VERTEBRAL MID-LINE PAIN: PAIN ARISING FROM THE INTERSPINOUS SPACES

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INTRODUCTION

Pain can arise from anything that has a nociceptive supply and, as far as the vertebral column is concerned, pain has frequently been attributed to either the intervertebral disc or the zygapophyseal joints. These structures are involved in the process known as spondylosis and the degenerative changes shown in this area have frequently been blamed as the source of pain. However, the work by Taylor and Twomey[1,2] have nicely demonstrated varying changes due to the aging process but pain and the degenerative process do not correlate well.

In the 1930s, Mixter and Barr demonstrated that a significant amount of back pain involved the intervertebral disc, while Baastrup[3,4] also described a condition in which the lumbar spines developed a reactive eburnation, thus producing considerable pain which resulted from excessive lordosis through such activities as gymnastics.

Abnormal contact of opposing spinous processes with sclerosis and flattening of the superior and inferior tips of successive spinal processes is characteristic of the condition known as Baastrup's disease.

It is generally accepted that muscular and ligamentous strains can be common causes of acute back pain, but that chronic pain more likely arises from the intervertebral disc or the zygapophyseal joints. This is supported by Schwazer et al[5] who examined 92 patients with chronic low back pain and found that 39% had at least one positive discogram while 9% were relieved by Z joint blocks. In this study, 45% of patients had pain arising from some other unidentifiable structure.

Some authors consider that ligamentous strains as a source of musculoskeletal pain are not particularly likely[6]. However, epicondylitis, achilles tendon strain, as well as the ligamentous strain related to the knees, are common areas of ongoing discomfort[7-12].

The interspinous spaces have, as a potential source of pain, the interspinous and supraspinous ligaments as well as the small tranversarii and rotatores muscles. Thus there are plenty of enthesis-type regions which on straining have the potential to cause pain, but there is conflicting literature on the structure and function of the interspinous and supraspinous ligaments. Structurally, the interspinous ligament can be divided into three parts: ventral, middle and posterior. Anteriorly, the ligament is bilateral, splitting to form a slit-like mid-line cavity filled with fat. The ventral portion contains elastin fibres and merges anteriorly with the ligamentum flavum. Changes in these ligaments have been described in some detail by Rissanen13. The main changes seen are fatty degeneration, fragmentation and necrotisation of fibre bundles, hyalinisation, calcification, proliferation of fibroblasts in small muscles, accumulation of various mucopolysaccharides and metaplasia into fibrocartilage. In another study[14], patients with proven herniated vertebral discs manifested a premature degeneration in the interspinous ligaments in the lumbar region.

The posterior portion of the interspinous ligament is totally collagenous and there are still conflicting opinions about the orientation of the collagen fibres in this part of the ligament. However, consensus seems to be that the fibres run from the posterior part of the spinous process above to the anterior part of the spinous process below[13,15,16]. Hugens[17] found that the ligaments are fan-like in nature and because of the orientation of their fibres, there was very little in the way of resistance to flexion of the spine.

The supraspinous ligament can also be divided into three sections: deep, middle and superficial. The middle part consists mainly of a merging of tendons of the erector spinae and the thoracolumbar fascia. The middle layer of the supraspinous ligaments has the microscopic appearance of a ligament as the tendons intertwine together close to the insertions on to the spinous processes. At the microscopic level, the fibre bundles are clearly identifiable as tendons. With aging, the middle and deep layers undergo metaplasia into fibrocartilage and later on in life this often becomes ossified.

Heylings[15] considered that the supraspinous ligament consists mainly of a confluence of tendons of erector spinae and the thoracolumbar fascia. In addition, the supraspinous ligament provides a cushion of connective tissue, helping to protect the spinous processes from impact. Since function can be implied from structure and orientation, then we should believe the primary functions of the interspinous ligaments are to anchor the attachments of the thoracolumbar fascia and the longissimus thoracicis to the spinous processes and laminae. Adams[18] and Postern at al[19] suggested that the ligaments do not have a major role in resisting flexion, rather that they may be a significant source of pain, particularly if they are the first to fail when the spine is maximally flexed.

Cusick et al[20] suggested that the absence of a supraspinous ligament at the lumbosacral level would result in greater stresses being applied to the interspinous ligament and that therefore the role of these ligaments is underestimated, especially when one considers the most prominent disc prolapse is where there is no supraspinous ligament naturally occurring.

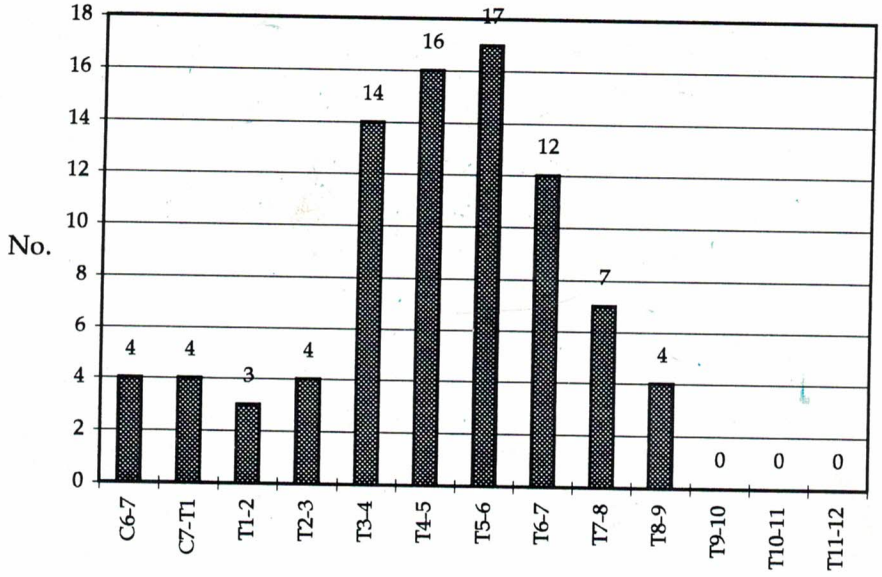

Figure 1
Pain arising from interspinous spaces in 26 patients

In a group of patients, Steindler and Luck[21] identified a source of pain in the posterior elements of the lumbar spine and by injecting with procaine hydrochloride were able to identify 14 people suffering from pain arising from the area of the supraspinous-interspinous ligaments. Surgical removal of this ligament did not resolve the pain when experienced in the mid-line[22]. Thus it would seem that while the area between the spines might be tender, the tenderness may not always arise from the interspinous ligaments.

METHOD

In a few patients who present with chronic mid-line musculoskeletal pain, the authors have noted that palpating the interspinous spaces often will reproduce the patient's pain. Very commonly, the lumbosacral interspinous space is painful to palpation, but this is usually accompanied by pain over the area of the iliolumbar ligaments and/or the enthesis of the thoracolumbar fascia where it inserts over the iliac crests.

The patients in this study were asked whether the pain produced by pressure over the interspinous space was the pain of which they complained. The tender areas were marked and initially injected with 2mls 0.5% lignocaine to determine to what degree the pain was diminished.

As the needle entered the space precisely in the mid-line, the needle was felt to pass through the supraspinous ligament and this was non-tender in these patients. The pain was produced deeper down amongst the more anterior fibres of the interspinous ligament. When the needle was angled up to 5mms from the mid-line, very similar pain was also produced as was produced by palpation over the mid-line. This would mean that ligaments and small vertebral muscles are likely to be the source of pain with the possibility of trigger points being present in the intrinsic muscles of the vertebral column.

Over a period of eighteen months, a total number of 26 patients have been identified as having pain arising solely out of the space between some spinal processes. X-rays of parts of the vertebral column in all patients were non-contributory as to an explanation of the source of their pain, which appeared to be predominantly in the soft tissues.

The levels of pain most commonly involved are shown in Figure 1, which indicates a predominance of discomfort occurring at the region of the cervicothoracic junction and again at the area of the thoracic spine which has the maximum kyphosis. The average number of tender spots per patient was a little over three.

Each patient was injected in the area of tenderness with 2mls of 0.5% lignocaine at a level when palpation over the interspinous spaces reproduced the patient's pain. The area a half of a centimetre on either side of the mid-line was infiltrated when the needle touched such an area which then reproduced the patient's pain.

In all cases, pain was reproduced up to half a centimetre from the mid-line on one side and occasionally bilaterally. The numbers were too small to determine whether there was any relationship between the lesion level and bilateral pain, or whether there was any relationship between site of pain and handedness.

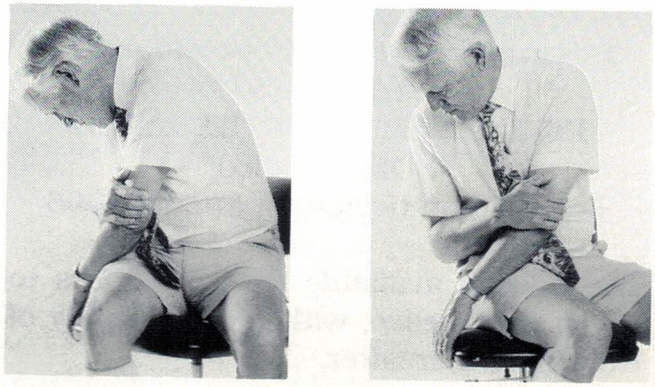

Figure 2
Patient breathes in and pulls the arm around and down. When the tender structures are felt to tighten, breathe out and hold in the stretched relaxed position for 10 seconds.

Of the 85 tender areas, 63 responded to injection of triamcinolone and local anaesthetic together with stretching exercises as shown in Figure 2. Nine other spaces responded to sclerosing with 15% dextrose given on three occasions, two weeks apart. The remainder did not respond to cortisone injections and did not opt for sclerosing.

SUMMARY

It would seem that there is an identifiable mid-line area of pain occurring between the spinous processes of the vertebral column. This pain probably involves the interspinous ligament, the capsule of the thoracic z-joints and the tiny intrinsic muscles at various levels. The pain levels peak at the thoracic kyphosis and the cervicothoracic junction. It was possible to produce a resolution of the patient's pain, in which there were good results in 76% of patients with injections of cortisone and exercises, with another 10% having their pain resolved by sclerosing (prolotherapy) injections.

REFERENCES

1 Taylor JR and Twomey LT Age changes in lumbar zygapophyseal joints Spine 1986 11:739-745
2 Twomey L and Taylor JR Age changes in lumbar intervertebral discs Acta Orthop Scand 1985 56:496-499
3 Baastrup CI On the spinous processes of the lumbar vertebrae and the soft tissue between them and on the pathological changes in that region Acta Radiologica Scand 1933 14:52-54
4 Baastrup CI Proc Spin vert lumbar und einige zwischen diesen leigende gelenkbildungen mit pathologischen prozessen in deiser region Fortschritee auf den Gebiete der Rontgenstrahlen 1933 48:430-435
5 Schwarzer AC, Aprill CN, Derby R, Fortin J, Kine G and Bogduk N The relative contributions of the disc and zygapophyseal joint in chronic low back pain Spine 1994 19:801-806
6 Bogduk N The causes of low back pain Med J of Aust 1992 156:153-157
7 Mercer W Tennis elbow Practitioner 1950 164:293
8 Nirschl RP The etiology and treatment of tennis elbow J Sports Med 1974 2:308-309
9 O'Donoghue DH Injuries of the elbow In DH O'Donoghue (Ed) Treatment of Injuries to Athletes 4th Vol W B Saunders, Philadelphia 1984 224-227
10 Martens MA, Hansen L and Mulier JC Adductor tendonitis and musculus rectus abdominis tendopathy Am J Sports med 1987 15:353-356
11 Nelen G, Martens M and Burssen A Surgical treatment of chronic achilles tendonitis Am J Sports Med 1989 17:754-759
12 Fritschy D and de Gautard R Jumpers knee and ultrasonography Am J Sports Med 1988 16:637-640
13 Rissanen PM The surgical anatomy and pathology of the supraspinous and interspinous ligaments of the lumbar spine with special reference to ligament ruptures Acta Ortho Scand 1960 Supply 46-48 1-100
14 Yahia LH, Garzon S, Strykowski H and Rivard CH Ultrastructure of the human interspinous ligament and ligamentum flavum: a preliminary study Spine 21990 15:262-268
15 Heylings DJA Supraspinous and interspinous ligaments of the human spine J Anatomy 1978 125:127-131
16 Panjabi MM, Goel VK and Takata K Physiologic strains in the lumbar spinal ligaments An in vitro biomechanical study 1981 Volvo Award in Biomechanics Spine 1982 7:192-203
17 Hukins DWL, Kirby MC, Sikoryn TA, Aspden RM and Cox AJ Comparison of structure, mechanical properties and functions of lumbar spinal ligaments Spine 1990 15:787-795
18 Adams MA, Hutton WC and Stott JRR The resistance to flexion of the lumbar intervertebral joint Spine 1980 5:245-253
19 Posner I, White AA, Edwards WT and Hayes WC A biomechanical analysis of the clinical stability of the lumbar and lumbosacral spine Spine 1982 7:374-389
20 Cusick JF, Yoganandan N, Pintar FA and Reinartz JM Biomechanics of sequential posterior lumbar surgical alterations J of Neurosurg 1992 76:805-811
21 Steindler A and Luck JV Differential diagnosis of pain in the back JAM 1938 110:106-112
22 Beks JF Kissing spines: fact or fancy Acta Neurochir 1989 100:134-135

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