/staying the same/getting worse?</td>
<td>2,2,2,2,2</td>
<td>2,2,2,1,2,1,2,1,1,1,2,2,1,1,2,1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44. Are you taking any medication for the pain?</td>
<td>3,2,3,2,1</td>
<td>2,2,2,2,2,1,2,1,2,2,1,1,1,1,1,1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45. Are you taking any medication for other problems?</td>
<td>2,3,2,2,3</td>
<td>2,2,2,1,2,1,2,1,1,1,1,2,2,2,1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46. Have you taken any steroid tablets?</td>
<td>1,2,3,1,2</td>
<td>2,2,2,1,1,1,2,1,1,1,1,2,1,1,1,1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46a. Have you ever taken anticoagulants?</td>
<td>2,3,3,3,3</td>
<td>1,1,2,2,3,1,3,3,3,1,3,3,1,1,2,2</td>
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/... more
<table>
<thead>
<tr>
<th></th>
<th>Doctors</th>
<th>Modal score</th>
<th>Physiotherapists</th>
<th>Modal score</th>
</tr>
</thead>
<tbody>
<tr>
<td>47. Does your weight remain steady?</td>
<td>3,2,3,3,3</td>
<td>3</td>
<td>2,2,2,1,1,1,2,2,1,1,1,1,2,2,2</td>
<td>2</td>
</tr>
<tr>
<td>48. If no, in what way has it altered, up or down?</td>
<td>3,2,2,2,3,3</td>
<td>2</td>
<td>2,1,2,2,1,2,1,1,1,1,1,2,1,1</td>
<td>1</td>
</tr>
<tr>
<td>49. Do you have any problems passing water?</td>
<td>3,1,2,3,3</td>
<td>3</td>
<td>2,2,2,1,1,1,2,1,1,1,1,1,1,2,1</td>
<td>1</td>
</tr>
<tr>
<td>50. Have you had any physiotherapy treatment for your pain?</td>
<td>2,1,2,2,2</td>
<td>2</td>
<td>2,2,2,1,2,1,2,1,1,1,1,1,1,1,2,1</td>
<td>1</td>
</tr>
<tr>
<td>51. Do you suffer from diabetes, epilepsy, rheumatoid arthritis?</td>
<td>1,2,2,2,3</td>
<td>2</td>
<td>2,2,2,2,1,1,2,2,1,2,2,1,2,2,2,2</td>
<td>2</td>
</tr>
<tr>
<td>51a. How would you describe your general health?</td>
<td>3,3,3,2,3</td>
<td>3</td>
<td>2,1,2,1,1,1,2,2,1,1,1,1,1,1,2,2</td>
<td>1</td>
</tr>
<tr>
<td>52. Have you had any bad falls?</td>
<td>2,3,2,2,2</td>
<td>2</td>
<td>2,3,2,2,1,1,1,1,1,2,3,2,1,1,2,1</td>
<td>1</td>
</tr>
<tr>
<td>53. Have you had any car accidents?</td>
<td>2,3,2,3,1</td>
<td>2, 3</td>
<td>2,3,2,2,1,2,1,1,2,2,2,3,1,1,1</td>
<td>1, 2</td>
</tr>
<tr>
<td>54. Have you had any surgery?</td>
<td>2,1,3,1,3</td>
<td>1, 3</td>
<td>2,2,2,2,1,1,2,1,1,3,1,3,1,2,2</td>
<td>1, 2</td>
</tr>
<tr>
<td>55. Have you had any back pain?</td>
<td>1,1,1,2,1</td>
<td>1</td>
<td>2,2,2,1,1,2,1,1,1,1,2,1,1,1,1</td>
<td>1</td>
</tr>
<tr>
<td>56. Are you seeing your GP or any other consultant for anything else at the moment?</td>
<td>2,2,2,2,2</td>
<td>2</td>
<td>2,2,2,1,1,1,2,2,1,1,1,1,1,1,2,2</td>
<td>1, 2</td>
</tr>
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</table>

/*... more */
<table>
<thead>
<tr>
<th>Question</th>
<th>Doctors</th>
<th>Modal score</th>
<th>Physiotherapists</th>
<th>Modal score</th>
</tr>
</thead>
<tbody>
<tr>
<td>57. Show me where you feel your worst pain?</td>
<td>1,2,1,1,1</td>
<td>1</td>
<td>2,2,2,1,1,1,1,1,1,1,1,1,1,2,1,1,1</td>
<td>1</td>
</tr>
<tr>
<td>58. Do you have any other areas of pain?</td>
<td>2,1,2,2,2</td>
<td>2</td>
<td>2,2,2,1,1,1,1,1,1,1,1,1,1,1,1,1</td>
<td>1</td>
</tr>
<tr>
<td>59. Do you have any areas of numbness or pins and needles?</td>
<td>2,1,1,2,1</td>
<td>1</td>
<td>2,2,2,1,1,1,1,1,1,1,1,1,1,1,1,1</td>
<td>1</td>
</tr>
</tbody>
</table>
# Appendix VII

## Relevance of physical examination procedures: modal scores

*Key: 1 = Very relevant  2 = Relevant  3 = Not relevant*

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Physiotherapist response</th>
<th>Modal Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assessment of posture for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Spasm</td>
<td>1,2,1,2,1,1,1,1,1,1,2,1,2,1,1</td>
<td>1</td>
</tr>
<tr>
<td>b. Scoliosis</td>
<td>1,2,1,1,2,2,1,1,1,1,2,1,1,1</td>
<td>1</td>
</tr>
<tr>
<td>c. Shift</td>
<td>1,3,1,1,1,1,1,2,1,1,2,1,1,1</td>
<td>1</td>
</tr>
<tr>
<td>2. Range of movement of lumbar spine</td>
<td>1,2,1,1,1,1,1,1,2,1,2,1,2</td>
<td>1</td>
</tr>
<tr>
<td>3. Range of movement of thoracic spine</td>
<td>2,2,1,1,1,1,1,1,2,1,2,1</td>
<td>1</td>
</tr>
<tr>
<td>4. Neuromeningeal testing 'slump'</td>
<td>1,2,1,1,1,1,1,1,2,1,1,1</td>
<td>1</td>
</tr>
<tr>
<td>5. Active abdominal contraction</td>
<td>3,2,2,2,2,1,1,2,3,1,2,2,2,2</td>
<td>2</td>
</tr>
<tr>
<td>6. Palpating costal cartilages</td>
<td>1,1,3,3,2,1,3,1,1,2,3,3,1,2,3,2</td>
<td>1, 3</td>
</tr>
<tr>
<td>7. Palpation of thoracic and lumbar spine:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Central posterior-anterior T1-L5</td>
<td>1,1,1,1,1,1,1,1,1,1,1,2,1,1</td>
<td>1</td>
</tr>
<tr>
<td>b. Unilateral costo-transverse joint T1 and T10 left and right sides</td>
<td>2,1,3,1,2,2,3,1,3,2,2,2,2,2,3,1</td>
<td>2</td>
</tr>
<tr>
<td>c. Unilateral costo-vertebral joint T11 and T12 left and right side</td>
<td>1,1,1,1,1,1,1,2,2,2,2,2,1,1</td>
<td>1</td>
</tr>
<tr>
<td>d. Rib angles T2-T10 left and right side</td>
<td>2,2,3,1,2,2,2,3,1,2,2,2,2,2,1</td>
<td>2</td>
</tr>
<tr>
<td>e. Transverse pressures left and right sides T1-T12</td>
<td>1,2,2,2,1,1,2,1,2,2,2,2,2,2,2,2</td>
<td>2</td>
</tr>
<tr>
<td>f. Unilateral facet joints L1-L5 left and right side</td>
<td>1,3,1,1,3,1,3,3,3,1,2,2,1,2,3,3</td>
<td>1, 3</td>
</tr>
<tr>
<td>g. Posterior superior iliac spine left and right side</td>
<td>1,3,3,3,3,2,1,3,3,2,1,3,3,3,2,2,3</td>
<td>3</td>
</tr>
</tbody>
</table>
Appendix VIII

Questionnaire used in main field work study

ABDOMINAL SYMPTOMS SURVEY

In order to help us understand some abdominal conditions more fully we are collecting certain information about patients' symptoms.

This information is confidential and will only be used for the purpose of this study. You do not need to write your name on the sheets. The ID number shown on the first page is randomly selected and is for statistical analysis only. It cannot be used to identify you in any way.

We should be grateful if you would answer the questions on the pages overleaf.

* Please leave at the reception desk
* Please return by ......................

Thank you

Please turn over the page
Body Chart

This section asks you to draw on the body chart where on average you feel your pain. If you have no pain go to question 18 on page 4 and complete the remaining questions.

1. Indicate on the body chart the areas of pain by using cross hatching ie.

2. If you experience any pins and needles indicate where on the body chart by using dots ie.

3. If you feel that any areas of the skin is extra sensitive to touch indicate where on the body chart by using crosses ie.

Please turn over
ABDOMINAL SYMPTOMS SURVEY

These questions are all connected with your PRESENT symptoms. Please put a ✔ in the appropriate box.

1. Do you get abdominal pain?
   Yes  □
   No  □

   *If you ticked NO, please go to Question 18*

2. Is your abdominal pain there all the time?
   Yes  □
   No  □

3. Does your abdominal pain feel sharp?
   Yes  □
   No  □

4. Does your abdominal pain feel like an ache?
   Yes  □
   No  □

   Please turn over the page
5. Does your abdominal pain feel deep inside you?
   Yes ☐
   No ☐

6. Does coughing, sneezing or taking a deep breath make your pain feel worse?
   Yes ☐
   No ☐

7. Do activities such as bending, sitting, lifting, twisting, or turning over in bed make your pain feel worse?
   Yes ☐
   No ☐

8. Does eating certain foods make your pain feel worse?
   Yes ☐
   No ☐

9. Does lying down or sitting ease your pain?
   Yes ☐
   No ☐

Please turn over the page
10. Does walking ease your pain?
   Yes □
   No □

11. Does using any form of heat ease your pain?
   Yes □
   No □

12. Does taking tablets ease your pain?
   Yes □
   No □

13. Would you say that nothing that you do or take eases your pain?
   Yes □
   No □

14. How long does your pain take to ease?
   Remember: please tick one box only
   14.1 Less than 1 hour □
   14.2 1-12 hours □
   14.3 12-24 hours □
   14.4 More than one day □
   14.5 Pain never eases □

Please turn over the page
15. **Does your pain keep you awake at night?**
   - Yes □
   - No □

16. **When you are sleeping do you find lying in one position eases your pain better than another?**
   - Yes □
   - No □

17. **Does your pain get worse as the day goes on?**
   - Yes □
   - No □

18. **Has there been any change in your bowel habit since the start of your symptoms?**
   - Yes □
   - No □

19. **Do you ever get a bloated feeling in your stomach?**
   - Yes □
   - No □

Please turn over the page
20. When your symptoms started did they come on suddenly?
   Yes □
   No □

21. Was the start of your symptoms in any way connected with a fall, an accident, or lifting something?
   Yes □
   No □

22. Do you ever get any back pain?
   Yes □
   No □

23. Does your back feel stiff first thing in the morning?
   Yes □
   No □

24. Has your weight changed same since your symptoms began?
   Yes □
   No □

Please turn over the page.
25. Have you ever used steroid tablets for medical reasons?
   Yes ☐
   No ☐

26. Do you suffer from rheumatoid arthritis?
   Yes ☐
   No ☐

Thank you for your time
Appendix IX

Main field work: physical examination procedures

Physical Examination
-- Instructions for Physiotherapist --

Thank you for your co-operation. Please read these instructions carefully before seeing the patient.

Please read the history-taking information to determine the irritability of the patient's symptoms. You may omit any tests you feel are unsuitable — please draw a line through any omitted — but under no circumstances must you add any tests. After assessing the patient you are asked to choose one of two diagnoses:

- Abdominal pain of musculoskeletal origin
- Abdominal pain NOT of musculoskeletal origin

(space is provided at the end of the questionnaire to enter your diagnosis).

Instructions for you are printed in plain type.

Questions or statements you should make to the patient are printed in italics.

Please ask the questions as they are written, and tick the appropriate box for the answer.

Where an * appears, please ask the appropriate question as determined by whether the patient has their pain at the time of the assessment.

Explain to the patient:

"We are going to do some tests on your spine and muscles to see if they are the source of your problems.

We need to see if any of these tests bring on or make your symptoms worse.

The tests may make you a little sore, and this may last for up to 24 hours.

If at any time you wish me to stop the tests please tell me. This will not affect any treatment that may be appropriate for you to receive."

Please turn over and commence the examination.
Physical Examination

Instructions for you to give to the patient are shown in italics.

"Please undress to your underwear and to stand with your feet one foot's width apart."

Use your foot to determine the spacing of the patient's feet.

SECTION I

(Tick one box only in this section)

Observation of standing posture

"Stand with your back towards me, I am going to look at the outline of your spine."

1. Is there any scoliosis or shift of the spine?
   - Yes (1)
   - No (0)

SECTION II

Range of movement lumbar spine

"I am now going to test the movements of your spine."

After each movement ask what stops them moving any further and tick the appropriate box.

Example: "What stops you going any further?"

<table>
<thead>
<tr>
<th>Abdominal pain</th>
<th>Yes (1)</th>
<th>✓</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back pain, stiffness or stretch</td>
<td>Yes</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Leg stiffness</td>
<td>Yes</td>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>
Lumbar Spine Flexion

"Bend forwards sliding your hands down the front of your legs."

2. "What stops you going any further?"

<table>
<thead>
<tr>
<th></th>
<th>Yes(1)</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain, stiffness or stretch</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Leg muscle tightness</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Left Lateral Flexion

"Slide your left hand down the side of your left leg."

3. "What stops you going any further?"

<table>
<thead>
<tr>
<th></th>
<th>Yes(1)</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain, stiffness or stretch</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Natural limit</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Right Lateral Flexion

"Slide your right hand down the side of your right leg."

4. "What stops you going any further?"

<table>
<thead>
<tr>
<th></th>
<th>Yes(1)</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain, stiffness or stretch</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Natural limit</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Lumbar Extension

"Put the backs of your hands on the backs of your legs and bend backwards as far as you can go."

5. "What stops you going any further?"

<table>
<thead>
<tr>
<th></th>
<th>Yes(1)</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain, stiffness or stretch</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Natural limit</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Thoracic Rotation: Right
(all thoracic movements done sitting on the bed)

"Sit on the bed with your arms folded across your chest. Turn your trunk around to the right as far as you can go."

6. "What stops you going any further?"

<table>
<thead>
<tr>
<th></th>
<th>Yes(1)</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain, stiffness or stretch</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Natural limit</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Thoracic Rotation: Left

"Sit on the bed with your arms folded across your chest. Turn your trunk around to the left as far as you can go."

7. "What stops you going any further?"

<table>
<thead>
<tr>
<th></th>
<th>Yes(1)</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain, stiffness or stretch</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Natural limit</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Thoracic Side Flexion: Right

"Keeping your arms folded across your chest, side bend to the right."

8. "What stops you going any further?"

<table>
<thead>
<tr>
<th></th>
<th>Yes(1)</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain, stiffness or stretch</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Natural limit</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Thoracic Side Flexion: Left

"Keeping your arms folded across your chest, side bend to the left."

9. "What stops you going any further?"

<table>
<thead>
<tr>
<th></th>
<th>Yes(1)</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain, stiffness or stretch</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Natural limit</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Thoracic Flexion

"Keeping your arms folded, bend forwards from the waist."

10. "What stops you going any further?"

<table>
<thead>
<tr>
<th></th>
<th>Yes (1)</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain, stiffness</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>or stretch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural limit</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Thoracic extension

"Keeping your arms folded, bend backwards."

11. "What stops you going any further?"

<table>
<thead>
<tr>
<th></th>
<th>Yes (1)</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain, stiffness</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>or stretch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural limit</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

SECTION III

Neural Testing

"I am going to do some movement tests on the nerves. I will ask you if these movements bring on or change your abdominal pain."

Determine prior to testing if patient has abdominal pain or not and ask appropriate question marked by *:

"Sit on the bed with your hands resting on the bed behind you."

12. "Tuck your chin onto your chest. Does that..."

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

13. "Keeping your head down now bend forwards from the waist. Does that..."

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

15. "Keeping that position now pull your toes up towards you. Does that..."

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

"Now sit up straight."

"We are going to do the same movements but with the right leg."

16. "Tuck your chin onto your chest. Does that..."

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

17. "Keeping your head down, now bend forwards from the waist. Does that..."

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

18. "Keeping bent down, now straighten your right leg. Does that..."

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

19. "Keeping that position, now pull your toes up towards you. Does that..."

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

"Now sit up straight."
SECTION IV

Abdominal Muscle Testing

This test is only appropriate for patients with a localised area of pain no greater than 4cm square. This test is not appropriate for patients with a generalised area or more than one area of abdominal pain.

Get the patient to identify the area of pain and then decide whether to include this test. If you decide to omit this test, proceed to Section V.

Patient to lie flat on back, legs straight with one pillow under head.

"I am now going to test the muscles in your abdomen."

"Please lie on your back and show me where your abdominal pain is."

Get the patient to identify the area of abdominal pain and mark with a cross on the abdomen with pen.

"Lift your head off the pillow."

Once patient has lifted head apply finger pressure on the area you marked with the pen and ask

20. "Does that ...

<table>
<thead>
<tr>
<th>Increase your pain or</th>
<th>Yes (1)</th>
<th>No (0)</th>
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<tbody>
<tr>
<td>Make no difference or</td>
<td>Yes (1)</td>
<td>No (0)</td>
</tr>
<tr>
<td>Decrease your pain</td>
<td>Yes (0)</td>
<td>No (1)</td>
</tr>
</tbody>
</table>

"Now rest your head down."

SECTION V

Cartilage Testing

This test is only appropriate where the abdominal pain is unilateral and located in the area of the costal cartilages. If this pattern does not fit the patient’s abdominal pain omit this test and proceed to Section VI.

"I am going to see if your ribs are the source of your abdominal pain."
Patient to lie on the bed, legs out straight and one pillow under the head. Using the finger tips of both hands pull inferior rib margin anteriorly, ie. away from abdominal wall. Test asymptomatic side first.

21. "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

Then test symptomatic side.

22. "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

SECTION VI

Palpation of Lumbar and Thoracic Spine

"I am going to press on your spine. I will ask you if the pressure on your spine *brings on/ *makes your abdominal pain worse. Lie on your front with your arms by your side and your head turned to one side."

Press on the spine to the end of range where possible. Never push through spasm. Tick "Yes" or "No" in each section.

Palpation: Central T6-L5

Ascertain whether abdominal pain is present and ask appropriate question.

23. T6: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

24. T7: "Does that ...

<p>| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |</p>
<table>
<thead>
<tr>
<th></th>
<th><em>bring on your abdominal pain</em></th>
<th>Yes (1)</th>
<th>No (0)</th>
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<tbody>
<tr>
<td></td>
<td><em>make your abdominal pain worse</em></td>
<td>Yes (1)</td>
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26. T9: "Does that ...

<table>
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<tr>
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<td><em>make your abdominal pain worse</em></td>
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27. T10: "Does that ...

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<td><em>make your abdominal pain worse</em></td>
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28. T11: "Does that ...

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<tr>
<td></td>
<td><em>make your abdominal pain worse</em></td>
<td>Yes (1)</td>
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29. T12: "Does that ...

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<tr>
<td></td>
<td><em>make your abdominal pain worse</em></td>
<td>Yes (1)</td>
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30. L1: "Does that ...

<table>
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<tr>
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<th>Yes (1)</th>
<th>No (0)</th>
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<tbody>
<tr>
<td></td>
<td><em>make your abdominal pain worse</em></td>
<td>Yes (1)</td>
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31. L2: "Does that ...

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<th>No (0)</th>
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<tbody>
<tr>
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<td><em>make your abdominal pain worse</em></td>
<td>Yes (1)</td>
<td>No (0)</td>
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32. L3: "Does that ...

<table>
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<th>No (0)</th>
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<tbody>
<tr>
<td></td>
<td><em>make your abdominal pain worse</em></td>
<td>Yes (1)</td>
<td>No (0)</td>
</tr>
</tbody>
</table>
33. L4: “Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

34. L5: “Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

35. T6 (unilateral L): “Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

36. T7: “Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

37. T8: “Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

38. T9: “Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

39. T10: “Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

40. T11: “Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |
41. T12: "Does that ...

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<thead>
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</tr>
<tr>
<td>*make your</td>
<td></td>
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42. L1: "Does that ...

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<tr>
<td>*bring on your</td>
<td></td>
<td></td>
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<tr>
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<tr>
<td>*make your</td>
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<td></td>
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<td>abdominal pain worse</td>
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</table>

43. L2: "Does that ...

<table>
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<tbody>
<tr>
<td>*bring on your</td>
<td></td>
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<tr>
<td>abdominal pain</td>
<td></td>
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<tr>
<td>*make your</td>
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<td>abdominal pain worse</td>
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44. L3: "Does that ...

<table>
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<tr>
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<th>No (0)</th>
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<tbody>
<tr>
<td>*bring on your</td>
<td></td>
<td></td>
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<tr>
<td>abdominal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*make your</td>
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<td></td>
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<tr>
<td>abdominal pain worse</td>
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45. L4: "Does that ...

<table>
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46. L5: "Does that ...

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<tr>
<td>*bring on your</td>
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<td>*make your</td>
<td></td>
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47. T6 (unilateral R): "Does that ...

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</tr>
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<tbody>
<tr>
<td>*bring on your</td>
<td></td>
<td></td>
</tr>
<tr>
<td>abdominal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*make your</td>
<td></td>
<td></td>
</tr>
<tr>
<td>abdominal pain worse</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

48. T7: "Does that ...

<table>
<thead>
<tr>
<th></th>
<th>Yes (1)</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*bring on your</td>
<td></td>
<td></td>
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<tr>
<td>abdominal pain</td>
<td></td>
<td></td>
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<tr>
<td>*make your</td>
<td></td>
<td></td>
</tr>
<tr>
<td>abdominal pain worse</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
49. **T8:** "Does that...

*bring on your abdominal pain* | Yes (1) | No (0)  
*make your abdominal pain worse* | Yes (1) | No (0)  

50. **T9:** "Does that...

*bring on your abdominal pain* | Yes (1) | No (0)  
*make your abdominal pain worse* | Yes (1) | No (0)  

51. **T10:** "Does that...

*bring on your abdominal pain* | Yes (1) | No (0)  
*make your abdominal pain worse* | Yes (1) | No (0)  

52. **T11:** "Does that...

*bring on your abdominal pain* | Yes (1) | No (0)  
*make your abdominal pain worse* | Yes (1) | No (0)  

53. **T12:** "Does that...

*bring on your abdominal pain* | Yes (1) | No (0)  
*make your abdominal pain worse* | Yes (1) | No (0)  

54. **L1:** "Does that...

*bring on your abdominal pain* | Yes (1) | No (0)  
*make your abdominal pain worse* | Yes (1) | No (0)  

55. **L2:** "Does that...

*bring on your abdominal pain* | Yes (1) | No (0)  
*make your abdominal pain worse* | Yes (1) | No (0)  

56. **L3:** "Does that...

*bring on your abdominal pain* | Yes (1) | No (0)  
*make your abdominal pain worse* | Yes (1) | No (0)  

---

278
57. L4: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

58. L5: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

Rib Angles T6-T10 right

59. T6: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

60. T7: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

61. T8: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

62. T9: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

63. T10: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

Rib angles T6-T10 Left

64. T6: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |
65. T7: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

66. T8: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

67. T9: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

68. T10: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

Sacro-iliac joints, left and right

69. LS-I Jt: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

70. RS-I Jt: "Does that ...

| *bring on your abdominal pain | Yes (1) | No (0) |
| *make your abdominal pain worse | Yes (1) | No (0) |

"Thank-you, you may get dressed now"

Diagnosis: Physiotherapist only
Please tick the appropriate box

- Abdominal pain of musculoskeletal origin
- Abdominal pain NOT of musculoskeletal origin

Thank you
Appendix X

Preliminary study: Comparison of diagnoses

**KEY:**

*Positive* = abdominal pain of musculoskeletal origin

*Negative* = abdominal pain not of musculoskeletal origin

*MSK* = musculoskeletal cause to symptoms

*Diet* = symptoms caused by food intolerance

*Hyper* = symptoms caused by hyperventilation

*Gynae* = gynaecological cause to symptoms

*Other* = symptoms of unclear origin

*Spon Rec* = spontaneous recovery of symptoms

*Shaded areas indicate cases of disagreement of diagnoses*

<table>
<thead>
<tr>
<th>Case</th>
<th>Physio</th>
<th>Doctor</th>
<th>Case</th>
<th>Physio</th>
<th>Doctor</th>
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<td>Negative Diet; Negative</td>
<td>31</td>
<td>Positive MSK; Positive</td>
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<tr>
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<td>Negative Hyper; Negative</td>
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282
Appendix XI

Main field work: Comparison of diagnoses

Positive = abdominal pain of musculoskeletal origin
Negative = abdominal pain not of musculoskeletal origin
Shaded areas indicate cases of disagreement of diagnoses

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<thead>
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<th>Patient</th>
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<th>Doctor</th>
<th>Patient</th>
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Appendix XII

Case studies

It is helpful to consider the value of this research study within the context of some real life examples. Apart from the subjects in the research, I have also been receiving referrals regularly from the Gastroenterology Department at Addenbrooke's NHS Trust Hospital.

Patient A

Profile

Female nursing assistant, aged 54 years. Off work due to pain at time of presentation. Lived outside Cambridgeshire area and had requested referral to the Gastroenterology team at Addenbrooke's in August 1990 with the view to be investigated for food intolerance.

Symptoms

Presented as an in-patient for investigations into unexplained abdominal pain. These consisted of central abdominal "colicky pain", which appeared to be aggravated by eating food that contained sugar. She also complained of other areas of pain, including burning pain between the scapula and neck, left arm pain, back pain, lower limb pain, nausea, malaise and weight loss of 20kg since 1986.

Past medical history

Christmas 1985: vague abdominal symptoms and backache, possibly after lifting heavy stones in the garden. Subsequently aggravated by lifting a
patient at work. Also, general feeling of unwell and an increase in vaginal discharge which was treated with erythromycin.

1986: developed left and right upper abdominal (costal pain) which prevented her from working and general household activities. This was diagnosed as Tietze's syndrome which was treated with anti-inflammatory with some effect.

1987: duodenal ulcer diagnosed from barium meal.

1988: increasing right sided costal pain, complaining of hard stools. Investigations included upper gastrointestinal endoscopy, barium enema and laparoscopy. All these were normal. Computerised topography (CT) scan of the abdomen revealed some chronic inflammation. A cholecystectomy was performed and her gallbladder was found to be normal. After this her symptoms appeared to increase.

1990: presented at Addenbrooke's Hospital with central abdominal colic pain, which appeared to come on approximately 20 minutes after eating foodstuffs containing sugar and this eased over a period of 60 minutes. Coughing and taking a deep breath aggravated her central abdominal and chest pain. She complained of some background abdominal pain most of the time. Also complaining of costal and sternal pain, left scapula, arm and neck pain, back pain, painful eyes, gaseousness leading to burping, becoming hot and sweaty after eating, suffering from general muscle aches, the muscles feeling weak and "thready" after eating. Complaining of neck muscles becoming achy after eating and intermittent headaches. She also complained that she would get the pain if she did not eat anything for over four hours. Symptoms eased by rest. This lady was virtually resting all day, only doing minimal tasks around the house and avoiding foods that aggravated her symptoms. She did not wake during the night but her ribs
feel achy in the morning. X-rays of her thoracic spine revealed Schmorls nodes at mid-thoracic level and signs consistent with costochondritis T7-T10. Current medication: none.

Weight now stable after losing 20kg. Eating a diet of chicken, beef, pork, potatoes and porridge made with oats and water.

Investigations on current presentation

Blood screening: normal.

CT scan of abdomen: normal showing minimal dilation of common bile duct consistent with previous cholecystectomy.

Patient was subject to a double blind nasogastric sucrose challenge: two placebos and one active: She complained of increased levels of pain with both the placebos and the challenge.

After four days in hospital the doctors referred this lady for physiotherapy assessment.

On examination

Tall thin lady with poor spinal and abdominal musculature. Thoracic movements revealed restricted left and right side flexion; left and right rotation were all limited by a pulling feeling and pain on the left lower abdominal and costal side. Cervical movements were limited in both rotations and upper cervical flexion with poor stability of the deep neck flexors. Neurological and neural tests were normal. Palpation of thoracic spine revealed tenderness of levels T3-T10 with the rib angles tender at levels T6-T10. Anterior palpation of the sternocostal junction revealed
tenderness consistent with her pain in that region. Upper cervical spine
tenderness at levels C2 and C3.

Diagnosis

Costochondritis of thoracic levels T3-T10 referring pain anteriorly to the
chest and the abdomen. Inflammation of the sternocostal joints giving her
sternal pain. Possibility of some symptoms linked to food intolerance.

Treatment

Hydrotherapy to improve her general musculature and exercise tolerance,
combined with mobilisation of her thoracic spine. She was given a graduated
programme of mobilising and stability exercises to do at home to improve her
general mobility and fitness.

She received dietary advice from the dietitian to increase her calorie intake
and variety of food. She was discharged on low dose amytriptiline used as a
muscle relaxant.

Outcome

Physiotherapy treatment directed at her spine and musculature was
continued by a physiotherapist in her home town and her pain levels reduced
gradually and her weight returned to her normal level. Six months after
discharge from hospital she was able to resume work.

Comments

This lady’s medical history represents a typical scenario which this research
study sought to address. She had “suffered” multiple investigations prior to
her hospital admittance. Many were repeated and others added, with
neither a satisfactory outcome nor the addition of new, positive information.
Although there was clear evidence of a history of spinal disease, several doctors had failed to recognise its significance. As in many cases, two conditions may co-exist, thereby presenting a mixed picture of symptoms which can confuse an unsuspecting clinician.

Early referral for musculoskeletal assessment would have saved time and money, and would probably have resulted in a much earlier resolution of her ailment.

**Patient B**

**Profile**

Female administrative assistant, aged 24 years.

Hobbies: horse riding, gym work and scuba diving, unable to participate due to pain.

**Symptoms**

Eighteen month history of right sided abdominal pain and nausea. Pain was mainly during the day but it could wake her at night, and was worse pre-menstrually and when lifting and other exertion. She was no longer able to scuba dive because lifting the oxygen cylinders appeared to aggravate it, as did horse riding.

The pain would last for several days and was eased by resting. She occasionally took some paracetamol if the pain was severe. General health was good and she was taking no medication other than the contraceptive pill. Weight was steady and bowels unchanged since the onset of these symptoms. Diet was normal.
Past medical history

Involved in a road traffic accident at age 10, when she was knocked over as a pedestrian and dragged several yards along the road. She sustained a minor head injury and extensive grazing to the lower limbs and face. No previous surgery other than laparoscopies for gynaecological investigations.

Investigations

 Whilst she was working in Australia she was referred initially to a gynaecologist who, after a laparoscopy, diagnosed endometriosis in the Douglas pouch. They also noted some adhesions around the right bowel. On arrival back in the UK she was seen at the Gynaecological clinic at Addenbrooke’s; on a repeated laparoscopy, no evidence of endometriosis could be found.

They subsequently referred her to the gastrointestinal surgeon who performed a sigmoidoscopy, rectal biopsy, barium meal, white cell scan, abdominal ultrasound and routine blood screening. All test results were normal.

A gastroscopy revealed post-inflammation adhesions around the colon and lateral abdominal wall. A diagnosis of IBS or peptic dyspepsia was made. The surgeon referred her with a preliminary diagnosis of IBS to another gastroenterologist who, after questioning, referred her to the Physiotherapy department for assessment.

On examination

She had a marked scoliosis of the dorsal spine with an apparent leg length discrepancy of 2.5 cm. Thoracic movements, especially rotations, aggravated her symptoms. Palpation of her thoracic spine revealed marked tenderness and stiffness at levels T8, T9, T10 and T11 on the right side, reproducing her
right sided abdominal pain. Central pressure on T9 reproduced nausea. Neurological and neural testing revealed no abnormality.

Diagnosis

Right sided abdominal pain of mechanical origin. Thoracic spine T8, 9, 10, 11 reproducing her symptoms. Leg length discrepancy and scoliosis adding to mechanical stresses on joints.

Treatment

She was treated with orthotics to raise her shoe and given mobilising and specific strengthening and stabilising exercises for her spine, and given a graduated exercise programme to develop her fitness.

Outcome

Her symptoms settled after several months but she was still unable to do heavy lifting without marked aggravation of her symptoms. She was able to recommence playing sport. Occasionally, she takes paracetamol if the pain becomes uncomfortable.

Comments

This is another familiar scenario where a woman with iliac fossa pain is referred to the gynaecologist and then undergoes repeated investigations by various departments. All too often the investigator will focus attention on the viscera or other internal organs as a source of the pain without considering the musculoskeletal system.

With such an obvious scoliosis it may have been prudent to have checked this first before doing other tests. This would have saved the NHS several hundreds of pounds and the patient much unnecessary angst and discomfort.
Appendix XIII

Reliability of refined history-taking questionnaire (Kappa Scores)

Note: Kappa scores for Q2-Q17 are based on those subjects who answered “Yes” to Q1 on both questionnaires

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