



Lumbosacral transitional vertebrae and nerve-root symptoms

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Transitional vertebrae (TV) may be one of the risk factors for lumbar disc herniation. It is not clear, however, whether the presence of TV can affect the development of nerve-root symptoms. Our aim was to clarify this relationship. A total of 501 patients with lumbar degenerative disease and nerve-root symptoms was studied in respect of their level and the presence of TV. As a control group, 508 patients without low back pain or nerve-root symptoms were studied to establish the incidence of TV. In patients with disc herniation, the incidence was statistically higher and the mean age lower in patients with TV than in those without. In most patients, the symptomatic disc level was just above the TV. Similarly, in those with stenosis of the spinal canal without spondylolisthesis, the symptomatic disc level was most commonly just above the TV.

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It has previously been shown that there is a relationship between the presence of a transitional vertebra (TV) and low back pain, with or without pain in the leg.¹⁻³ It is also accepted that the presence of a TV may increase the incidence and affect the level of herniation of the lumbar disc,⁴⁻⁶ but the relationship between lumbosacral nerve-root symptoms and TV remains unclear. There has been no comparative study considering the relationship between TV and low back pain, with or without pain in the leg. Our aim therefore was to assess the relationship between the presence of lumbosacral TV and nerve-root symptoms.

Patients and Methods

We compared a group of patients with nerve-root symptoms caused by herniation of a lumbar disc or spondylosis with a control group without back pain or root symptoms to establish the incidence of TV. All patients with tumours, infections, secondary deformity due to fracture or infection, previous spinal surgery, spondylolysis and spondylolisthesis were excluded.

Symptomatic group. A total of 501 patients with herniation of the disc or spondylosis and nerve-root symptoms was studied retrospectively with regard to involvement of the nerve root and the presence of a lumbosacral TV. All were Asian and had unilateral or bilateral pain with sensory and/or motor disturbance in the leg. They had previously received infiltration of local anaesthetic in order to identify the symptomatic nerve root.⁷⁻¹⁰ The level of the symptoms was evaluated by preoperative and postoperative changes such as variation in the pain induced at different positions of flexion and extension of the lumbar spine, the reflexes, motor and sensory changes and straight-leg raising (SLR).

There were 321 men and 180 women, with a mean age of 51 years (14 to 86). The type of TV was determined by the classification of Castellvi et al¹ (Fig. 1). In the presence of a TV, the disc level above is the most caudal mobile level.¹¹ In our study, the disc level above the TV was related to the segment between the fifth lumbar vertebra and the sacrum in normal lumbosacral anatomy, irrespective of whether the TV was a sacralised L5 or a lumbarised S1. The patients were divided into two groups based on the radiological findings and CT or MRI, into those with disc herniation (253) and those with spondylosis (248). Herniation was defined by pain induced by flexion of the spine, a positive SLR test, or the presence of sensory and/or motor disturbance with a herniated disc on CT or MRI which matched the neurological findings. Patients in the spondylosis group had degenerative changes of second degree or more as judged by the criteria of Nathan¹² at the symptomatic level on plain anteroposterior (AP) radiological examination, but without spondylolisthesis or isthmic spondylolysis. This group represented patients with stenosis of the spinal canal, including the superior facet or lateral recess syndrome. Degenerative spondylolisthesis was defined as an anterior slip of more than 3 mm on the lateral view in the neutral or

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Fig. 1a



Fig. 1b



Fig. 1c



Fig. 1d



Fig. 1e

Radiographs showing the classification of Castellvi et al¹: a) IIA, b) IIB, c) IIIA, d) IIIB and e) IV.

flexed position, at the symptomatic level.¹³ Patients with isthmic spondylolysis, as determined by a defect of the pars interarticularis,¹⁴ were excluded.

Asymptomatic group. A control group of 508 patients was studied to establish the incidence of a lumbosacral TV. These were Asian patients who had urological symptoms and underwent plain AP radiological examination of the abdomen as part of their routine assessment. Patients with previous low back pain or radicular symptoms were excluded. There were 299 men and 209 women with a mean age of 52 years (7 to 90).

Statistical analysis. For statistical analysis we used Student's *t*-test and the Mann-Whitney U test. A *p* value of <0.05 was considered to be significant.

Results

Presence of TV in the symptomatic and asymptomatic groups. A TV was present in 64 of the 501 patients (13%) of the symptomatic group and in 55 of 508 (11%) of the control group. There was no statistically significant difference of the incidence of the types of TV between the two groups.

Relationship between the incidence of TV and disease in the symptomatic group. In the patients with disc hernia-

tion there was an incidence of TV of 17% (42 of 253) slightly higher than the 9% (22 of 248) in those with spondylolysis and the 11% in the control group (55 of 508). The difference was statistically significant only when compared with the control group ($p < 0.05$). The mean age of the patients with disc herniation and TV was 35 ± 15 years and in those without TV 41 ± 14 years. In the spondylotic group, the mean age was 59 ± 10 years in patients with TV and 62 ± 10 years in those without. This difference was only statistically significant in the group with disc herniation ($p < 0.05$). The difference in incidence between men and women with and without TV in the disc herniation group was not significant. Neither was there a statistical difference between the type of TV and the incidence of herniation of the disc. Similarly, in the spondylolysis group, there was no significant difference in the incidence between the men and women with and without TV. There was no statistical difference between the type of TV and the incidence of nerve-root symptoms caused by spondylolysis.

Relationship of the symptomatic disc level between TV and non-TV

Disc herniation. In the disc herniation group there were 42 patients with TV and 211 without. In those patients with TV, 35 (83%) had symptoms arising from the last caudal mobile segment (i.e. the level above the TV). In the

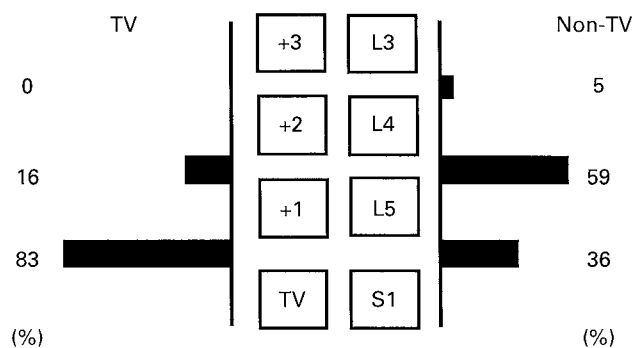


Fig. 2

The relationship of the symptomatic level in patients with disc herniation, with and without a TV.

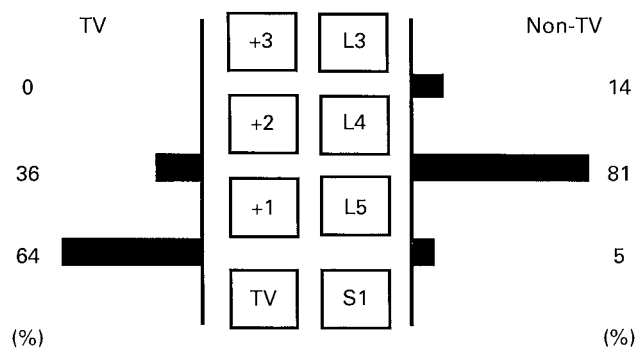


Fig. 3

The relationship of the symptomatic level in patients with spondylosis with and without a TV.

patients without TV, 125 (59%) had symptoms most frequently arising from the second last mobile segment (L4/L5) (Fig. 2). This was statistically significant ($p < 0.0001$). There was no statistical difference between the type of TV and the symptomatic level.

Spondylosis. In the spondylosis group (Fig. 3) there were 22 patients with TV and 226 without. In those patients with TV, 14 (64%) had symptoms arising from the last mobile segment (i.e., the level above the TV). In patients without TV, 183 (81%) had symptoms most frequently arising from the second last mobile segment (L4/L5). This difference was statistically significant ($p < 0.0001$). There was no statistical difference between the type of TV and the symptomatic disc level.

Discussion

The relationship between low back pain, with or without leg pain, and the presence of a TV has been much discussed since it was first described by Bertolotti in 1917.^{1-3,15} Although the presence of a TV is thought to be a risk factor for disc herniation,^{4,6} there has been no previous study comparing the incidence of TV in a group of patients with symptomatic nerve-root pain and a control group. It is generally accepted that degeneration and herniation of the lumbar disc with pressure on the dura or nerve roots, does not always cause leg pain, or sensory or motor disturbances.⁶ We therefore assessed whether the presence of a TV affected the incidence and localisation of nerve-root symptoms caused by disc herniation and spondylosis.

Our study gave new information with regard to the relationship between the presence of a TV and nerve-root symptoms. First, we found that 13% of patients in the symptomatic group and 11% in the control group had TV. Neither the presence nor type of TV affects the incidence of such symptoms. Secondly, in patients with disc herniation or spinal stenosis without spondylolisthesis, the presence of a TV may have some influence on the incidence of lumbosacral nerve-root symptoms. A TV was statistically found more often in patients with disc herniation (17%) than in

the control group (11%). The mean age of patients with a TV was statistically lower than in those without. By contrast, in the spondylosis group, there was no statistical difference in the incidence of TV between the patients with symptoms and the control group and no difference in the mean age between those with and without a TV. This suggests that the presence of a TV affects the incidence of nerve-root symptoms caused by disc herniation. Thirdly, most patients with a TV had a symptomatic disc level just above it (84% in patients with disc herniation and 64% in patients with spondylosis). Thus, the presence of a TV affects the level from which symptoms arise.

The TV is connected to the sacrum by a joint-like or bony union. The mechanical stresses therefore may be increased at the level above the TV. Disc degeneration may be more common in the presence of a TV.^{9,11} We found that disc herniation most often occurs at the segment above the TV.^{4,6} We believe that the lower mean age in patients with disc herniation than in those with TV is due to this increase in local stress. Spondylosis may therefore occur just above a TV.

Our study shows that the presence of a lumbosacral TV does not affect the incidence of nerve-root symptoms. In patients with herniation or lumbar canal stenosis without spondylolisthesis the presence of a TV may be a risk factor for the development of nerve-root symptoms. The presence of a TV can affect various aspects of disc herniation such as the incidence, the age of the patient and the symptomatic level, and also the level which is symptomatic in patients who have spondylosis.

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