

# Sacralized Lumbosacral Transitional Vertebra (LSTV) and its Association with Reduced L5-S1 Intervertebral Disc Space

ZIMAR ARSHAD<sup>1</sup>, ANEK AMMAR<sup>2</sup>, MUHAMMAD ARSHAD<sup>3</sup>, TALIA ARSHAD<sup>4</sup>, DAROOJ ARSHAD<sup>5</sup>, IFFAT NOREEN<sup>6</sup>

<sup>1,2</sup>Residents Radiology CMH Lahore, <sup>3</sup>Classified Radiologist Avicenna Medical College Lahore, <sup>4</sup>Medical Officer, Mayo Hospital, Lahore  
<sup>5</sup>Final Years BDS, De'Montmorency College of Dentistry, Lahore

<sup>6</sup>Resident Surgeon Department of Surgery, Benazir Bhutto Hospital, Rawalpindi

Correspondence to Dr. Zimar Arshad, E-mail: arshadzimar@gmail.com, Cell: 0337-4937374

## ABSTRACT

**Aim:** To study the prevalence of sacralized lumbosacral transitional vertebra in Pakistani population and its association with reduced L5-S1 intervertebral disc space.

**Study design:** Cross sectional study

**Place and duration of study:** Department of Radiology, CMH Lahore from 1<sup>st</sup> April 2020 to 30<sup>th</sup> September 2020.

**Methodology:** Three hundred and seventy two patients with sacralized lumbosacral transitional vertebra were included in the study. Lateral views of lumbar spines were done of the patients who had lumbosacral transitional vertebra on abdominal radiograph. Sacralized lumbosacral transitional vertebra was classified according to Castellvi. The L5-S1 intervertebral disc was evaluated for its height.

**Results:** There were 276 (74.2%) males and 96 (25.8%) females. Patient ages ranged from 26 to 80 years with a mean value of 45 years. According to Castellvi, there were 198 cases {53.3%} of type I, 84 cases {22.6%} of type II, 60 cases {16.2%} of type III and 30 cases {8.1%} of type IV. Among cases of unilateral sacralized lumbosacral transitional vertebra there was a higher involvement of left transverse process.

**Conclusion:** There is a high prevalence of sacralized lumbosacral transitional vertebra in our population with significant association between reduced L5-S1 intervertebral disc height and Castellvi type III.

**Keywords:** Sacralized lumbosacral transitional vertebra, Castellvi, Intervertebral

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## INTRODUCTION

Lumbosacral transitional vertebrae are defined as either sacralization of last lumbar vertebra i.e., the L5 vertebra; or the lumbarization of the first sacral vertebra i.e., S1 vertebra<sup>1</sup>. This condition was first described by Bertolotti, hence also being called Bertolotti syndrome<sup>2</sup>. This is the commonest congenital anomaly of the lumbosacral spine and account for about 7% to 30% of the normal population<sup>3,4</sup>. The incidence of the lumbarization is significantly lower as compared to sacralization with one study showing a percentage of only 8.9% lumbarization in LSTV<sup>5</sup>. Lumbosacral transitional vertebra may be seen on almost all imaging modalities, however the best described is the Ap radiograph of lumbar spine angled 30° cranially<sup>1</sup>.

In 1985, LSTV was classified by Castellvi into four types based on the fusion between the transverse process of the last lumbar vertebra and the first sacral segment. Type I shows dysplastic transverse processes with width >19 mm (Unilateral is type IA while bilateral is type IB). Incomplete lumbarization or sacralization comprises Type II anomaly including an enlarged transverse process causing pseudoarthrosis with adjacent sacral ala (Unilateral is type IIA while bilateral is type IIB). Type III LSTV includes complete lumbarization or sacralization with complete fusion of transverse process and adjacent sacral ala (Unilateral is type IIIA while bilateral is type IIIB). Type IV is a mixed type, characterized by Type IIA, on one side, and Type IIIA on the other side<sup>6</sup>.

Lumbosacral transitional vertebra has been shown to be significantly associated with symptoms of low back pain and disc degenerative diseases<sup>2,7</sup>.

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## PATIENTS AND METHODS

This prospective study was carried out at Department of Radiology, CMH Lahore from 1<sup>st</sup> April 2020 to 30<sup>th</sup> September 2020. A total of 372 confirmed cases of sacralized lumbosacral transitional vertebrae were included in the study. Three cases of lumbarized LSTV were excluded. All patients aged 10 and above years presenting for lumbar or abdominal radiographs were included. Patients with spondylolisthesis and post-lumbar surgery were excluded. Age and gender of the patients were recorded and evaluated for percentages and mean. Sacralized LSTV was classified according to Castellvi. The different Castellvi types were correlated with age and gender. L5-S1 intervertebral disc space was evaluated for being normal in height versus reduced, indicative of disc degenerative disease. The L5-S1 disc height was measured at mid portion and compared to the mid portion of intervertebral disc at L3-L4 level; as there is a good correlation between L3-L4 and L5-S1 intervertebral disc heights<sup>8</sup>. The data was entered and analyzed through SPSS-24.

## RESULTS

There were 276 (74.2%) males and 96 (25.8%) females. Patient ages ranged from 26 to 80 years with a mean value of 45 years. According to Castellvi, there were 126 cases of type IA and 72 cases of type IB (198 cases {53.3%} of type I), 60 cases of type IIA and 24 cases of type IIB (84 cases {22.6%} of type II), 30 cases of type IIIA and 30 cases of type IIIB (60 cases {16.2%} of type III), and 30 cases {8.1%} of type IV. Among cases of unilateral sacralized LSTV (including Castellvi types IA, IIA and IIIA), there was involvement of 186 left transverse process (75.6%) and 60

right transverse process (24.4%).180 patients had a reduced L5-S1 intervertebral disc space while 192 cases showed normal discheights. There was a higher percentage (70%) of cases of reduced L5-S1 intervertebral disc spaces with Castellvi type 3 LSTV than other types of LSTV [45%, 42% and 40% in types I, II and IV respectively] (Tables 1-3, Fig. 1).

Table 1: Gender distribution of patients with sacralized LSTV (n=372)

Gender	No.	%
Male	276	74.2
Female	96	25.8

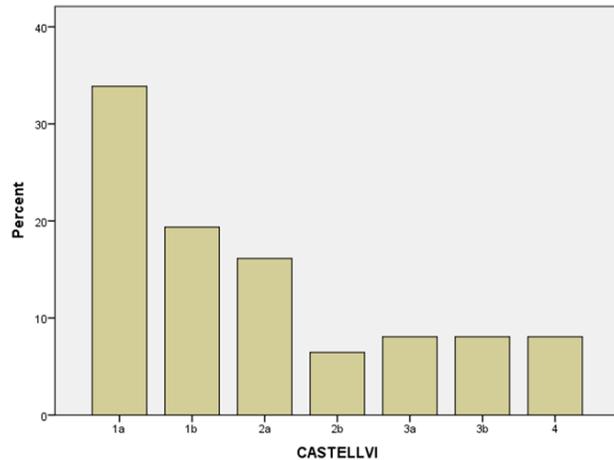


Fig. 1: Frequencies of Castellvi types of sacralized LSTV

Table 2: Distribution of involvement of transverse processes in unilateral sacralized LSTV

Involvement of transverse	No.	%
Right	60	24.4
Left	186	75.6

Table 1: Reduction of L5-S1 intervertebral disc space according to sacralized LSTV Castellvi types

Castellvi types	Disc		Total
	Reduced	Normal	
1a	54	72	126
1b	36	36	72
2a	30	30	60
2b	6	18	24
3a	24	6	20
3b	18	12	30
4	12	18	30
Total	180	192	372

**DISCUSSION**

Lumbosacral transitional vertebra is the most common lumbosacral anomaly found. Doo Lee et al<sup>9</sup> and Frenshet al<sup>10</sup> shows a prevalence of 8.3% and 9.9% respectively. In one study by Ucaret al<sup>5</sup> reported that prevalence of LSTV was almost 18.9%. Ricart et al<sup>11</sup> used a lower population study size and showed LSTV to be prevalent in about 35.6% of patients. Similar prevalence of 30% was reported from Deport et al.<sup>12</sup> There is a prevalence of 10.3% of sacralized LSTV in our study.

There is a male predominance of LSTV in our study which is also shown by Nardoet al.<sup>13</sup> Aihara et al<sup>14</sup> shows

mean ages of 53 and 47 years for men and women respectively. Similar to our study's age mean of 45 years.

The commonest type of LSTV was Castellvi IA, IIA and IIB according to Tucker et al<sup>15</sup>, Sekharappa et al<sup>3</sup> and Patel et al<sup>16</sup> respectively. Type I was most common according to Tang et al<sup>17</sup> and Apaydinet al.<sup>18</sup> Our study showed Castellvi type IA to be most common.

There was a statistically significant decrease in L5-S1 disc height in low back pain patients with LSTV according to Daniel et al<sup>6</sup>. Weber et al<sup>19</sup> demonstrate extraforaminal spinal stenosis in unilateral LSTV. However, there was no association between LSTV and low back pain according to Tiniet al<sup>20</sup> and Luoma et al<sup>21</sup> respectively. Our study showed a high association of reduced L5-S1 intervertebral disc height with sacralized LSTV type 3.

**CONCLUSION**

There is a high prevalence of sacralized LSTV in our population of patients, with more males affected as compared to females. The left transverse process is involved in a higher number of patients. Involvement of reduced L5-S1 intervertebral disc space is higher in patients with sacralized LSTV Castellvi type III, that might lead to degenerative disc changes in future. However, there is no significant correlation between sacralized LSTV overall and increased incidence of reduced L5-S1 intervertebral disc space.

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