

Incidence of Lumbosacral Transitional Vertebrae in Patients with Low Back Pain

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ABSTRACT

Background: The lumbar spine's lumbosacral transitional vertebrae (LSTV), a structural defect, have been variously linked to low back pain (LBP). Their presence can also lead to an incorrect pre-operative level identification.

Objective: To examine the relationship between lumbosacral transitional vertebrae detected on plain radiographs and low back pain in patients.

Study Setting: Department of orthopedics, Shifa international hospital, Islamabad

Methods: The study design was prospective and descriptive. The study was conducted between July 2021 to December 2021. The radiographs of 100 patients with low back pain who met the inclusion/exclusion criteria were evaluated. The frequency of patients with low back pain and lumbosacral transitional vertebra (LSTV) was calculated using SPSS version 26. For the quantitative data presentation mean and standard deviation was utilized and for qualitative data frequencies were used. P value less than 0.05 was considered significant.

Results: In a sample of 100 patients, 40 were men and 60 were women. 45 patients were diagnosed with axial type of lower back pain. The prevalence of LSTV was 27%, with males constituting the majority. No significant difference in the LSTV and Normal spine age distribution intervals was observed except, in the age interval of 51-60 years with a P-Value of <0.001.

Conclusion: There is substantial evidence linking lumbosacral transitional vertebrae and low back pain.

INTRODUCTION

Bertolotti was the first to identify a vertebra between the lumbosacral and sacral areas in 1917¹. There are numerous forms of transitional vertebrae, but they are always characterised by an aberrant lumbosacral articulation between the transverse process(es) of the lowest lumbar vertebrae and the sacrum. The transverse processes and sacrum are frequently categorised based on the form of articulation between them.

Eighty percent of the population will experience low back pain in their lifetime. The connection between low back pain and Lumbosacral transitional vertebrae (LSTV) is controversial. LSTV is a birth defect that impacts the lumbosacral spine¹. Lumbarization or sacralization of the superior sacral segment is the definition. Four to thirty percent of the general population are affected². Two LSTVs are detected on the lateral and Ferguson radiographs (Fig. 1).³

This may happen on any side. Regarding whether or not a transitional vertebra has any influence on clinical practise, there are numerous divergent perspectives. Estimates for the overall population may range from 4% to 24%, depending on the size of the sample and the demography under investigation.³ Multiple investigations^{3,9,10} and a comprehensive review¹¹ indicate that transitional vertebrae are equally prevalent in individuals with and without back pain. This suggests that they are identified unintentionally through imaging. Other investigators have shown that disc degeneration above the transitional portion (2.5) and herniations at younger ages occur at higher rates, with rates ranging from 16% to 30% in back pain populations⁵.

Castellvi categorised four varieties of LSTV (Fig. 2). Type I is distinguished by at least 19 mm wide unilateral (Ia) or bilateral (Ib) transverse processes (craniocaudal dimension). Type II is characterised by total unilateral (IIa) or bilateral (IIb) lumbarization/sacralization accompanied by an enlarged transverse process and a diarthrodial joint between the transverse process and sacrum. Unilateral (IIIa) or bilateral (IIIb) lumbarization/sacralization and osseous fusion of the transverse processes to the sacrum distinguish Type III LSTV. Type IV consists of a unilateral transition from type II to type III and a contralateral transition from type III to type II. This classification system lacks information pertinent to the precise enumeration of the segment involved in defining the relationship of the transitional segment to the level above or below. The controversy motivates

this research.⁴ This study aims to ascertain the prevalence of this congenital anomaly associated with low back pain.

When planning spinal surgery, we frequently administer epidural spinal injections for radicular pain and selective nerve root blocks to localise the exact anatomic location of the pain generator. At the moment of injection or surgery, transitional vertebrae can make it difficult to distinguish which level corresponds to which leaving nerve root. Existence of a transitional vertebra may have contributed to instances of incorrect lumbar level surgery described in medical literature¹³. Due to these considerations, we consider the existence of a transitional vertebra to be clinically significant.

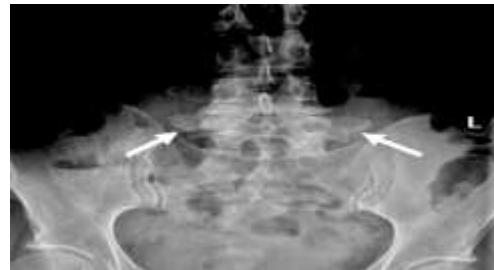


Fig 1: A man aged 35 underwent a Ferguson examination. An improved description of L5 transverse processes is possible with AP radiographs inclined cranially at 30 degrees. Ferguson radiography has always been regarded as the gold standard for seeing LSTVs.

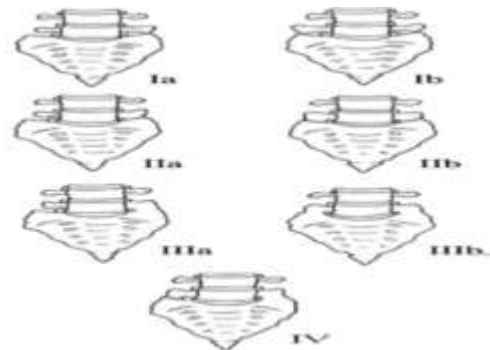


Fig 2: Castellvi Classification



Fig 3: LSTV

METHODOLOGY

The hospital's Institutional Review Board approved the trial. 100 consecutive patients with lumbar spine complaints of axial, referred, and/or radicular pain were evaluated by two consultants at an orthopedics outpatient clinic using plain films. The doctor recorded the presence of a lumbar transitional vertebra in each analysed radiographs. We utilised a system comparable to Castellvi's, but with fewer categories that were either unlabeled or marked as complete or unfinished. On one side or the other, all of the forms are possible. There was no discernible space between the most inferior lumbar vertebra and the sacrum in the films from the incomplete collection. Due to the fact that flat films only have two dimensions, determining this was frequently difficult. The most inferior lumbar vertebra was defined as transitional if T12 lacked or had short ribs and L4 displayed the usual morphology of L5.

Shifa international hospital, Islamabad conducted the study between July to December 2021. 100 patients over the age of 18 who presented to the outpatient of orthopedics department with low back pain were selected. Patients with a history of back trauma, distal abnormality, degenerative osteoarthritis, or spina bifida were excluded from the study.

All patients who were included were evaluated with frontal and lateral LS radiographs. Age, gender, types of pains and radiographic findings, such as incidence of LSTV, lumbarization, and sacralization, were recorded. The frequency of sexes and the incidence of LSTV were calculated and analyzed using SPSS 26. The P-value less than 0.05 was considered significant.

RESULTS

One hundred participants' data collected was analyzed (Table 1). Seventy-three percent of patients had normal spines, while 27% had LSTV. The age and gender distributions of patients with LSTV and normal spines are depicted in Tables 2 and 3, respectively. Indicated is the frequency of sacralization and lumbarization in male and female LSTV patients (Table 4).

Table 1: Demographics and types of pain characteristics in study population

Gender distribution		Age Distribution				Types of pain								
		Male		Female		Axial			Referred			Radicular		
Male	female	Mean	S. D	Mean	S. D	Mean age	S. D	N	Mean age	S. D	N	Mean age	S. D	N
40 (40%)	60 (60%)	48 y	±2.2	39y	±1.7	55	±3.2	45	48	±1.07	30	45	±5.5	25

Table 2: Age Intervals

Age Distribution	LSTV (%)			Normal spine (%)			P value
	N	Mean age	S. D	N	Mean age	S. D	
<=30	3	25	±1.0	14	27	±2.64	0.454
31-40	6	37	±1.41	14	34	±1.17	0.33
41-50	6	43.5	±1.22	13	45	±1.21	0.799
51-60	8	54.75	±1.58	22	55.3	±1.66	<0.01
>60	4	64.2	±1.50	10	67	±2.4	0.20
Total	27			73			

Table 3: Incidence of lumbosacral Transitional vertebrae in 100 patients with low back pain, stratified by gender

	Male Percentage	Female Percentage	Total
Lumbosacral transitional vertebrae	15 (55.5%)	12 (44.4%)	27
Normal spine	29 (38%)	44 (60.2%)	73

Table 4: 27 patients with lumbosacral transitional vertebrae were evaluated to determine the incidence of lumbarization and sacralization.

	Males	Females	Total
Sacralization	10	11	1 (77.7%)
Lumbarization	4	2	6 (22.2%)
Total	14	13	27(100%)

DISCUSSION

The results of this survey indicate that 27% of the population has LSTV.⁵ This is an important event that requires considerable consideration. One-third of Castellvi and others concur with our findings. In 1917, Bertolotti recognised the LSTV-Bertoni syndrome as a source of low back pain.⁶ The transitional phase comprises of categories I through IV of Castellvi. Castellvi asserts that the LSTV subtype has minimal impact on patient care.⁷

Sacralization causes greater discomfort than lumbarization. It is the responsibility of the lumbosacral spine to safeguard the spinal cord and nerves. It facilitates upright posture, mobility, and weight-bearing. Compared to other skeletal structures, it is extremely resilient. If either is neglected, stability and biomechanics of the vertebral column are compromised.⁸ When a person is upright, the skeleton supports the majority of the trunk's weight. Lumbar's spines bore the brunt of the assault. Therefore, vertebral stability is necessary. Low back pain, which might be caused by LSTV or another illness that affects the spine, is the most prevalent rheumatological complaint seen by primary care physicians.

LSTV is connected with a number of potential discomforts, including a narrow intervertebral disc, the chance of disc herniation, the development of spondylolisthesis, and the narrowing of the disc space^{9,10}. To prevent surgical and procedural errors, it is crucial to calculate the correct amount of LSTV in patients with diverse anatomies. When MR imaging is performed without a lumbosacral radiograph¹¹, which is crucial for establishing disc level in spine surgery, surgical errors are common. To avoid doing surgery on the incorrect level, the surgeon and radiologist must maintain open communication. There are numerous treatment options available, including conservative treatments like as oral analgesics, local anaesthetic injections, and corticosteroid.¹² Transverse process excision, posterior spinal fusion, and radiofrequency ablation are surgical techniques.¹³ When non-invasive treatments fail to reduce discomfort arising from the transitional joint, surgery may be the best course of action. One such surgery is transverse process excision.

Perhaps the most intriguing characteristic of this vertebra is the difference in lumbar spine mechanics caused by the presence of the transitional vertebra. Bilateral articulation between the transverse processes of the lowest lumbar vertebra and the sacrum is thought to limit mobility at this joint, although no study has confirmed the actual change in biomechanics with a transitional vertebra^{5,16}. This would result in increased translation and rotation at this level during motion, as well as increased stresses on the segment above. It is hypothesised that an L5-S1 transitional vertebra and a surgical fusion of this level have similar biomechanical loading conditions, with both placing greater stress on the level above¹⁴. It has been determined that the disc above the fused region is more prone to degradation Elster's¹⁵ study of 2,000 patients revealed that disc bulging or herniation is nine times more likely above the transitional vertebra than at any other level. Castellvi discovered that those with Type II transitional vertebrae had a higher prevalence of herniations just above the transition, whereas those with a complete bony union had a similar distribution of herniations to the normal population. An unbalanced motion induced by a unilateral articulation may provide increased stresses on the articulation or the contralateral facet¹⁷.

CONCLUSION

Lumbosacral transitional vertebra (LSTV) of the spine are prevalent and need precise localization of the affected area. Low back pain and LSTV have been linked in a number of studies, and while this hasn't been accepted universally, the evidence is strong. If LSTV is correctly diagnosed, errors like doing surgery on the wrong level can be avoided. The mean age of the patient with axial pain arrived at orthopedic clinical is 55 years and a significant difference ($p < 0.001$) between LSTV and normal spine was observed on 50-50 age interval.

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