



Radio-Diagnosis

PREVALENCE OF LUMBOSACRAL TRANSITIONAL VERTEBRA IN PATIENTS PRESENTING WITH LOW BACKACHE AND IT'S ASSOCIATION WITH DEGENERATIVE SPINE CHANGES ON MRI: A STUDY IN RURAL TERTIARY CARE HOSPITAL OF SOUTH INDIA.

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ABSTRACT

Introduction- Lumbosacral transitional vertebra (LSTV) is a congenital spinal anomaly defined as either sacralization of lumbar segment or lumbarization of sacral segment of the spine. Identification of accurate level of pathology is of utmost importance in patients undergoing surgical intervention. Failure to do so, might result in wrong level surgery, leading to significant morbidity.

Aims and objectives-

- To analyze the prevalence, age and sex distribution of LSTV in low back pain patients.
- To analyze the various methods of identifying and numbering LSTV.
- To explore the relationship between LSTV and degenerative spine changes.

Materials and methods- This was a crosssectional observational study done in 217 cases presented with low back pain and underwent MRI LS spine using PHILIPS Ingenia 1.5 Tesla machine in department of radio-diagnosis at MAHARAJHS INSTITUTE OF MEDICAL SCIENCES, NELLIMARLA. **Conclusion-** LSTV prevalence was 18.8% in this study. Most of the patients with LSTV belonged to 4th and 5th decades. No significant sex predilection was seen. Castellvi types II & IV are the most frequent types. An association between the transitional vertebra and herniation of the disc above was found in patients with low back pain i.e., Disc herniation was always noted above the transitional vertebra and not below that level (L4/5 disc prolapse in sacralization and L5/S1 disc prolapse in lumbarization), Sacralization was common than lumbarization in LSTV, approximately in the ratio of 2.3:1. The reliability of MRI (sagittal MRI to count from C2, axial MRI to look for iliolumbar ligaments) to identify and correctly numbering LSTV was 100%. Severity of degenerative spine changes was slightly higher among LSTV group than 'No LSTV' group.

KEYWORDS : Lumbosacral Transitional vertebra (LSTV), low backache, MRI, Castellvi classification, Sacralization, Lumbarization.

INTRODUCTION

Lumbosacral transitional vertebra (LSTV) are congenital spinal anomalies defined as either sacralisation of the lowest lumbar segment or Lumbarisation of the most superior sacral segment of the spine 1-3. Lumbarisation is either complete or incomplete fusion of the upper sacral vertebrae, while sacralisation is either complete or incomplete fusion of L5 vertebra to the top of the sacrum.

Due to its clinical effects and surgical management, accurate LSTV identification is crucial. incorrect identification could result in Localization in lumbar disc surgery and back syndrome leading to prolonged patient morbidity.^{4,8}

The term "lumbarization" describes a caudal shift in which the first sacral segment adopts some lumbar vertebral characteristics.

A cranial shift known as sacralisation occurs when the last lumbar vertebra develops sacral characteristics and frequently fuses with the sacrum. An individual may end up with either an extra or fewer lumbar segments depending on the direction of the shift, which can have important biomechanical and clinical ramifications.

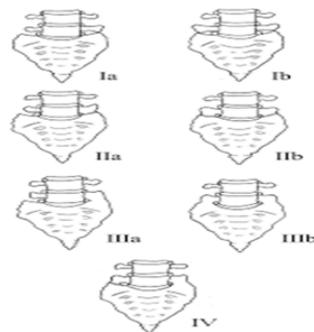
CLASSIFICATION SYSTEMS:**CASTELVI et al CLASSIFICATION:**

On the basis of morphologic traits, Castellvi et al 2. described a radiographic classification system in 1984 that distinguished 4 types of LSTVs. Traditionally, lateral and AP radiographs have been used to identify the lumbosacral transitional vertebrae.

Type I: Includes unilateral (I a) or bilateral (I b) dysplastic transverse processes, measuring at least 19 mm in width.

Type II: Includes incomplete unilateral (II a) or bilateral (II b) Lumbarisation/ sacralisation with an enlarged transverse process that has a diarthrodial joint between itself and the sacrum.

Type III: Includes unilateral (III a) or bilateral (III b) Lumbarisation/ sacralisation with complete osseous fusion of the transverse process(es) to the sacrum.



Type IV: Includes a unilateral type II transition with a type III on the contralateral side.

Although useful for characterizing the relationship between the transitional segment and the level above or below, this classification system does not provide information relevant to accurate enumeration of the involved segment.

SQUARING/WEDGING OF LSTV

Other morphological features of transitional vertebrae include wedging of the lowest lumbar segment during sacralization and squaring of the upper sacral segment during lumbarization. These morphologic alterations represent, respectively, cranial and caudal shifts of the spine, leading to an increase or decrease in the number of motion segments. According to Wigh and Anthony 9, the ratio of the superior vertebral endplate's AP diameter to the inferior vertebral endplate's AP diameter is 1.37, which causes transitional vertebrae to appear "squared" on lateral radiographs. This relative "squaring" and "wedging" represent a range of morphologic change in the vertebral body and cannot be relied upon to accurately pinpoint an LSTV.

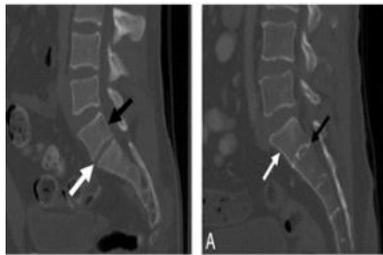
Numbering Technique

1. Plain X ray LS spine - counting from last rib.
2. Sagittal MRI whole spine – counting from C2 downwards.

3. MRI axial view to look for iliolumbar ligaments.

Aim of the study-

- 1-To analyze the prevalence, age and sex distribution of LSTV in low back pain patients.
- 2-To analyze the various methods of identifying and numbering LSTV.
- 3-To explore the relationship between LSTV and degenerative spine changes.



Lumbarised S1 vertebral body showing "squaring" of a S1 vertebral body and fully-sized lumbar type disc between S1 and S2

Sacralised L5 vertebral body showing "wedging" of the L5 body and decreased disc space between L5 and S1

Materials and methods-

This was a cross sectional observational study done in 217 cases presented with low back pain, done in Dept of Radio-Diagnosis at MAHARAJAH'S INSTITUTE OF MEDICAL SCIENCES, NELLIMARLA between November 2021 to October 2022. A structured pre-prepared case proforma was used to enter the patient details and brief clinical history was taken, of patients who met the inclusion criteria. Imaging was done with 1.5 Tesla Philips Ingenia Machine using abdominal surface coils and spine coils in Department of Radio-diagnosis.

Inclusion criteria:

The study includes patients presenting with low back/ radicular pain. Patients of both sexes and all age groups.

Exclusion criteria:

- Patients with history of acute trauma.
- Patient having history of claustrophobia.
- Patient having history of metallic implants, cardiac pacemakers and metallic foreign body in-situ

All the patients were evaluated for presence or absence of LSTV. LSTV cases were identified as either sacralization or lumbarization, classified according to Castellvi's classification. Degenerative changes and their relation with respect to level of LSTV were noted.

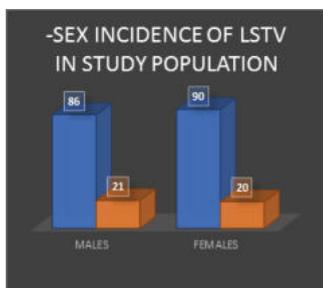
Results and Discussion

SEX DISTRIBUTION

Among the total 217 cases, 107 were male (49.3%) and 110 patients (50.7%) were females. Among the LSTV patients (41 cases), 21 were males (51.2%), and remaining 20 were females (48.8%). Male slightly outnumber the females in the incidence of LSTV. The incidence of LSTV among male population were 19.6 % (21 out of 107). The incidence of LSTV among female population were 18.1 % (20 out of 110).

Table 1- SEX INCIDENCE OF LSTV IN STUDY POPULATION

	MALES (19.6%)	FEMALES (18.1%)	TOTAL
LSTV	21	20	41
NORMAL SPINE	86	90	176
TOTAL	107	110	217

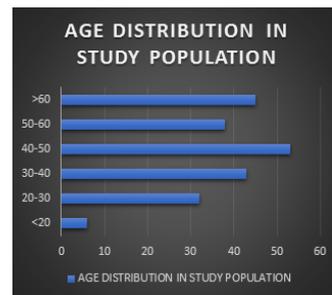


Age distribution:

Age group varies from 11- 79. The incidence was more observed in 4th to 5th decade as the disc disease is also common in that age group. Among the study population (241 cases), the age distribution is as follows: 6 patients are in the age group < 20 (2.7%), 32 patients are in the age group 20-30 (14.7 %), 43 patients are in the group 30-40 (19.8%), 53 patients were in the group 40-50 (24.4%), 38 patients were in the group 50-60 (17.5%) and 45 patients were in the group >60 (20.7%).

TABLE-2 AGE DISTRIBUTION IN STUDY POPULATION

AGE	NO. OF PT	PERCENTAGE
<20	6	2.7%
20-30	32	14.7%
30-40	43	19.8%
40-50	53	24.4%
50-60	38	17.5%
>60	45	20.7%

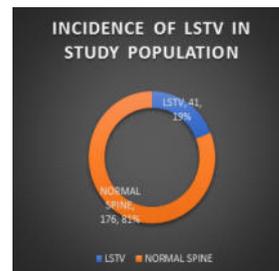


Prevalence OF LSTV:

Of the 241 cases studied, LSTV was seen in 41 cases and the observed incidence was 18.8 %. which is comparable to the various studies in the literature. The prevalence of LSTV reported in the literature ranges from 4 to over 35%. In a systematic review of comparable observational studies from 1986 to date we found a mean prevalence of 12.3%. The highest incidence of 35.9% was found in Erken et al 10 series with a study population of 729. The lowest incidence of 4% was found in Hsieh et al 11 with a population of 1668. This wide range may be explained by differences in diagnostic criteria, imaging techniques, and confounding factors between the investigated population samples.

TABLE-3 INCIDENCE OF LSTV IN STUDY POPULATION

	TOTAL NO. OF CASES	PERCENTAGE
LSTV	41	18.8%
NORMAL SPINE	176	81.1%
TOTAL	217	100%



SACRALISATION VS LUMBARISATION:

Of the 41 cases of LSTV, 29 were sacralized vertebra (70.7%) and 12 were lumbarised vertebra (31.3%). Among 29 cases of sacralisation, 13 were male and 16 were females. Among 12 cases of lumbarisation, 8 were male and 4 were female.

LSTV can be sacralisation or lumbarisation as already described, of which sacralisation is more common compared to lumbarisation.

In almost all the series, sacralisation is more common than lumbarisation approximately in the ratio of 2:1 to 3:1, except in the series of Kim et al, where lumbarisation is common. In a systematic review of comparable observational studies from 1986 to date we found a mean prevalence of sacralisation 78% and lumbarisation 22 % (approximately in the ratio of 3:1).

TABLE-4 INCIDENCE OF LUMBARISATION / SACRALISATION IN LSTV

	MALE	FEMALE	TOTAL	%
LUMBARISATION	8	4	12	29.2%
SACRALISATION	13	16	29	70.7%
	21	20	41	100%



Level of disc prolapse and LSTV:

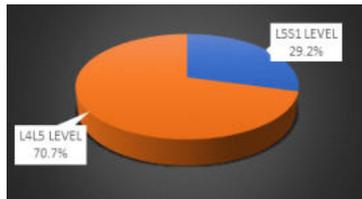
Among those patients with LSTV (41 CASES), 29 were L4L5 disc prolapse (70.7 %), 12 were L5S1 disc prolapse (29.2%) and other disc levels were also involved in few patients.

All cases with sacralised vertebra have L4L5 disc prolapse and all cases with lumbarised vertebra have L5S1 disc prolapse.

Disc herniation is always noted above the transitional vertebra and not below that level (L4L5 disc prolapse in sacralisation and L5S1 disc prolapsed in lumbarisation).12-14

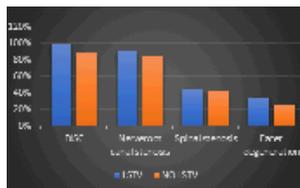
TABLE-5 LEVEL OF DISC PROLAPSE

DISC PROLAPSE	CASES TOTAL 41	%
L4L5 LEVEL	29	70.7 %
L5S1 LEVEL	12	29.2 %



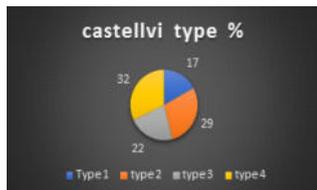
Severity of degenerative spine changes were slightly higher among LSTV group than No LSTV group.

Presentation	LSTV N= 41	NO LSTV N=176
Disc protrusion /extrusion	41 (100%)	156 (88.6%)
Nerveroot canal stenosis	37 (90.2%)	147 (83.5%)
Spinal stenosis	18 (43.9%)	74 (42.0 %)
Facet degeneration	14 (34.1%)	45 (25.5 %)

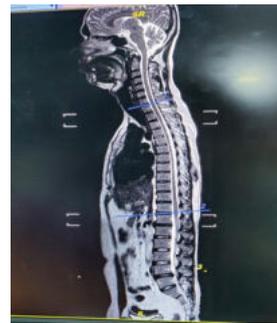


Castellvi types:

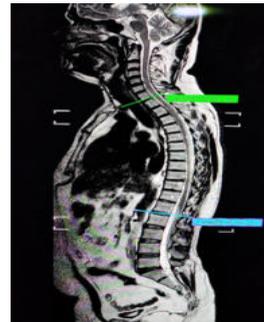
Among those patients with LSTV (41 cases), 7 (17%) were castellvi type I, 12(29%) were castellvi type II, 9(22%) were castellvi type III and 13(32%) were castellvi type IV. Castellvi types II and IV were more frequent in our study.



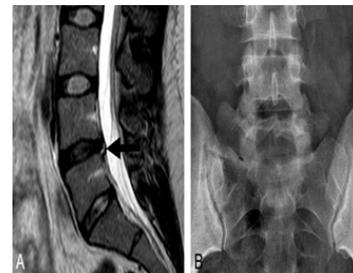
REPRESENTATIVE CASES



Sagittal T2 weighted MR image demonstrating lumbarisation of L1 vertebra.



Sagittal T2 WI demonstrating sacralisation of L5 vertebral body.



Sagittal T2-weighted MR image (A) demonstrates disk desiccation with a small central protrusion and associated annular tear (black arrow) in a 25-year-old female patient with a Castellvi type II a LSTV as seen on this AP radiograph (B).



Coronal T2-weighted MR image demonstrates osseous fusion of the L5 transverse process to the sacrum on the left with an anomalous articulation on the right - Castellvi type IV LSTV

Limitations:

Small sample size is a major limitation to our study, as the results cannot be interpolated to larger populations. Assessing relation between different Castellvi's classes of LSTV and clinical symptoms, degree of degenerative changes on MRI could have yielded more information on causative association.

CONCLUSION:

1. LSTV occurs in significant percentage in patients with low back pain. (18.8% in this study).
2. An association between the transitional vertebra and herniation in the disc above has been found in patients with low back pain i.e., Disc herniation is always noted above the transitional vertebra and not below that level (L4L5 disc prolapse in sacralisation and L5S1 disc prolapse in lumbarisation)

3. Sacralisation is common LSTV than lumbarisation approximately in the ratio of 2.3:1

4. Castellvi types II & IV were more frequent in our study

5. There is slight male predominance for LSTV in this study population.

6. The common age group is between 40-50, parallels with that of lumbar disc prolapse.

7. The reliability of combined radiological methods (x ray LS spine with D12, MRI sag to count from c2, MRI axial to look for iliolumbar ligaments) to identify and correctly numbering LSTV is 100 %.

8. Severity of degenerative spine changes were slightly higher among LSTV group than No LSTV group.

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