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Prevalence of Lumbosacral Transitional Vertebrae (LSTV) among Patients Presented to the Outpatient Department of Orthopedics in Tertiary Care Center

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ABSTRACT

Lumbosacral transitional vertebra (LSTV) is a congenital anomaly of the lumbosacral junction in the spine. It occurs due to socialization or lumbarization, in socialization the transverse processes of the fifth lumbar vertebra get fused with the first sacral segment and in lumbarization the first sacral segment shows an abnormal transverse process like that of the lumbar vertebra. Presence of LSTV is associated with low back pain. Presence of LSTV may cause incorrect numbering of the lumber vertebra, which may lead to untoward clinical consequences during the different clinical procedure. There is wide variety in the prevalence of LSTV in different part of the world. The present study aims to determine the prevalence of LSTV among patients in the Orthopaedics department of a tertiary care center. The study was a cross-sectional study done among the patients attending outpatient department of Orthopaedics, Lakhimpur Medical College and Hospital, North Lakhimpur, Assam for low back pain. A total of 350 patient of age 18 and above were included, anteroposterior view X-ray was done after informed consent. When present, LSTV were further classified according to the Castellvi radiographic classification. The present study found a prevalence of 19.70% of LSTV among the patients. There was no difference in the prevalence among the male and female. Majority of the patients falls in the type Ib (31%) followed by IIIb (23%) and IIB (16%) as per Castellvi's classification. Majority of the patients 84.06% (n=58) with LSTV shows socialization. It can be seen from the finding of the present study that prevalence of LSTV is high. Therefore, the awareness among the clinician about the presence of LSTV is very important so that any untoward event during clinical procedure can be averted.

INTRODUCTION

Lumbosacral transitional vertebra (LSTV) is a congenital vertebral anomaly of the L5-S1 junction in the spine. It is due to sacralisation in which the transverse processes of the fifth lumbar vertebra get elongated and broadened and fused with the first sacral segment or due to lumbarisation where the first sacral segment shows an abnormal transverse process like that of the lumbar vertebra[1]. There is a trend of family aggregation of LSTV, Hox 10 and Hox 11 genes influence axial pattern of Lumbar and sacral vertebrae, mutation in these genes may play a role in formation of LSTV[2].

The prevalence of LSTV previously reported in the literature ranges from 4 to 35%[1]. Bertolotti was first to describe the morphologic characteristics of LSTV and its association with low back pain in 1917 and this association is known as Bertolotti syndrome[2]. In 1984 Castellvi classified the LSTV into four types on the basis of morphologic characteristics (Table 1)[3]. LSTV can be identified by Lumbosacral anterior posterior (AP) view of Plain radiographs, Ferguson radiograph (AP radiograph angled cranially at 300) and abdominal radiograph[4]. CT scan is the best imaging technique for characterization of LSTVs but CT is not routinely advised to identify LSTVs due to radiation concerns[2-4]. Identification of LSTV is important as its presence may lead to clinical consequences like performing spinal surgery at the wrong level, errors in other lumbosacral procedures and poor correlation of patient's symptoms because of failure to correctly number the problematic vertebra[3-8]. Several studies have reported a wide range of prevalence of LSTV in different parts of the world, it is important to have an idea about the local prevalence of it. Hence, the present study aims to determine prevalence of LSTV in our Tertiary care center. It calculates the prevalence rate of Lumbosacral transitional vertebra among the patients presented to the outpatient department of Orthopaedics in a Tertiary Care Center. The study also intended to find out gender-based differences in the prevalence of LSTV and further distinguished the difference between lumbarization and socialization of the LSTV and its distribution as per gender.

MATERIALS AND METHODS

Study Design: Cross sectional study.

Study Period: Six months (with effect from November 2023 to April 2024).

Study Population: Patients attending outpatient department of Orthopaedics, Lakhimpur Medical College and Hospital, North Lakhimpur, Assam for low back pain, who meet the inclusion criteria outlined below.

Sample Size: Sample size is calculated by this formula:

$=z^2\ pq/d^2$, [where, q=1-p, p=0.3]
$=1.96^2 \times 0.3 \times 0.7/0.0025$
=323 (In the study 350 sample were included)

Inclusion Criteria:

- Subject older than 18 years.
- Clear visibility of the last ribs vertebral body articulation, all transverse process of lumbar vertebrae, sacrum and complete iliac wing in radiograph.

Exclusion Criteria:

- Poor image quality.
- Inadequate exposure of the lumbar spine, or inability to identify transitional vertebrae due to instrumentation or abdominal contents.

Radiographic Evaluation: All Patients attending outpatient department of Orthopaedics, Lakhimpur Medical College and Hospital, North Lakhimpur, Assam, India, for low back pain, who meet the inclusion criteria were examined and advise plain radiographs of Lumbosacral spine (AP and LAT view) after taking an informed consent. On the AP view of LS spine plain radiograph, twelfth thoracic (T12) vertebrae were identified which is defined as the vertebra to which the lowest rib is attached and then numbering of lumbar vertebrae was done craniocaudal with vertebra immediately below T12 vertebra numbered as first lumbar vertebrae thus noting presence or absence of LSTV. When present, LSTV were further classified according to the Castellvi radiographic classification. All the radiographs were reported by the Radiologist.

All four types of LSTV (Castellvi Radiographic Classification) were included in the study. Data collection consist of subjects':

- Age at the time of imaging.
- Gender.
- Finding of lumbosacral vertebral region including.
- Numbering of lumbar vertebrae.
- Bilateral cranio-caudal measurement of transverse process of lowest lumbar vertebrae.
- Pseudoarthrosis or bony fusion of L5 vertebral transverse process with the sacrum.

The study was approved by the Institutional Ethics Committee [LMC/IEC(H)26].

RESULTS AND DISCUSSIONS

A total of 350 patients were included in the study as per the inclusion and exclusion criteria. Out of 350 patients 192 (54.85%) were male and 158 (45.14) were female patients. Mean age of the patients was 44.94 years with standard deviation 12.86. Out of the 350

Table 1: Castellvi Radiographic Classification of Lumbosacral Transitional Vertebrae

Types	Definition	Castellvi type
Type 1	Enlarged and dysplastic transverse process (with height /craniocaudal distance more than 19mm)	Type I- A: Unilateral B: Bilateral
Type II	Exhibits incomplete Lumbarization / Sacralization with an enlarged transverse process of L5 vertebrae that has a diarthrodial joint between itself and the sacrum.	Type II - A: Unilateral B: Bilateral
Type III	Lumbarization/Sacralization with complete osseous fusion of the transverse process to the sacrum.	Type III - A: Unilateral B: Bilateral
Type IV	Type II on one side and type III on the contralateral side	Type IV- Mixed type

Table 2: Distribution of Male and Female Patients with LSTV (χ^2=0.0528, p=0.818)

Gender	With LSTV	Without LSTV	%
Male	37	155	19.27%
Female	32	126	20.25%
Total	69	281	19.70%

Table 3: Distribution of Socialization and Lumbarization According to Gender

LSTV Type	Male (%)	Female (%)	Total (%)	P-value
Socialization	33 (56.89%)	25 (43.10%)	58 (84.06%)	0.2105
Lumbarization	4 (36.36%)	7 (63.63%)	11 (15.94%)	0.356

patients 69 (19.70%) patients showed the presence of LSTV. Presence of LSTV among male and females were almost equal with 37 (19.27%) male and 32 (20.25%) female, statistically also the difference is not significant (Table 2).

(Fig. 1) shows the distribution of the LSTV type according to Castellvi's classification. Majority of the patients fall in the type Ib (31%) followed by IIIb (23%) and IIB (16%).

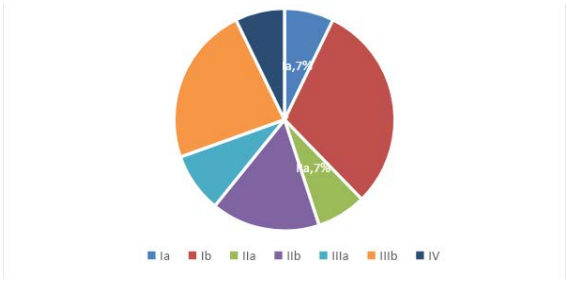

Fig. 1: Morphological Distribution Based on Castellvi's Classification

Male female distribution of the LSTV as per Castellvi's classification also shows a similar trend (Fig. 2).

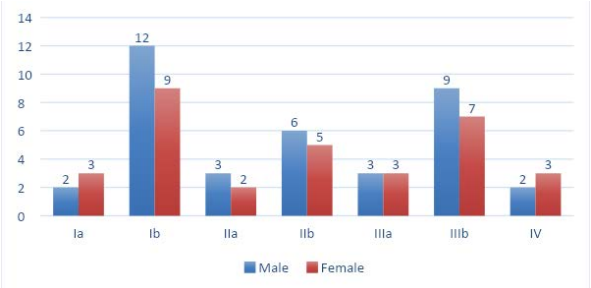

Fig. 2: Comparison of Castellvi's Classification According to Gender

58 (84.06%) patients with LSTV showed socialization whereas 11 (15.94%) patients with LSTV showed lumbarization. Out of 58 patients with socialization 33 were male and 25 were female. In case of lumbarization out of 11 patients, 4 were male and 7 were female. However, there was no statistically significant difference in the distribution of socialization and lumbarization according to gender (Table 3).

LSTV is a common congenital anomaly of Lumbosacral junction with a wide range of prevalence from 4% to 35.9% as reported in different studies[1-9]. The present study shows a prevalence of 19.70% among the patients who attended Orthopaedics OPD in a tertiary care center. Apazidis[9] found the prevalence at 35.6% in the American general population. They examined 211 subjects (107 men and 104 women) and found that 75 were positive for transitional Lumbosacral vertebrae, with a gender distribution of 40 (19%) men and 35 (16.6%) women. Hsieh[10] reported a prevalence of 4% in the Chinese population. They excluded Catellvi Type I. Erken[11] found a prevalence at 35.9% in the Turkish population sample. Hsieh *et al.* and Erken *et al.* both used anteroposterior (AP) view of lumbosacral spine plain radiograph for their studies. The study of Apazidis[9] used kidney-urinary bladder radiographs. In the present study we used Anteroposterior (AP) view of Lumbosacral spine plain radiograph. Present study found no significant difference in prevalence of LSTV among male and female patients. This finding is in contrast to the finding of Ramakrishnan *et al.* and Paton *et al.* where there was higher prevalence of LSTV among females compared to male[12,13]. 31% of patients with LSTV in the present study fall in the type Ib of classification followed by type IIIb (23%) and type IIb (16%). In the study done by Byvaltsev[14], it has been seen that type II and type III are the most common categories of LSTV, contrary to the finding of the present study. Shaikh *et*

al. also found the type III and type II to be more common[15]. In the present study majority of the patients 84.06% (n=58) with LSTV shows socialization whereas 15.94% (n=11) shows Lumbarization. Sacralization is more common in males, meanwhile accessory L5-S1 articulations and Lumbarization of S1 are more common in women[16]. However, there was no statistically significant difference in the distribution of sacralization and lumbarization according to gender in present study. Magora and Shwartz[17] found an overall incidence of 0.65% lumbarization and 20.08% sacralization and the incidence was markedly lower in women. They reported no direct relation between sacralization and age, sex or ethnic community.

Limitation: The present study has included only the patient attending the tertiary care center, so the finding may not be generalized in the community.

CONCLUSION

From the present study as well as from other studies it is evident that LSTV is a common congenital anomaly. Therefore, it is very important for the clinician to be aware of it, as presence of LSTV may cause inaccurate numbering of the vertebra, which is very important while performing any surgical procedure at the lumbosacral region.

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