27

Disorders of the thoracic spine: disc lesions

CHAPTER CONTENTS

Although the spine is anatomically part of the thoracic cage, we prefer to discuss the thoracic disorders in two main categories – spinal lesions (this chapter and Ch. 28) and lesions of the thoracic cage and abdomen (see online chapter *Disorders of the thoracic cage and abdomen*). Thoracic ankylosing spondylitis is discussed separately (Ch. 29). This is done to standardize the discussion of the spine throughout, in the hope that a better clinical understanding may result.

Introduction

Cervical and lumbar disc lesions are widely accepted as common causes of pain. For the thoracic spine, the situation is different. Although thoracic disc lesions giving rise to compression of the spinal cord are well recognized,[1–5] disc protrusion resulting in pain without causing neurological signs is poorly documented.[6] The incidence of thoracic disc lesions affecting the spinal cord is about one case per million people per year,[3,7] usually affecting adults, although cases have been reported in children as young as 12.[8] The existence of minor thoracic disc lesions provoking pain in the absence of cord compression was first established by Hochman, who removed a disc protrusion at T8–T9 in a 67-year-old lady with continuous unilateral pain in the thorax.[9] Neurological signs were not present. The diagnosis was established by computed tomography (CT).

The incidence of minor thoracic disc lesions is much higher. Degenerative changes of the thoracic spine are observed in approximately half of asymptomatic subjects and 30% have a posterior disc protrusion.[10] A recent magnetic resonance imaging (MRI) study found a prevalence of thoracic disc herniations of 37% in asymptomatic subjects, disc bulging in 53% and annular tears in 58%.[11] Another study of asymptomatic patients identified impressive disc protrusions in no less than 16%.[12] An unexpectedly high prevalence of thoracic disc herniation (14.5%) was also demonstrated in the thoracic spines of a group of 48 oncology patients examined by MRI.[13] Although these relatively high figures do not correspond to the real clinical situation, we believe that symptomatic thoracic disc protrusions are far more common than is generally accepted and agree with Krämer,[14] who estimated the frequency of thoracic disc lesions to be about 2% of all symptomatic disc lesions. Recent studies also confirmed the incidence of symptomatic thoracic disc prolapses as being between 0.15% and 4% of all intervertebral disc prolapses.[15,16]

However, the clinical diagnosis is often not made and the patients are frequently classified as suffering from intercostal neuralgia, neuritis, cardiac neurosis or pleurodynia. If left untreated, the pain can persist for many years, causing continuing morbidity. Nevertheless, the majority of such lesions can easily be reduced in a few manipulative sessions, fully relieving the patient's pain.

Although more frequently present than commonly believed, thoracic disc protrusions are clinically far less common than those in the lumbar spine because of the greater rigidity of the thoracic spine. This is partly a result of the stabilizing effect of the rib cage on the thoracic spine and partly due to the thoracic intervertebral discs, which are thinner on account of a less voluminous nucleus pulposus.[17] Therefore extension and flexion movements are of a smaller range in the thoracic spine.

Minor thoracic disc lesions occur most often between T4 and T8. Those with cord compression are usually found in the lower half of the thorax.[6,18] About 70% lie between T9 and T12, the commonest level (29%) being T11. A logical explanation for this could be that the lower segments have an increased mobility due to free ribs at these levels.[19] Another reason could be that the cord has a critical vascular supply at this level.[20]

Clinical presentation

It is hypothesized that disc degenerations and disc displacements are of themselves painless events because the disc is almost completely without nociceptive structures. Clinical syndromes originate only when a subluxated fragment of disc tissue impinges on the sensitive dura mater or on the dural nerve root sleeve. This clinical hypothesis is extensively discussed in the lumbar section of this book (see Chs 31 and 33).

Disc displacements (protrusions and prolapses) are either soft (nuclear) or hard (annular), and may have a posterocentral or posterolateral localization.

Posterocentral protrusions compressing the dura mater may provoke multisegmental pain, which is mainly referred into the posterior thorax but may also spread into the anterior chest, the abdomen or the lumbar area.[21] The pain is never referred down the arm. When a posterocentral displacement increases, cord compression can result.

Posterolateral protrusions interfering with the dural sleeve around the nerve root result in pain that is segmentally referred into the corresponding dermatome. A more massive posterolateral protrusion may compress the ganglion or the nerve root fibres, resulting in motor and/or sensory disturbances in the innervation area of the root.

When the T1 nerve root is compressed by a disc lesion, pain is referred to the inner side of the arm between elbow and wrist. A T2 nerve root impingement creates pain referred towards the clavicle and to the scapular spine and down the inner side of the upper arm. The corresponding dermatomes of the T3–T8 nerve roots follow the intercostal spaces, ending at the lower margin of the thoracic cage. The dermatomes of T9–T11 include a part of the abdomen, and T11 also includes part of the groin (see Fig. 25.3).[22,23]

Thoracic disc protrusions may give rise to four different clinical presentations: chronic thoracic backache, acute thoracic lumbago, thoracic root pain and spinal cord compression (Cyriax:[24] pp. 202–205).

Each clinical pattern corresponds to a specific type of disc lesion. Besides dural and articular signs and symptoms, elements which may indicate compression of the spinal cord must always be sought.

Symptoms and signs

The clinical findings in symptomatic thoracic disc displacements are analogous to the lumbar and cervical disc syndromes. Again, both dural and articular signs and symptoms can be identified (see Ch. 52).

Dural symptoms

Increasing the intra-abdominal pressure by deep inspiration, coughing or sneezing may aggravate the pain in all types of symptomatic disc displacements. A deep breath usually has more effect than does a cough – the opposite is true for the lumbar spine – and is the consequence of traction exerted on the dura mater via the intercostal nerves. This dural symptom is of major importance in the lumbar spine but is less helpful in the thorax. Indeed, pain from other disorders of a musculoskeletal or visceral nature may also be under the influence of respiratory movements. Therefore these symptoms are nonspecific at the thoracic level and can be interpreted only as suggesting that the dura is involved when the rest of the history and examination indicates a disc lesion.

Articular symptoms

Pain in disc lesions is caused by certain positions and movements, and disappears with others. Often activities in prolonged flexion or rotation movements provoke or increase the pain.

Dural signs

In disc lesions interfering with the normal mobility of the dura mater or of the dural nerve sleeve, movements that stretch the dura pull in harder against the protrusion and increase compression and pain. The movements regarded as dural signs are:

- Pain on neck flexion
- Pain on movements of the scapulae, most commonly on scapular approximation, which stretches the dura via the T1 and T2 nerve roots.

Articular signs

A disc lesion usually affects only a part of the intervertebral joint. Therefore, certain movements cause biomechanical changes that result in forcing the protrusion against the dura. Consequently, it is to be expected that on clinical examination only some of the active movements will increase the discodural interactions while other movements will be without effect and therefore painless. This results in a partial articular pattern, which is an absolute condition for the diagnosis of a disc protrusion, although it is not pathognomonic.

Examples of non-articular patterns are illustrated in Figure 27.1.

Depending on the degree of the compression, the partial articular pattern is more or less pronounced: more tests are painful and more severe pain is present. However, frequently, only one movement is painful, most commonly one of the rotations.

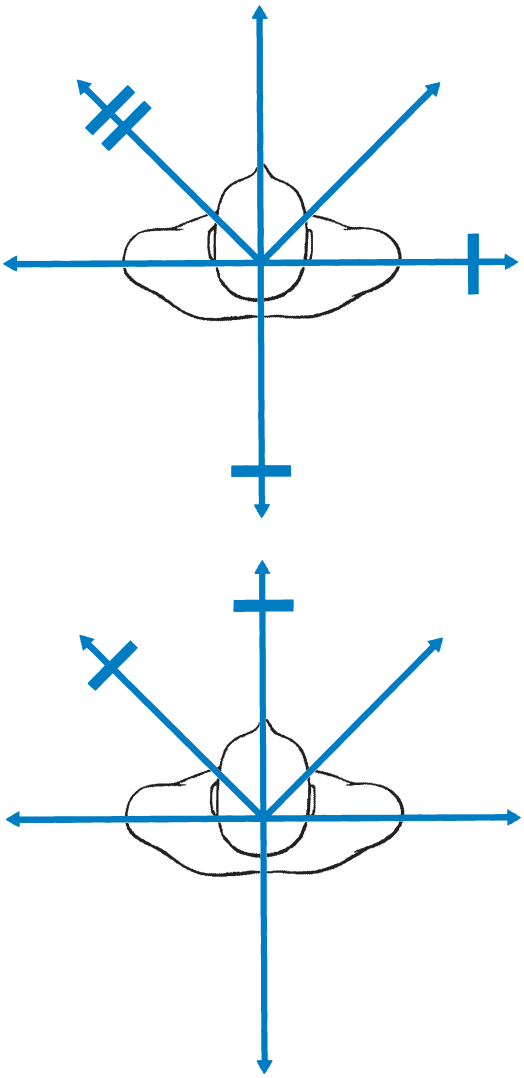


Fig 27.1 • Examples of partial articular patterns.

Often both articular and dural signs are present, although the latter are sometimes absent.

Exceptionally, a combination of a partial articular pattern with pain on one or more resisted movements is found. In this event, the question that arises is whether there is a muscular problem or a lesion of an inert structure. In the latter, pain on passive movements is more severe whereas, in the former, resisted movements are more painful.

Pain and limitation on side flexion towards the painless side as the only positive movement does not match the pattern of a disc lesion. Other disorders, such as a pulmonary or abdominal tumour with invasion of the thoracoabdominal wall, must be considered. An intraspinal tumour – for example, a neurofibroma – is also possible (see online chapter *Disorders of the thoracic spine and their treatment*).

Warning

If pain and limitation on side flexion away from the painful side is the only abnormal movement (Fig. 27.2), a tumour should be suspected.

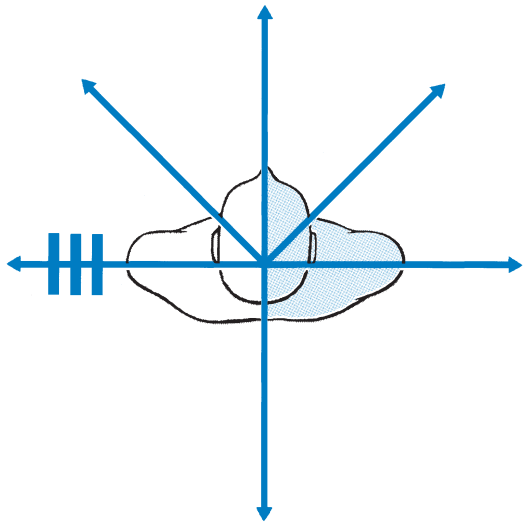


Fig 27.2 • Pain and limitation only on side flexion away from the painful (coloured) side is a warning sign for serious disorders.

Table 27.1 Articular and dural symptoms and signs in thoracic disc lesions

	Symptoms	Signs
Articular	Particular movements or postures increase the pain; others ease	Existence of a partial articular pattern
Dural	Pain on deep breath	Pain on neck flexion Pain on scapular movements

Symptoms and signs of cord compression

In thoracic disc lesions, careful attention must always be paid to abnormal neurological elements that may indicate compression of the spinal cord: pins and needles in both feet, disturbed coordination of lower limbs and positive Babinski's sign (see Table 27.1 and pp. 165–168).

Clinical types of thoracic disc protrusion

Symptomatic disc displacements in the thoracic spine may give rise to four different clinical syndromes: acute thoracic 'lumbago', chronic thoracic backache or 'dorsalgia', thoracic root pain and spinal cord compression (Figs 27.3–27.5).[24] Each syndrome corresponds to a specific type of disc lesion.

It is obvious that, besides dural and articular signs and symptoms, elements that may indicate compression of the spinal cord must always be sought.

Thoracic backache

A small annular posterocentral disc displacement causes a unilateral discodural interaction. The subsequent unilateral

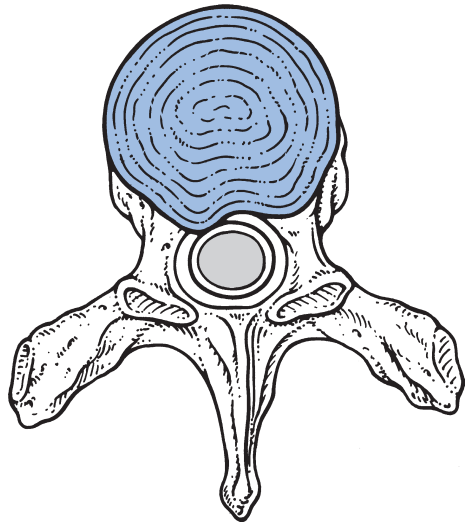


Fig 27.3 • Thoracic disc displacement: small posterior displacement with dural contact – nuclear 'lumbago' or dorsalgia.

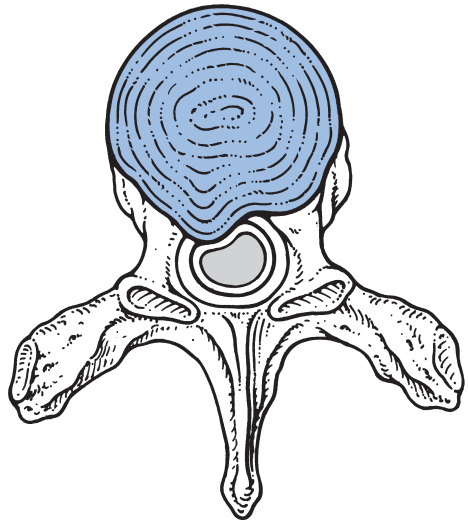


Fig 27.4 • Thoracic disc displacement: massive posterior displacement – cord compression.

interscapular pain is of moderate severity and is usually brought on by prolonged activities or postures in anteflexion. The pain gets worse during or after particular movements or positions and wears off on rest, but seldom disappears completely. In chronic thoracic backache there is no spontaneous recovery and untreated pain can persist for many years.

Because the pain is usually not severe, the articular signs are not always very impressive. However, no matter how subtle the outcome of the tests, some 'asymmetry' in the clinical picture will always be present. It is, for instance, not unexceptional to find only one articular movement that is slightly positive, very often one of the rotations.

This non-articular pattern, in the absence of pain on resisted movements, can usually be interpreted as the outcome of a disc lesion. A further argument in favour of this diagnosis is

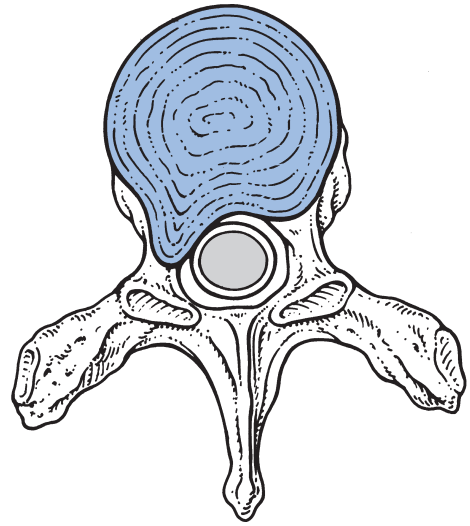


Fig 27.5 • Thoracic disc displacement: posterolateral displacement with radicular compression.

when neck flexion increases the pain on full passive rotation of the trunk (dural sign).

If both posterior pain and anterior thoracic pain are present, the posterior pain is often influenced by articular movements and the anterior pain is increased by neck flexion.

Disc lesions at level T1 and T2 may give rise to diagnostic difficulties in that very little spinal mobility exists at this level and articular movements may have no influence at all on the pain, so none is positive. The pain is often provoked only by flexion of the neck, which then suggests a cervical disc lesion. When this pattern is found, a differential diagnosis between both types of disc protrusion must be made. Stretching the T1 root and performing all three scapular movements provides the key: they may provoke or increase the pain in a high thoracic disc lesion but usually have no influence on a cervical disc protrusion.

In chronic thoracic backache there is no spontaneous recovery and untreated pain can persist for many years.

All cases of thoracic backache from a disc protrusion, in the absence of any contraindication, should be treated by manipulations, which are usually quickly successful. If this fails, traction must be tried. If there is frequent recurrence, sclerosant infiltrations into the different ligaments and facet capsules must be given to increase spinal stability.

Special case: self-reducing disc lesion

As the term implies, the disc undergoes spontaneous reduction. Patients who suffer from this condition usually sit for most of the day. On waking up in the morning they are symptom-free but, after they sit for some hours, pain starts in the mid-thorax and gets progressively worse. On lying down, the pain gradually eases off. The time needed for the pain to disappear fully depends on the degree of displacement and is initially from 10 to 15 minutes. Later, or if the patient sits for a longer period, it may take an hour or more. Pain may be absent when prolonged sitting is not part of the daily routine – for example, at weekends.

In this condition the disc gradually dehydrates as the result of the prolonged sitting position.[25] Simultaneously, the imposed kyphosis pushes the whole intra-articular content of the disc posteriorly, compressing the dura mater and resulting in thoracic backache. On lying down, the effects of hyperkyphosis and gravity are largely diminished and the disc shifts spontaneously back into its original position. These patients should avoid prolonged anteflexion. Manipulative reduction is useless but sclerosant infiltrations may be helpful.

Acute thoracic lumbago

Due to a combined flexion–rotation movement of the trunk, the patient becomes suddenly immobilized by a sharp posterior pain in the thorax, with the trunk fixed in flexion. The condition is similar to acute lumbago at the lumbar spine. In both, the underlying cause is a posterocentral disc protrusion. Pain is usually felt posteriorly in the centre of the back, radiating unilaterally or bilaterally around the chest. In high thoracic lesions, the pain may even reach the sternum; in low thoracic lesions, the pain is sometimes referred to the abdomen.

A deep breath is very painful and normally hurts more than a cough. Sudden onset in the absence of injury in a middle-aged person, together with pain on deep inspiration and on neck flexion, is very suggestive of such a disc lesion.

A partial articular pattern is present in which three, four or five movements are painful, and in severe instances all movements cause pain, but still in an asymmetrical way. The symptoms and signs are thus much more pronounced than in thoracic backache.

If the patient stays in bed for some days, spontaneous resolution occurs over about 2 weeks. Cure can be obtained much more quickly by manipulative reduction. Exceptionally the pain can be so severe that the patient can hardly stand up or needs a great deal of time to turn around on the couch. Such patients should remain in bed until they have improved to such a point that normal manipulations become possible. A manipulative attempt should not be made during the initial period because it is unbearable. Sometimes special oscillatory techniques can be tried.

Recurrence may occur but the pain is not necessarily always felt at the same side.

Special case: sternal lumbago

This is a rare disorder that often causes diagnostic difficulties. A high or mid-thoracic posterocentral protrusion coming on suddenly can give rise to agonizing pain felt only anteriorly over the sternum or in the epigastrium, without back pain. Differential diagnosis with an acute myocardial infarction has to be made but is not always simple. The effect of deep inspiration can be helpful: it increases the pain of a disc lesion but usually does not affect that originating from the myocardium.

Thoracic root pain

As in the cervical and lumbar spines, two types of root pain can be encountered: a primary and a secondary posterolateral protrusion. The latter is more common. In the first type, the protrusion is deviated in a posterolateral direction from the onset; in the second, there is first a posterocentral protrusion that later shifts laterally, analogous to a lumbar disc lesion.

- *In a primary posterolateral protrusion*, segmental pain is felt from the start at the lateral aspect of the thorax and often radiates unilaterally to the front of the chest or the abdomen. The absence of pain in the back may lead to the discogenic origin being overlooked.
- *In a secondary posterolateral protrusion*, an extrasegmental posterocentral or posterior unilateral pain is initially present, which then moves more to the side and sometimes towards the anterior thorax or abdomen – meanwhile becoming segmentally referred – a sequence of symptoms that strongly suggests a secondary posterolateral disc lesion.

Both types of root compression give rise to segmental referred pain. This has a unilateral band-shaped distribution that follows the intercostal nerves. At the thoracic level a posterolateral protrusion seldom gives rise to pins and needles. If present, they follow the same segmental distribution as the pain. As the T12 dermatome spreads into the lower abdomen, interference with this nerve root can result in pain and occasionally pins and needles in the groin and/or the testicles.[26]

On functional examination, a partial articular pattern is usually found. Occasionally, the patient feels nothing on articular movements but flexion of the neck provokes a sharp unilateral sternal pain, sometimes accompanied by pins and needles in the same place. As flexion of the neck also stretches the nerve roots via the dura, one of these can be pulled further against a protrusion, resulting in a sudden pain.

Neurological signs are seldom encountered and, if present, are always difficult to diagnose. As the majority of the thoracic nerve roots cannot be stretched by movements of arms or trunk, an analogue of straight leg raising does not exist. Moreover, motor deficit, except for a T1 lesion, cannot be tested. The only feature that is occasionally found is numbness. When present, it is of little help in determining the exact level of the protrusion because the dermatomes overlap. Only numbness in the groin draws attention to a nerve root palsy – T12. In rare instances, an area of hyperaesthesia is felt in the front of the chest.

A T1 root palsy is detected during the clinical examination of the cervical spine. It is seldom the result of a disc protrusion but usually the outcome of a serious disorder such as a superior sulcus tumour of the lung, a neurofibroma or vertebral metastases. Although T1–T2 discoradicular compressions with neurological deficit have been reported,[27–29] it should be kept in mind that if a neurological deficit of T1 is present, more severe disorders should always be excluded first (see see online chapter *Disorders of the thoracic spine and their treatment*).

Thoracic disc lesions compressing a nerve root do not usually resolve spontaneously, although there are a few reports of spontaneous regression at a lower thoracic level.[30,31] However, posterolateral thoracic disc protrusions which cause root pain remain reducible by manipulation, no matter how long they have existed. Where manipulation has failed or where neurological deficit is present, a sinuvertebral block should be given.

Compression of the spinal cord

The spinal cord is most vulnerable at the lower thoracic levels, between T9 and T12,[29,32] because the spinal canal is at its narrowest there and the vascularization is at its most critical.[33] It has been suggested that signs of cord compression do not always stem from pressure on the cord itself, but rather are the result of interference with the blood supply.[3–5]

Osteophytes narrowing the spinal canal are an extra contributing factor.[34] Previous injury to the thoracic spine can also play a role in the later development of cord compression, although this circumstance is rare.

History

The most commonly observed chronological sequence in cord compression is pain, followed by sensory disturbance, motor weakness and finally visceral dysfunction. All of these features may be present in any combination.

Pain

Initially almost all patients complain of pain. It is never particularly severe, often has a vague band-shaped distribution, and may sometimes disappear completely.[35–38] It is usually localized in the back, although it may radiate into the pelvis or groin and down the legs. Occasionally, patients complain of subumbilical pain.[1] The quality varies from a constant, dull and burning pain to – exceptionally – a lancinating, cramping and spasmodic pain.

Pins and needles

These are the most common symptom. They are usually felt in one or both feet, sometimes radiating into the legs, and are often provoked or increased by flexion of the neck.

Numbness

Later in the course, unilateral or bilateral numbness may set in and may be accompanied by a motor palsy. The numbness is more a diminution of normal sensation than a complete loss of sensitivity. It often starts at the big toe and is accompanied by a subjective sensation of coldness.[3]

Weakness

Because of interference with motor function, patients often complain of difficulty on walking, which sometimes presents as subjective weakness of the legs with unsteadiness or stiffness; it may, however, truly interfere with gait, making the patient stagger or even making walking impossible. It is important to note that the patient's subjective complaint of motor weakness is not always confirmable clinically.

Visceral symptoms

Very often visceral symptoms involving the urinary tract or bowel are also mentioned. Urinary symptoms may vary from difficulty in starting, to urgency, change in frequency, incontinence, incomplete emptying and even complete urinary retention. Occasionally, patients complain of impotence or of decreased sensation during intercourse.

Bowel problems are of the same nature as those related to the urinary tract, with constipation quite frequently present.

Functional examination

The functional examination normally confirms what is already expected from the history. The most characteristic signs are found on neurological examination; the articular signs are of secondary importance.

Some or all of the following neurological signs may be present:

- Disturbed coordination with spastic gait.
- Increased muscle tone, with the affected muscles not limited to one myotome.[39] Occasionally, weakness of the lower abdominal muscles can be demonstrated, when the umbilicus is seen to move as the patient attempts to sit up.[1] This is known as Beevor's sign.
- Weakness and/or atrophy of some lower limb muscles.
- Hyperreactive patellar or Achilles tendon reflexes with ankle clonus.
- Occasionally, absent tendon reflexes, particularly and inevitably when a flaccid type of paraplegia is present. The abdominal reflexes are often absent or diminished, most commonly in both lower quadrants. All these signs may be unilateral or bilateral.
- Positive Babinski's and Oppenheim's signs.
- Absence of the cremasteric reflex.
- Numbness.
- Limitation of straight leg raising, sometimes bilateral.[2]
- Occasionally, a Brown–Séquard syndrome in cord compression.[6] It is characterized by an ipsilateral flaccid segmental palsy, together with an ipsilateral spastic palsy below the lesion, with ipsilateral anaesthesia and loss of proprioception and loss of appreciation of the vibration of a tuning fork. Contralateral discrimination of pain sensation (analgesia) and thermoanaesthesia may be present and are both sited below the lesion.[40,41]

Although many of these tests are not included in the basic examination, they should be undertaken when the slightest suspicion of compression of the spinal cord exists.

Sometimes the neurological disturbances are found to extend proximal to the territory of the level of compression. This may be the outcome of interference with the blood supply of the anterior spinal artery rather than compression on the cord as such.[3–5]

Differential diagnosis

Differentiation from other compressive disorders of the spinal cord, such as neoplasm, infection, vertebral fracture and epidural haematoma, dissecting aneurysm and diseases of the cord (multiple sclerosis, Guillain–Barré syndrome and amyotrophic lateral sclerosis), is not always easy and requires further clinical reasoning and more technical investigations.

Technical investigations

The clinical description given above necessitates further imaging investigations. A plain radiograph sometimes shows

calcification in the disc that is at fault.[1,6,29,42] However, other authors, including Cyriax, consider calcification, together with the accompanying narrowing of the intervertebral joint space, to be non-specific.[43]

A myelogram usually indicates the level of the lesion with certainty, although special projections may be needed.[44]

Today, MRI is the imaging method of choice in the investigation of the thoracic spinal canal.[45] It provides a good-quality image over the entire length of the spine and can assess the morphology of the discs and cord. It is non-invasive, has comparable sensitivity to conventional myelography in visualizing lumbar nerve roots, and allows overall assessment of the spinal canal even in the presence of cerebrospinal fluid block.[46,47]

Treatment

The only treatment in cord compression is surgery.

Warning

Summary of warning signs: these are two-fold.

1. Presence of neurological signs.
   First exclude: neoplastic process
   infectious process
   fracture
   If negative: consider disc protrusion
2. Side flexion away from the painful side is the only painful and limited movement:
   No disc lesion is present but a tumour is most likely

Treatment

Almost all thoracic disc protrusions can be reduced by manipulation in 3–5 sessions. If manipulation does not succeed after, say, three sessions, the diagnosis should be reconsidered and, if a disc lesion is confirmed, traction can be tried. Traction can also be used for thoracic postural pain syndrome and for lateral recess stenosis in the thorax (see later). Other treatments, discussed later, include sinuvertebral blocks for persistent root pain or for root pain with neurological deficit, surgery, bed rest and prevention of recurrence.

Manipulation

Indications

All actual and symptomatic thoracic disc protrusions should be manipulated, in the absence of contraindications.

Unlike in the cervical and the lumbar spine, the type of onset is of less importance for treatment of the thoracic spine, since the great majority of thoracic disc protrusions are annular. Consequently, manipulations should be tried first. If these fail, and if the diagnosis of a disc lesion is confirmed, a nuclear protrusion should be considered. The time that has elapsed from the onset of pain can also be disregarded, because thoracic disc protrusions remain reducible regardless of their duration. Although T1 and T2 disc lesions will come to light in the cervical examination (rather than the thoracic examination), when a disc protrusion is present it should be treated using manipulative techniques designed for the thoracic spine.

Indications for and contraindications to manipulation are summarized in Box 27.1.

Box 27.1

Indications for and contraindications to manipulation

Indications

- All symptomatic disc displacements in the absence of contraindications

Contraindications

Relative

- Absence of actual symptomatic disc displacement
- Self-reducing disc lesion
- Monoradicular neurological deficit

Absolute

- Signs and/or symptoms of cord compression
- Patients with bleeding disorders
- Patients on anticoagulant treatment

Contraindications

Relative contraindications

Disc protrusion is not present

It is obvious that, in the absence of a disc protrusion, manipulation is inappropriate and could even do harm by displacing a disc fragment.

Self-reducing disc lesions

In self-reducing disc displacements, no manipulative attempt must be undertaken because reduction occurs on lying down. However, measures for prevention of recurrences must be taken. A series of infiltrations with sclerosant solution is then the treatment of choice.

Segmental neurological deficit

Neurological deficit indicates that the protrusion is too large to be reduced. Therefore no manipulative attempt is made if monoradicular numbness and/or motor palsy is found. Should this be present, the patient can be treated by an infiltration around the nerve root.

Central protrusion

This occurs mainly in young patients with a large thoracic kyphosis, is nuclear in origin and posterocentrally localized, and causes bilateral radiation of pain. The treatment of choice is sustained traction.

Absolute contraindications

Cord compression

Signs and symptoms of compression on the spinal cord, such as a positive Babinski's sign, weakness of the lower limbs or spastic paresis, are absolute contraindications to manipulation. Such patients should be operated on at once.

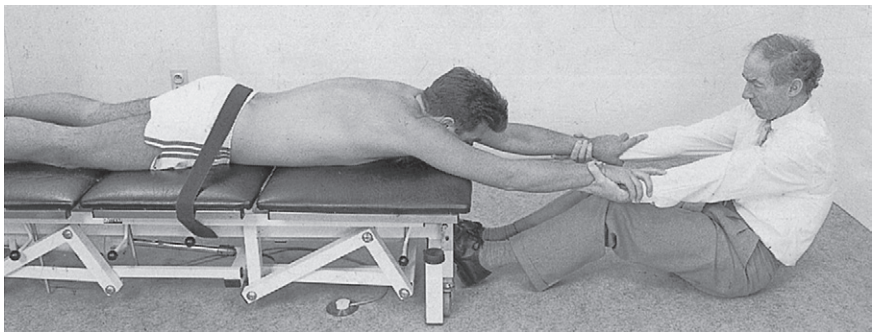


Fig 27.6 • Traction given by one assistant, using a belt.

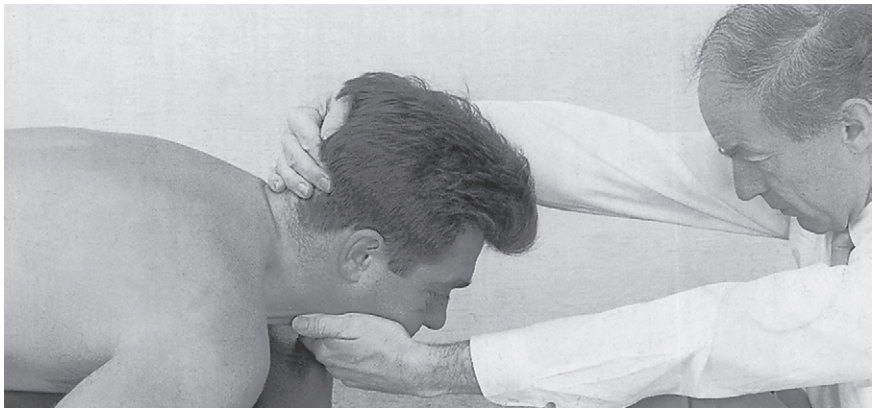


Fig 27.7 • Traction is applied via the head if the lesion is situated above T6.

Sometimes patients with cord compression are encountered who complain of pins and needles only in the legs and feet, increased or provoked by flexion of the neck. On clinical examination, further evidence of cord compression is not found. The implication is that the protrusion interferes minimally with the cord; nevertheless, manipulations could easily increase the problem and are absolutely contraindicated. This does not apply to sustained traction, which can be tried in cases in which the clinical features have not been present for too long.

Bleeding disorders

Patients who suffer from bleeding disorders, either inherited or acquired, or who are on anticoagulants should never be subject to manipulation because this could provoke an intraspinal haematoma. If a patient on anticoagulants suffers from a disc lesion, the anticoagulants must be stopped over a period of days (should the condition for which treatment is prescribed permit) until blood coagulation has returned to normal. Manipulation can then be performed safely.

Techniques

Thoracic manipulations are always performed under strong traction. Three main types of procedure are considered: extension techniques in which extension is always present, sometimes together with a rotation; rotation techniques, in which rotation is the only element and extension is not incorporated; a third type, the 'high thoracic technique', used only in upper thoracic disc lesions.

All extension manipulations of the thoracic spine are specific, i.e. they are performed only at the two vertebrae on either side of the disc protrusion.

Principle of strong traction

No one can foresee with absolute certainty the direction in which the protruded fragment will move during a manipulation. Theoretically, it could be displaced further towards the spinal cord. To avoid this and for a number of other beneficial effects (see p. 256), traction is always incorporated in thoracic manipulation.

Traction is normally provided by one assistant who sits beyond the patient's head and takes hold of either the head or the hands. Stabilization of the pelvis is provided either by a second assistant sitting at the patient's legs and holding the ankles or by a fixation belt around the pelvis (Fig. 27.6). Whether traction is given via the head or the arms depends on the level of the lesion and the patient's comfort. As traction on the arms opens the intervertebral joints only from T6 downwards, traction must be given via the head in disc protrusions above T6 (Fig. 27.7).

If traction via the arms provokes pain anywhere in the upper limb, it is replaced by traction on the head.

Disc protrusion above T6: traction via the head.
Disc protrusion below T6: traction via the hands.

Traction via the head is provided by putting one hand under the patient's chin and the other below the occiput, with the head and neck always kept in the neutral position (see Fig. 27.7). Both hands pull equally hard.

Traction via the arms is achieved by the patient and assistant taking each other's wrists in their hands.

Before any manipulation is done the assistant must first create traction because very often slack in a belt must be taken up and adjustment may be needed.

The traction provided should always be given with maximum force in order to open the joint space as far as possible. Because maximum traction can only be maintained for a few seconds, it is only given after the manipulator has taken up all the slack of the manœuvre to be performed. The different steps of the manipulation, including traction, are coordinated by the manipulator.

Although exerted with as much strength as possible, traction is not a manipulation in itself. In other words, the assistant does not add a jerk to the pull during the manipulation but only maintains the pull maximally until the manipulation is complete.

Amount of force

Each manipulation must be performed with a reasonable amount of force. This depends on both the manipulator's and patient's physical size and the level of the protrusion. If a large examiner is dealing with a lightly built patient, the whole of the former's strength will not be used, but if a lightly built manipulator has to manipulate a heavier person, the maximum effort may be needed to achieve good results.

Because the upper half of the thorax is the most rigid, disc protrusions at this level require more forceful manipulation than for the lower half. Therefore a lesion below T6 can be treated with a less vigorous impulse.

All manipulation must be performed using the body. The most common mistake occurs when the manipulator uses his arms rather than his body. This leads to a loss of the slack already taken up and results in increased amplitude of manipulation, which may be dangerous because the manipulator has no control over the force used.

Extension techniques in prone position

Unless the patient is 60 years old or more, extension techniques are used initially. All extension manipulations are specific in that they are performed directly on the vertebrae between which the lesion lies.

Identifying the level of the lesion

The two most painful consecutive spinous processes are identified by extension pressure. The protrusion normally lies between their corresponding vertebrae. If only one spinous process is found to be tender, the disc at fault is usually the one lying just below. This being so, the extension manipulations are undertaken between the vertebra with the tender spinous process and the one immediately below.

Sometimes all spinous processes are equally tender on extension pressure. It can then be useful to take two consecutive spinous processes between the fingertips one by one and to try to rotate them in the opposite direction towards each other. This is done at all levels and the two that prove most painful are indicative of the level of the lesion.

From this point on, in describing the different extension techniques, the phrase 'two most tender spinous processes' is used. It is important to understand that this always means the two most tender on extension pressure and not just on palpation for local tenderness.

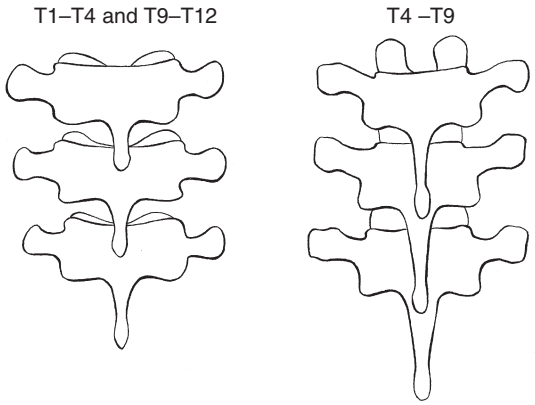


Fig 27.8 • Relationship between the level of the spinous processes and their corresponding transverse processes.

Some extension techniques are executed on the transverse processes. To be able to perform these manipulations at the right level, it is essential to have a good knowledge of the relationship between the spinous processes and their corresponding transverse processes, because this varies with the level (Fig. 27.8).

- *T1–T4 and T9–T12:* there is a difference of one level between the consecutive vertebrae, i.e. the transverse process of one vertebra lies level with the spinous process of the vertebra above. For example, the transverse process of T3 lies level with the spinous process of T2.
- *T4–T9:* there is a difference of 1½ levels. The transverse process lies level with the interspinal line between the spinous processes of the first and the second vertebrae above (Fig. 27.9). The transverse process of T8, for example, lies between the spinous processes of T6–T7, that of T9 between T7–T8.

Direction of rotation

This is important in manipulations that include an element of rotation. Manipulation is first undertaken in the direction of the less painful rotation. If this is only partly or completely unhelpful or makes the patient worse, rotation in the other direction follows.

The direction of the rotation is always defined by the direction in which the anterior part of the upper vertebra rotates. So when the upper vertebra rotates to the left, the movement is defined as a left rotation (Fig. 27.10).

Technique I: central pressure (Fig. 27.11)

The patient lies prone on a low couch. The two most tender spinous processes are marked. The examiner stands to the side, facing the patient, and places one hand, reinforced by the other, on the lower of the two processes. Because the thoracic spinous processes cover each other like tiles on a roof, it is logical to place the hands on the lower one in order to achieve as much movement as possible between the vertebrae. If the hand is placed on the upper vertebra, the movement is assured by the bony contact between the spinous processes; when the hand is placed on the lower vertebra, it is pushed away from the upper vertebra, resulting in increased range of motion.

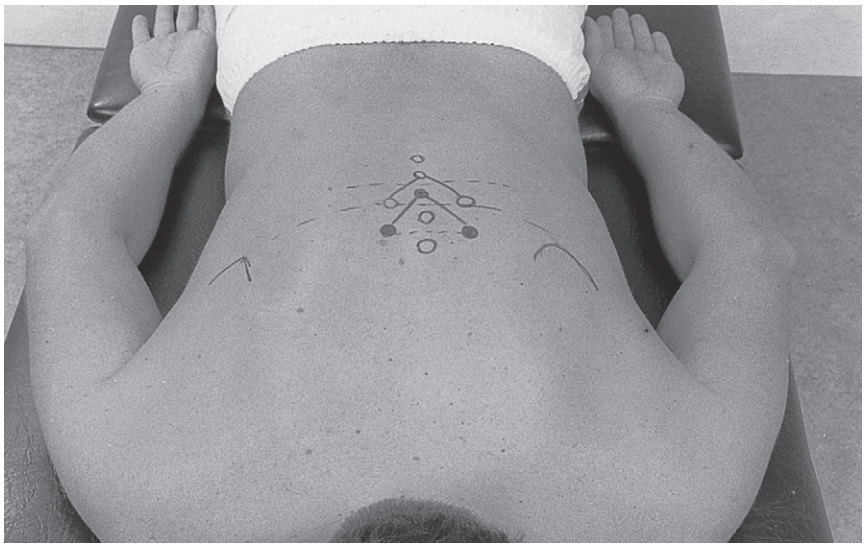


Fig 27.9 • The 1½-level difference between the spinous and transverse processes, which is present in T4–T9.

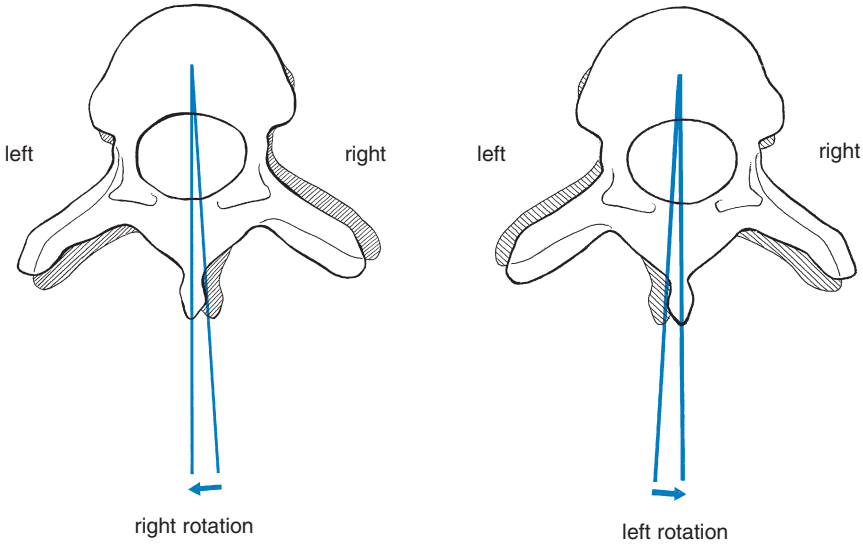


Fig 27.10 • Direction of rotation.

The hand makes contact with the spinous process via the fifth metacarpal bone and, to make the manœuvre less painful, the hand is placed slightly oblique so that the hypothenar muscles lie between the bones of the hand and the patient's spine.

The assistants adopt the positions already described.

The manipulator leans over the patient, the shoulders vertically above the hands, elbows straight, and feet a distance away from or close to the couch, depending on the effort to be used. All the slack is taken up by use of the body weight and is maintained until the final manipulative thrust is given. The patient is now asked to relax fully by taking a deep breath, followed by a maximal expiration. The moment the patient starts to breathe out, the manipulator tells the assistants to pull. Waiting until the end of expiration and under maximal traction, the final extension thrust is given by the manipulator's body, transmitted to the patient via the arm and hands.

Technique II: unilateral pressure (Fig. 27.12)

This manipulation is performed unilaterally on the transverse process.

The patient lies prone and the two most painful spinous processes and their corresponding transverse processes are marked. Vertical pressure is exerted on the transverse process of the lower of the two vertebrae.

The manipulator stands on the contralateral side of the patient: on the left for a right rotation. One hand, reinforced by the other, is placed with the pisiform bone on the transverse process. To make good bony contact, the paravertebral muscles are first moved to the side. This is achieved by pushing the muscles away from the vertebra with the base of the lower hand. One assistant holds the patient's ankles, while the other grasps the head or hands. With the elbows straight, the manipulator leans over the patient and brings the body weight perpendicular over the spine, taking up all the slack. The patient

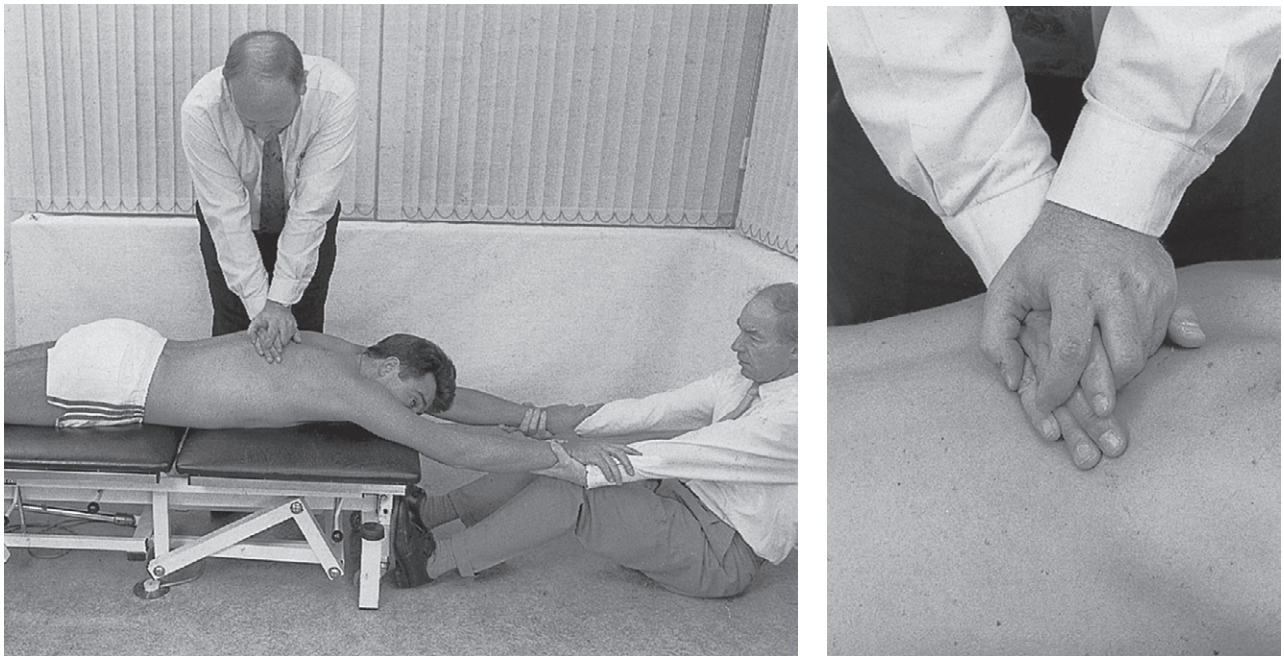


Fig 27.11 • Central pressure.

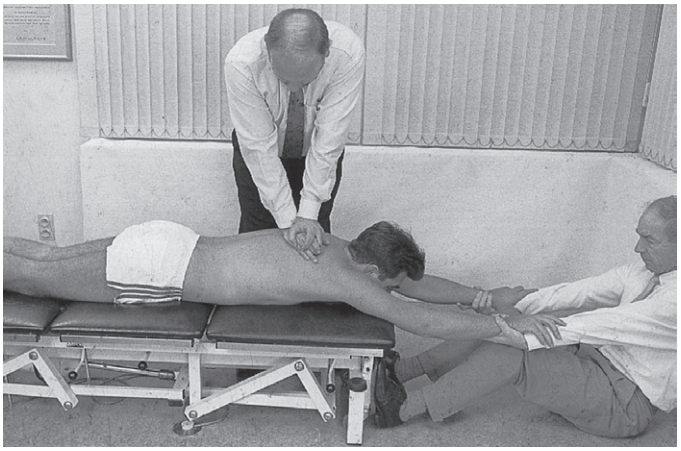


Fig 27.12 • Unilateral pressure.

is now asked to relax, take a deep breath in and then expire fully. The assistants are told to pull. After a couple of seconds of traction, the manipulator gives the final jerk vertically downwards. This causes a rotation and an extension movement.

Technique III: using crossed hands (Fig. 27.13)
Although a strong rotation element is present in this manipulation, it is still regarded as an extension technique.

The patient lies prone on a low couch. The manipulator can choose to stand on either side of the patient. The two most tender spinous processes and their corresponding transverse processes are marked. The rotation found during the clinical examination to be the less painful is performed first. If this is without benefit, the opposite rotation is performed. One hand is put on the transverse process of one vertebra, the other hand on the transverse process of the second vertebra on the opposite side. Care should be taken to cross the hands fully. The

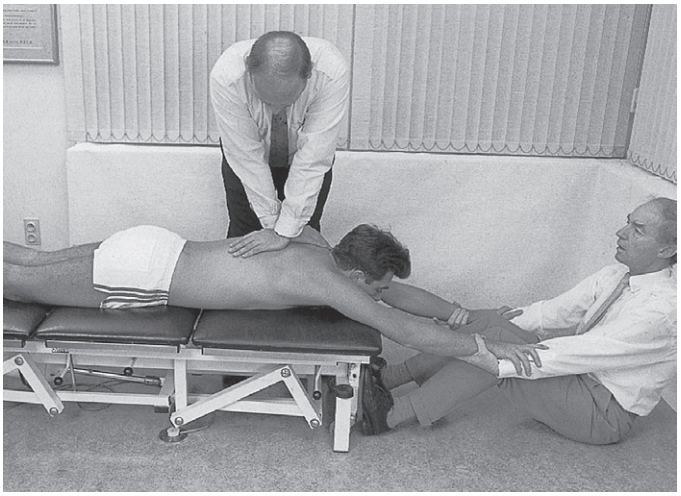


Fig 27.13 • Using crossed hands.

hand closer to the manipulator is placed on the transverse process via the pisiform bone. The other hand is in contact via the base of the trapezium–first metacarpal joint. Good bony contact is essential and is achieved by first pushing the paravertebral muscles away from the spine. The trapezium–first metacarpal joint of the one hand and the pisiform of the other are first placed just to the side of the spinous process. Both hands are now twisted into ulnar deviation, so pushing the muscles further to the side, and are then brought back closer to the midline but still remain on the transverse processes.

With the elbows straight, the manipulator leans over the patient and brings both shoulders vertically above the hands. As a result, all the slack is taken up. The assistants provide traction and the final jerk from the manipulator's body follows.

Extension technique in supine position

The patient lies supine just near the edge of the couch and places both hands behind the neck, the fingers covering the upper thoracic spinal processes. The elbows are placed well forwards and close together. The manipulator stands on the right-hand side facing the patient. By grasping the patient's left shoulder in the right hand and both elbows on the left hand (Fig. 27.14a), the manipulator flexes the patient's neck and trunk and rolls the upper body inwards (Fig. 27.14b).

Then a fist is made with the middle, ring and little fingers of the right hand – thumb and index finger are left out. This fist is now brought into firm contact with the lower vertebra of the segment being manipulated – the thenar eminence against the left and the middle phalanx of the flexed middle finger against the right transverse process. In this way the spinous process of the lower vertebra lies in the groove between these two eminences (Fig. 27.14c).

Now the patient is lowered back again until the manipulator's hand is wedged between the patient and the couch. In order to achieve full control over the movement, the patient's elbows are firmly held against the manipulator's sternum (Fig. 27.14d). Leaning well over the patient and using the weight of the trunk, the manipulator obtains considerable separation at the intervertebral joint. At the moment when the limit of tissue tension is felt (and the patient relaxes as fully as possible), the manipulator pushes the body forwards to apply a certain amount of overpressure. At that moment a 'click' or 'snap' is nearly always heard and felt, and the result of the manipulation is then assessed.

Variations

- If the patient is not able to reach the upper thoracic spine with the hands because of stiffness or a painful shoulder, the technique may be varied by crossing the arms fully over the chest. The right hand clasps the left shoulder, the left hand the right shoulder.
- Some degree of rotation can be added if the thenar eminence and the middle phalanx of the middle finger are positioned on two consecutive transverse processes and not on those of the same vertebra.

Techniques for upper thoracic disc lesions

Rotation techniques for upper thoracic disc lesions (Fig. 27.15)

This manœuvre is suitable only for upper thoracic disc lesions. It is best performed on a couch of medium height. The less painful rotation is done first.

The patient lies prone. For a right rotation, the manipulator stands facing the patient on the left-hand side. The right arm of the patient lies fully medially rotated on his back, the elbow flexed. One assistant exerts traction via the patient's head and also rotates it slightly to the right. In this way, the cervical spine is kept in neutral position during the whole manœuvre. The other assistant holds both of the patient's feet.

The manipulator hooks his left arm underneath the patient's furthest shoulder so that the proximal part of the lower arm can lift the patient's shoulder off the couch. The right hand is placed on the dorsal aspect of the ribs as high and as close to the thoracic spine as possible. The fingers of both hands are now clasped together. Both hands rest on the ribs, just lateral to the spine and no further down than mid-thorax. The manipulator now bends the trunk to the right, meanwhile pulling the patient's right shoulder off the couch via the left lower arm. The rest of the spine is held down on the couch by both hands pressing on the ribs. The assistants are asked to apply traction and the manipulator suddenly increases the side flexion. With this final movement, extension and rotation at the upper thoracic spine are increased. The rigidity of the upper thorax allows movement over only a small range.

Longitudinal traction for upper thoracic disc lesions (Fig. 27.16)

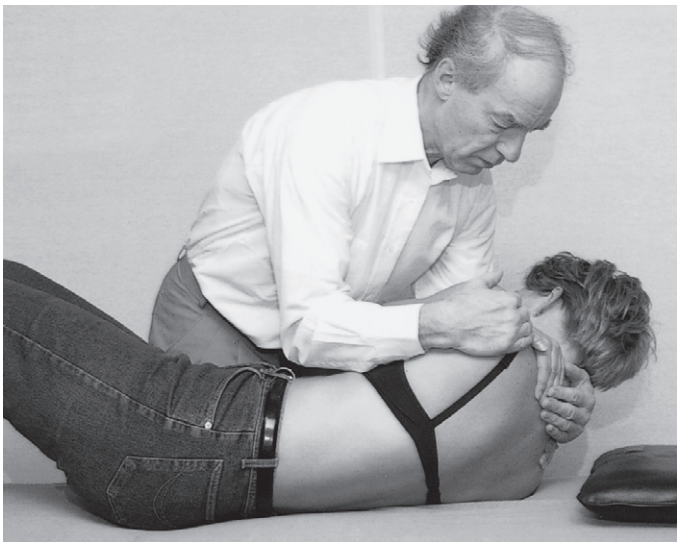
The patient stands or sits with the back to the manipulator. A sitting position is preferred if the patient is taller or heavier in weight than the manipulator. The patient is then asked to grasp the hands behind the neck, allowing the elbows to drop forwards.

The manipulator threads the arms in front of the patient's axillae and grasps both wrists. The patient is then asked to bend the head, so allowing the elbows to drop further forwards and to lean backwards against the chest of the manipulator. The latter performs a preliminary lift and at the moment the patient allows the trunk to sag, suddenly extends the knees. This results in a longitudinal traction and separation particular to the upper thoracic joints. A 'click' or 'snap' is felt and the result then assessed.

Some degree of extension may be added to this technique. The manipulator achieves this by adopting a slightly modified starting position: turning the trunk slightly to one side allows positioning of the lower ribs against the spine at the level at which manipulation is required.

Warning

Beware of forcefully flexing the neck of the patient during the upward thrust.



(a)

(d)

(b)

(e)

(c)

Fig 27.14 • Extension technique in supine position (a, b, c). Variation for upper lumbar level (d). Position for thenar and middle finger (e).

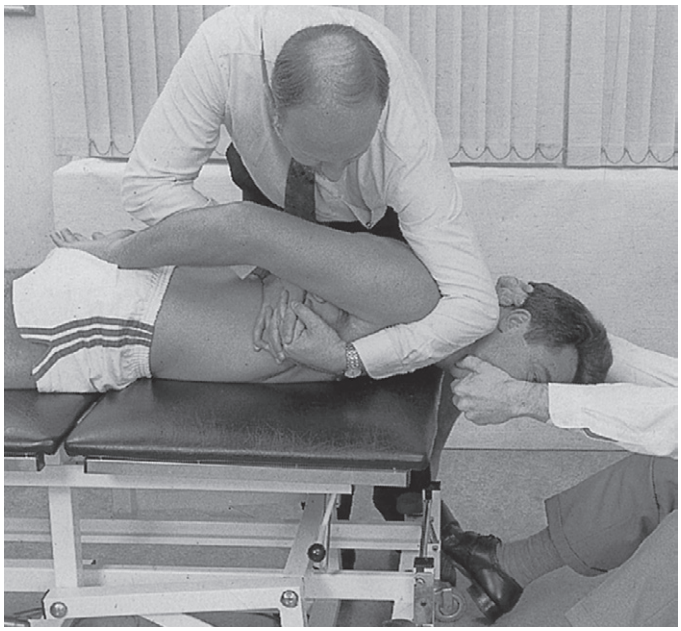


Fig 27.15 • Technique for upper thoracic disc lesions.

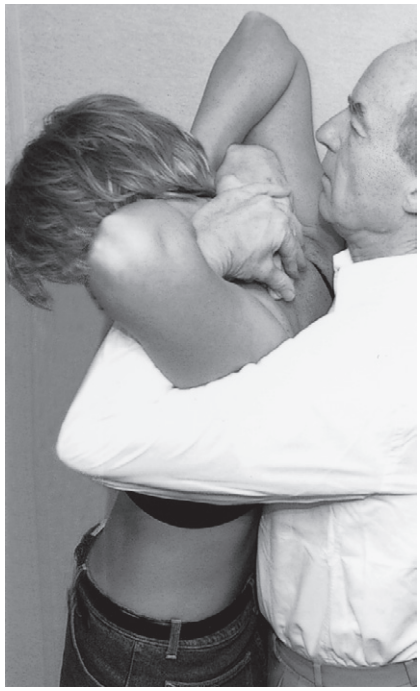


Fig 27.16 • Longitudinal traction for upper thoracic disc lesions.

Choice of manœuvre

The different techniques are used in a specific sequence, depending on the patient's age, the level of the protrusion and the immediate result of the preceding manipulation.

After each manœuvre the patient is re-examined and, if improved, the same manœuvre is repeated several times with increasing strength until the patient has completely recovered or until no further improvement is obtained. In the latter event, another type of manipulation follows. If the patient does not improve or even becomes worse, the same manipulation is not carried out a second time but is immediately replaced by another. In such cases, the same type of technique is performed, but in the opposite direction. If this manipulation also aggravates the lesion, manipulation must be stopped and the diagnosis reconsidered.

Improvement is indicated by pain, which is perceived over a small area and/or which becomes less severe. Another important sign is centralization of the pain: pain that first spreads far distally or laterally, but becomes more centrally localized, is regarded as an improvement.[48,49] Manipulations are stopped as soon as the pain has disappeared and the clinical examination becomes negative. A total number of 5 (elderly) to 10 (younger patients) manipulations are executed during one session. These can be repeated daily, although for the elderly it is advisable to allow 3 or 4 days in between. It may take 3–5 sessions before the patient has fully recovered. A certain amount of after-pain is sometimes present. If there is a recurrence, the patient should return as soon as possible to be manipulated again.

Usually the extension techniques are used first. In patients over 60 years of age, however, extension techniques may fracture a rib and are therefore never used. The same applies if the extension pressure on the spinous processes performed at the end of the clinical examination is very painful. In such a case, oscillatory techniques should then be used (see below).

Warning

Extension techniques should never be used in patients over 60 years of age or when there is excessive pain on extension pressure.

Failure of manipulative reduction

Ninety-five percent of thoracic disc lesions are reduced in 3–5 sessions. If, after 3–5 manipulative sessions, relief of symptoms is not obtained, it should be accepted that either the diagnosis is wrong or the disc lesion is not suitable for manipulation. The latter may be the result of too large a protrusion, as shown by the presence of neurological deficit, or may occur when a nuclear disc lesion is present (Box 27.2).

Oscillatory techniques

Some cases respond better to oscillations. These consist of gentle high-frequency mobilizations at 2–3 vibrations per second. Oscillations should be given for 10–15 minutes daily and are performed as either central or unilateral pressure to the thoracic spine.[50]

Indications

There are three groups of indications:

- Patients who present with a great deal of discomfort but with very minor articular signs on clinical examination.
- Patients with acute thoracic lumbago who are in such pain that they cannot tolerate normal manipulations. Oscillatory techniques can be used until the pain is

Box 27.2

Unsuccessful manipulations

Wrong diagnosis: no disc protrusion?

- Facet joint?
- Tumour?
- Muscular lesion?
- Osseous lesion?
- Ligamentous lesion?
- Visceral disorder?

Disc protrusion confirmed

- Check for neurological deficit
  1. If neurological deficit is present:
     - Stop manipulation
     - Give sinuvertebral block
  2. If no neurological deficit is present, consider nuclear protrusion:
     - Stop manipulation
     - Try traction

reduced to a level at which normal manipulations can be started.

- Patients who cannot tolerate the extension or rotation techniques.

Sustained traction

In some patients with thoracic disc protrusion, reduction by means of traction may be needed. However, traction may be technically impossible in patients suffering from orthopnoea, asthma or hiatus hernia or who have recently undergone thoracic or abdominal surgery (see Ch. 40).[51]

Indications

- *Central protrusions*: it can be dangerous to manipulate very central protrusions, as there is a possibility of causing compression of the spinal cord. Central protrusions are present mainly in those with a marked thoracic kyphosis, either postural or after a wedge fracture. These patients complain of central pain radiating to both sides.
- *Failure of manipulation*: patients suffering from a disc lesion in whom manipulative attempts have failed or who have been made worse, should receive traction unless nerve root compression with neurological deficit is present. There is usually a history of gradual onset, although this is not pathognomonic in the thoracic spine for a nuclear protrusion.
- *Symptoms of cord compression in the absence of signs*: patients suffering from a thoracic disc protrusion with pins and needles in both feet can undergo cautious traction if no other symptoms or signs of cord compression are present.
- *Thoracic postural pain syndrome*: these patients can be helped by daily sustained traction with increasing traction-free intervals (see online chapter *Disorders of the thoracic spine and their treatment*).
- *Disc lesions at a very kyphotic thoracic joint.*
- *Disc lesions adjacent to a wedge fracture of a vertebral body.*
- *Anterior and lateral erosion* (see online chapter *Disorders of the thoracic spine and their treatment*).
- *Lateral recess stenosis* (see online chapter *Disorders of the thoracic spine and their treatment*).

Technique

Traction is given daily over 30–45 minutes. Thoracic discs above T9 are treated with cervical traction. For these, the rules of cervical traction should be observed (see Ch. 11).

For thoracic protrusions below T9, traction is given using the lumbar technique (see Ch. 40). An intensity of 35 kg (small person) to 70 kg (heavy, well-built person) is used. Obviously, the thoracic belt should be placed cranial to the level of the lesion. The initial traction sessions are used as the manipulator's guide for positioning the patient and for the strength to be used.

Results

Improvement normally begins after 6–10 sessions, whereas full cure may require up to 20 sessions.

Sinuvertebral nerve block

In persistant root pain or in pain associated with neurological deficit, a sinuvertebral nerve block is the treatment of choice. This should only be performed under radiological control.

Bed rest

If both manipulation and traction have failed and no indication for surgical intervention is present, the only remaining alternative is prolonged rest in bed in the hope that removing the influence of gravity on the spine may allow the protrusion to reduce spontaneously.

Surgery: removal of protruded discs

The main indication is early cord compression by a progressive disc lesion.

Laminectomies done before 1960 were dangerous interventions with disappointing results.[52,53] It was found that almost all serious complications occurred among those having midline protrusions at levels T10–T11.[53] This is probably the outcome of the shape of the spinal canal, which is quite narrow at this level. The posterior approach used required some displacement of the cord in a very confined space, with consequent considerable risk to the blood supply.

Since 1960 a transthoracic lateral approach has been used and in recent years more progress has been made with new thoracoscopic microsurgical techniques.[54,55] They seem to give better results and fewer complications.[56] Recently,

percutaneous laser disc decompression – intervertebral discs are treated by reduction of intradiscal pressure through laser energy – has also been promoted as a valuable method in treating recalcitrant thoracic disc lesions.[57]

Prevention of recurrence

Postural prophylaxis

Reduction of a thoracic disc protrusion normally does not cause much in the way of difficulties but recurrence is not uncommon and stability is often difficult to achieve. This is obviously because of the normal thoracic kyphosis which results in a posteriorly directed force acting on the disc.

All the rules on prophylaxis for the lumbar spine are also applicable here (see Ch. 40). However, it is much more difficult and sometimes even impossible to put them into practice. For example, it is impossible to obtain the equivalent of lumbar lordosis because even the most flexible person cannot get beyond a straight line in full extension. The most hazardous movements are those that include combined flexion and rotation elements. Lifting a weight at the same time makes them even more dangerous. Therefore patients should avoid rotating their trunk but must turn their body around using their legs and should bend their knees to lift.

Sitting for a prolonged period in a kyphotic posture must also be avoided.

Ligamentous sclerosis

In those patients in whom the risk of recurrence is high (thoracic hyperkyphosis), or when recurrence is frequent, local reinforcement is needed for the supraspinal and interspinal ligaments and for the capsules of the facet joints of the vertebrae between which the protrusion lies. This can be achieved by infiltrating a sclerosant solution into these structures, which leads to proliferation of fibroblasts and formation of new collagen.[58] The final result is increased stability of the disc fragment because the two vertebrae become less mobile. Before this procedure is undertaken, full reduction must be achieved.

Occasionally, the same technique can be employed for arthritis of the facet joint or for ligamentous lesions. In these cases triamcinolone is used.

The sclerosant infiltrations are given at weekly intervals and the greatest effect is normally obtained after 3 weeks; exceptionally it may take up to 2 months. Usually, one full treatment suffices; if there is further recurrence, it can be repeated.

Technique: infiltration of the interspinal and supraspinal ligaments (Fig. 27.17)

A 5 mL syringe is filled with 3 mL of sclerosant solution and 1 mL of lidocaine 2%, and a 4 cm needle is fitted to it; 2 mL of this solution are used for the interspinal and supraspinal ligaments, the rest for the facet joints.

The relevant spinous processes are marked and the needle is inserted halfway in between them at the midline. At about 1 cm deep it is changed into an almost horizontal position, pointing cranially and aiming at the inferior part of the upper spinous process. Once it hits bone, 0.5 mL of the solution is infiltrated dropwise into the supraspinal ligament and the same

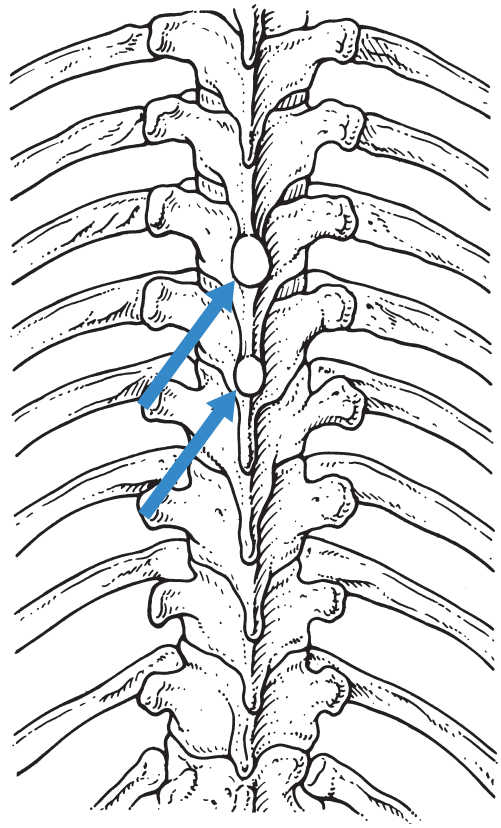


Fig 27.17 • Infiltration of the interspinal and supraspinal ligaments.

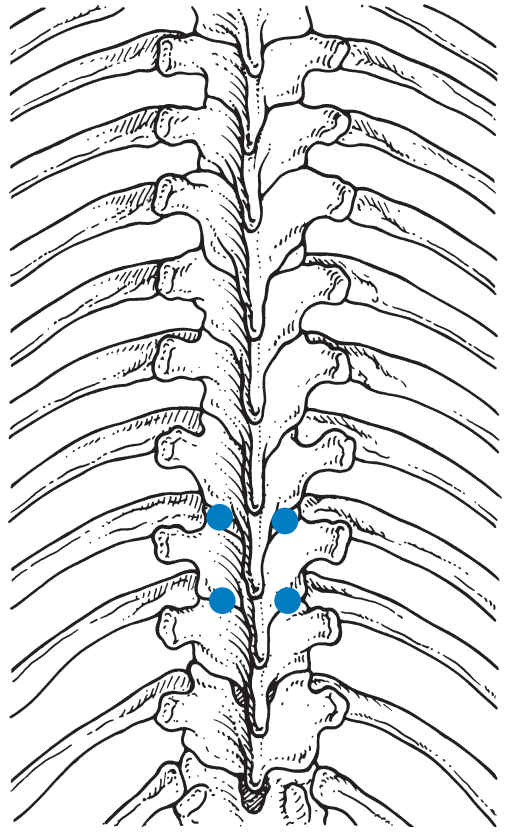


Fig 27.18 • Infiltration of the capsule of the facet joint.

quantity a little deeper down in the interspinal ligament. Infiltration is only given with the tip of the needle in bony contact. The needle is then half-withdrawn and brought into a more vertical position towards the insertions of the ligaments on the upper aspect of the lower spinous process, which are infiltrated in the same way. When the supraspinal ligament is infiltrated, it offers tough resistance, whereas infiltration of the interspinal ligament is much easier.

Technique: infiltration of the facet joint (Fig. 27.18)
A 4 cm needle is used. The patient remains prone and the transverse processes corresponding to the most painful consecutive spinous processes are marked. The needle is inserted at about 1.5 cm from the midline halfway in between the two transverse processes. It is thrust in vertically downwards until it touches the articular process at about 3 cm depth. Capsular resistance to the needle tip is sought by minor repositioning of the needle. The infiltration is given mainly into the capsule with the tip of the needle always in bony contact and considerable resistance is usually felt during the whole infiltration. This is done at both sides using 1 mL of the solution at each side.

The interspinous and supraspinous ligaments and the facet joints are infiltrated at the same time, repeated three times at weekly intervals.

Access the complete reference list online at **www.orthopaedicmedicineonline.com**

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