publicly and should not be the sole prerogative of any one professional group or any single agency of government.

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Bone and Joint Diseases

Surgery in the treatment of cervical and thoracic disc protrusions

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Cervical disc disorders

Disorders of the cervical intervertebral discs are a common cause of pain and disability, especially in the fourth and fifth decades of life. Symptoms rarely develop from a cervical disc prolapse but more commonly they arise in association with cervical spondylosis. Two groups of symptoms may arise from the latter—unilateral nerve root pain and paraesthesiae in association with pain in the neck and shoulder or cervical myelopathy produced by interference with the vascular supply of the spinal cord.

NERVE ROOT PAIN FROM CERVICAL DISC PROTRUSION AND CERVICAL SPONDYLOSIS

Cervical disc protrusion is rare compared with that found in the lumbar region. It affects young people. The protrusion, which is small, arises in the posterolateral part of the disc and is accompanied by characteristic pain in the neck and arm in the distribution of one cervical nerve root. The horizontal course of cervical nerve roots from the spinal cord to the intervertebral foramina precludes more than one nerve root being affected by the prolapse of a particular disc. Although motor and reflex signs may be present, they are not always observed. Pain is severe proximally, unilateral, and accompanied by paraesthesiae in the fingers of the affected arm.

It is questionable whether prolapse occurs in older people. The same signs and symptoms more commonly arise with cervical spondylosis, when the nerve root may be placed at risk by a thickened hard annulus fibrosus, associated with osteophyte formation in the intervertebral foramen and adjacent vertebral body margins. The nerve root sheath is thickened and adherent. Pain may be in the neck, radiating bilaterally to the proximal parts of the arms or into the occiput, or this may occur with or without unilateral nerve root pain distributed into the more peripheral parts of the arm.

Surgery for cervical disc prolapse is rarely needed as spontaneous resolution tends to occur. Immobilisation of the cervical spine with a collar or the help of intermittent or continuous traction produces resolution within two to three months, with no residual ill effects. Recurrence, however, is possible, but the intervals of freedom from symptoms vary from a few months to many years, and it is impossible to predict the frequency and timing of any recurrence.

Surgery is indicated only for those patients with persistent severe nerve root pain despite adequate closed treatment including head traction with bed rest and suitable analgesia. Surgery for its relief is needed far less often than for lumbar disc prolapse. It aims at reducing movement of the vertebral joints at the affected level, together with decompression of the affected nerve root. Excision of most of the intervertebral disc by an anterior approach through the neck, removing as much disc as is visible, without interfering with the posterior part of the annulus, is accompanied by the insertion of a bone graft removed from the iliac crest to fuse two vertebral bodies on either side of the affected site, so reducing interference with the blood flow in the vessels to the spinal cord. Satisfactory fusion is likely to result in subsequent absorption of osteophyte formation, and this alone will minimise the risk of any future recurrence.

Some surgeons prefer to employ a more radical excision where the intervertebral disc is completely removed by the same approach—excision of the posterior part of the annulus accompanied by fusion of the adjacent intervertebral bodies.

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Removal of the posterior part of the annulus is fraught with the danger of damage to the anterior spinal vessels, with subsequent ischaemia of the spinal cord and resultant paraplegia. It is doubtful whether the added risks of radical disc excision are justified, in view of the satisfactory results of partial enucleation and simultaneous fusion, as the latter gives equally satisfactory relief of the symptoms with minimal risk of recurrence or any spinal cord damage.

SURGICAL INTERVENTION IN CERVICAL SPONDYLOSIS

Surgical intervention in cervical spondylosis may be required for: (1) repeated disabling recurrences, or persistence, of localised cervical and occipital pain that may or may not be accompanied by nerve root pain and paraesthesiae in the arm despite prolonged intensive conservative treatment; and (2) the compressive effects of cervical spondylosis on the spinal cord and its blood vessels, producing myelopathy.

Surgery for the peripheral nerve root and local cervical symptoms of cervical spondylosis

The local and root symptoms of cervical spondylosis are usually well controlled by non-operative methods. Nevertheless, in cases when severe symptoms persist despite the prolonged use of closed methods of treatment or in those patients who suffer repeated disabling symptoms from this source, anterior cervical fusion gives beneficial results, provided the cervical spondylosis is localised to one, or at the most, two cervical segments.

Surgical fusion in a generalised spondylosis affecting multiple segmental levels is likely to give disappointing results. Localised fusion will have no beneficial effect on the segments that are still affected and not fused. In fact, the additional strain placed on the untreated segments by the fixation of one segment is likely to exacerbate symptoms from the non-fused areas.

Discography may be used to detect degrees of degeneration in the intervertebral discs above the proposed level of fusion, even when plain x-ray films show no changes. This radiological investigation will indicate the intervertebral discs that are already the seat of degenerative changes and allow rejection of unsuitable cases for surgery—that is, where generalised degenerative disc changes are present. The distribution of pain and paraesthesiae in a particular nerve root distribution should indicate the level needing surgery. Discography will not indicate which of the degenerated discs is producing the pain and is an unreliable method of investigation to indicate which level to fuse on that account. Similarly, tests using intradiscal injection of saline in an attempt to reproduce pain are equally unreliable.

Surgical intervention for cervical myelopathy due to cervical spondylosis

Cervical myelopathy resulting from cervical spondylosis is a progressive condition needing surgery, which regrettably may not reverse the changes already induced in the spinal cord but may be expected to arrest their further progress. The radiological changes of spondylosis may not be severe. Probably the spinal cord changes are secondary to interference with the anterior spinal artery and vein lying between the bony and fibrous bars on the posterior aspect of the intervertebral disc and the cord and dura mater. Vascular anastomoses in the cervical region are poorly developed, the major channels being those from the vertebral vessels which pass through the intervertebral foramina at C5, 6, and 7 to join the anterior spinal vessels.

Interference with these communicating vascular channels from the vertebral vessels to the anterior spinal artery and vein as they pass through the intervertebral foramina at the site of the extensive spondylosis, usually at C5/6 and C6/7, is thus an important cause.¹ Characteristically there is an insidious onset

of spasticity of the legs with a lower motor neurone lesion and sensory disturbance affecting the peripheral parts of the arms. The patient has variable signs and symptoms from day to day, which often delays recognition of the condition, resulting in irreversible ischaemic changes in the spinal cord. Early diagnosis of cervical myelopathy, therefore, is essential if surgery is to produce any improvement, while its use in late cases is merely an attempt to arrest the progression of the neurological state.

Surgery may take the form of a decompression laminectomy, this being particularly indicated in the patient who has an increased lordotic curve in the cervical spine. It does not, however, relieve any interference with the vascular anastomosis through the intervertebral foramina. The preferable procedure is anterior cervical interbody fusion at one or two of the severely affected spondylitic levels by an anterior approach, this usually being at C5/6 and C6/7. This restricts movement at the affected levels and reduces any obstruction to the communicating vessels in the intervertebral foramina. Subsequent decompression of the nerve roots by foraminotomy or, rarely, laminectomy may be necessary to obtain maximum neurological improvement.

Surgery and treatment in thoracic disc protrusions

Thoracic disc protrusions are rarely encountered, the incidence being estimated at one patient per million population a year.² This is possibly related to the reduced thickness of the thoracic disc and its nucleus and the lessened movement in the thoracic spine as compared with cervical and lumbar regions.

They usually occur in the fourth and fifth decades of life and are invariably overlooked until they have been present for a considerable time, owing to the protean presentation. Often extensive neurological signs are present before the diagnosis is ever considered. The protrusion occurs most commonly in the lower thoracic spine. Those in the lower segments of the region of D11/12 often show no calcification, while those in the D8/10 interspaces often show this phenomenon on radiological examination. A fall on to the buttocks may precipitate the onset of symptoms, either by directly compressing the thoracic cord by the disc itself or by disturbance of its vascular relationships.

A thoracic disc prolapse produces lower thoracic or lumbar pain, usually aching, but there may be radiation to the front of the abdomen as a girdle-type pain, associated with paraesthesiae and often mistaken for internal abdominal disease. The ache is usually the first symptom. Weakness and heaviness of the limbs are characteristic features that follow, while sensory phenomena invariably accompany these—perverted sensation being characteristic.

A non-calcified prolapse is usually placed laterally and produces radicular pain, often interpreted as intercostal neuralgia. A sensory level of hyperaesthesia is a common finding. The calcified type of prolapse may run a transient self-limiting course of three to six months. Unfortunately this may progress to affect the vascular supply to the spinal cord, producing varying degrees of paralysis or complete paraplegia. The extruded disc material may run under the posterior longitudinal ligament and affect more than one cord segment. Diagnosis is aided by radiological investigation. A calcified intervertebral disc with neurological symptoms urges one to consider the possibility of this diagnosis. Further investigation with tomography, myelography, and air-contrast myelography helps to locate the lesion. As the size of the prolapse may be limited, it may have to be located purely on clinical grounds.

Conservative measures are feasible only for those patients without any abnormal neurological signs, who usually have a lateral calcified prolapse, when back-raising exercises will help to relieve pain.

As the space of the thoracic cord is relatively smaller than in the lumbar and cervical region, and the blood supply to the lower thoracic spinal cord is precarious, a laminectomy may be inadequate to remove any disc fragments that have protruded

without interference with the blood supply of the cord, so increasing any existing paralysis.

Surgery is indicated in all cases where there are progressive neurological signs. Emergency intervention is necessary where paraplegia has a rapid onset, trauma often being a precipitating factor.

The surgical approach to a protruding intervertebral disc in the dorsal region may endanger the blood supply to the thoracic cord. It may be removed by transthoracic approach³ to the anterolateral part of the disc or by a lateral rachotomy, when the disc is exposed laterally after excision of the associated rib and enlargement of the intervertebral foramen.⁶

This may be combined with partial laminectomy of the vertebra above and below the affected level to improve the exposure. Thus exact location of the level of the disc prolapse is essential. The results of surgical relief in the past have been poor.²⁻⁵ This was the result partly of late diagnosis, when irreversible neurological damage had already occurred, and partly of the use of an unsuitable surgical approach to the protrusion.⁴⁻⁶ Approach by laminectomy, either extradural or transdural, is difficult if neurological deficit is not to be increased at operation and gives inadequate exposure of the prolapse. Extensive removal of the laminae, especially if the facet joints are excised, may cause the disc to protrude further into the spinal canal and produce complete paraplegia. The anterolateral or lateral combined approach, with unilateral facetectomy, allows better access with less risk of any interference with the spinal cord and its blood supply and its more frequent use now gives a better prognosis.²⁻⁷ Maximal improvement after operation is reached within six to eight weeks, but recovery may progress for a further two years. The condition then tends to become stationary.

Early diagnosis and operation are essential if the former poor prognosis of thoracic disc prolapse is to be avoided. Severe neurological deficit will indicate a poor end result.⁴ The best prognosis is given by the protrusion that produces unilateral pain and minimal neurological deficit. A slow onset, especially if a lateral prolapse is present, gives a better prognosis, but a rapid onset, which is often a central prolapse, needs urgent surgery. Reports show an inverse relation of the length of pre-operative history and postoperative result. The known anatomical paucity of the blood supply to the thoracic cord—and the considerable risk of aggravating this by any operative manipulation and the difficulty of removing a prolapse (which is often adherent to the dura)—make the risks of surgery for thoracic prolapse far greater than those in the cervical or lumbar region. On the other hand, while the operation does carry these risks, which are now reduced considerably by using the lateral approach, failure to intervene makes progressive deterioration certain.

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Clinical Topics

Icarus's syndrome: new hazards in flight

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Summary

The British Hang Gliding Association accident report for 1975 reported two deaths. The remaining cases were predominantly limb fractures. The major causes of the injuries were inexperience, high wind speed, turbulence, and stalling. It is contended that the sport is no more risky than is rock climbing, motor-bike racing, skiing, or potholing, yet against these undoubtedly dangerous sports no threat of prohibition exists. The current accident rate in hang gliding could be reduced dramatically by the provision of proper courses of instruction.

Introduction

The commonest hang glider—called kite—is the Rogallo design. It consists of a roughly V-shaped structure of aluminium tubes supporting about 18.5 sq m (200 sq ft) of sail. The rigidity of the assembly is increased by wire struts. The pilot is suspended in a saddle from the centre of the structure. In front of him, projecting downwards, is the A-frame—so named because of its shape (figs 1 and 2). The pilot can alter the attitude of the kite by shifting his weight in both an anterior-posterior and lateral direction in relation to the A-frame. Lift-off occurs at about 19-24 kph (12-15 mph), and flying speed is in the range of 24-56 kph (15-35 mph). Kites weigh about 16-18 kg (35-40 lb). In the event of sudden deceleration the pilot inevitably strikes part of the A-frame.

To take off, the pilot runs down hill until a sufficient airspeed is reached and then he hangs in the saddle or harness. To land, he flies straight and level with his feet just clearing the ground and holds the nose of the kite up, progressively trading speed for maintenance of height until the craft sinks gently at walking speed or at rest, and he then takes the weight on his feet. This

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