

## Sacralisation of fifth lumbar vertebra: A case report.

Dr. Devanshi Vaishnav<sup>1\*</sup>, Dr. Dipali Trivedi<sup>2</sup>, Dr. Sucheta Chaudhary<sup>3</sup>

<sup>1</sup>Second year resident, <sup>2</sup>Professor, <sup>3</sup>Professor & Head, Department of Anatomy, B. J. Medical College, Ahmedabad, Gujarat.

### Abstract:

Sacrum is a large triangular bone formed by fusion of five sacral vertebrae. It lies obliquely at upper and posterior part of pelvic cavity between two hipbones. Lumbosacral transitional vertebra (LSTV) is common congenital anomaly of lumbosacral region which includes sacralisation & lumbarisation. Sacralisation is a congenital condition in which usually the fifth lumbar vertebra fuses completely or partially with sacrum. One sacrum with partial fusion of lumbar (L5) vertebra was observed in Department of Anatomy, B. J. Medical College, Ahmedabad, Gujarat. There was complete fusion of left sided transverse process of fifth lumbar vertebra with ala of sacrum. The knowledge of sacralisation helps to understand the possible complications such as low back pain, spinal or radicular pain due to pressure on spinal nerve. Knowledge of sacralisation is very important for orthopedician & neurosurgeon to avoid surgery at incorrect level and for anaesthetist during administration of epidural, subdural and caudal anaesthesia.

**Keywords:** Fusion, Lumbar vertebra, Sacrum, Sacralisation.

### Introduction:

Sacrum is a large triangular bone formed by the fusion of five sacral vertebrae and forms the posterosuperior wall of pelvic cavity, wedged between two innominate bones. Its blunted, caudal apex articulates with the coccyx and its superior, wide base with fifth lumbar vertebra at the lumbosacral angle<sup>1</sup>. The sacrum provides strength and stability to the pelvis and also transmits the body weight to the lower limb via pelvic girdle through sacroiliac joint and also plays an important role in upright posture<sup>2</sup>. Lumbosacral transitional vertebrae are congenital anomalies of lumbosacral spine, which includes sacralisation of fifth lumbar vertebra or lumbarisation of first sacral vertebra. The incidence ratio of sacralisation to lumbarisation was reported as 2:1<sup>3</sup>. Sacralisation is classified as bilateral and unilateral, in bilateral there is a bony fusion between transverse process of fifth lumbar and sacrum on both sides; whereas in unilateral the fusion is on either right or left side only. It is also classified as complete and incomplete; in complete sacralisation there is complete bony fusion between the abnormal transverse process and sacrum. In case of incomplete sacralisation there will be a well-defined joint line between the

### \* Corresponding Author:

Dr. Devanshi Vaishnav

Email: [djv20695@gmail.com](mailto:djv20695@gmail.com)

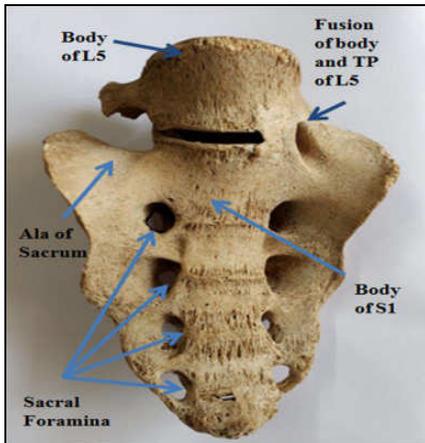
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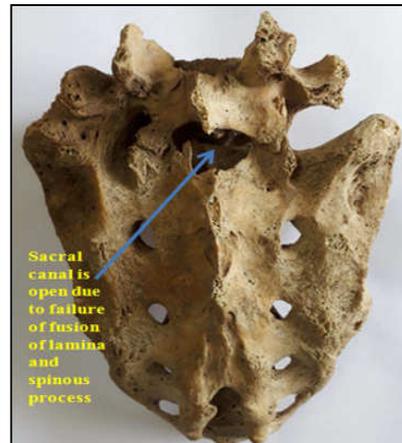
transverse process and sacrum<sup>4</sup>. In case of lumbarisation, the first sacral vertebra fails to fuse with the second one, thus individual appears to have six lumbar vertebrae. On the other hand, in sacralisation the last lumbar vertebra fuses with first sacral vertebra the person appears to have four lumbar vertebrae. One of the earliest to describe these anomalies was T. Manners Smith in 1909 where he explained the articulation or fusion of the costal element of the L5 transverse process with the sacrum producing sacralisation. The etiology explained referred to a mechanical force in utero<sup>6</sup>. In 1917, Bertolotti explained the relationship of LSTV with lowback pain, which subsequently came to be known as “bertolotti syndrome”<sup>7</sup>. After sacralisation L4 becomes last lumbar vertebra and it lacks the ability to perform functions like L5 and problems occur. It is difficult for L4 to cope with increased demand causing overuse and undue strain to the disc between L4 and L5. This usually leads to pain and discomfort in region of lower back. Sacralisation can lead to narrowing of intervertebral foramina causing compression of spinal nerve which can lead to spinalor radicular pain<sup>8</sup>. Sacralisation can lead to narrowing of intervertebral disc which can cause disc prolapse or degeneration<sup>9</sup>.

**Case Report:**

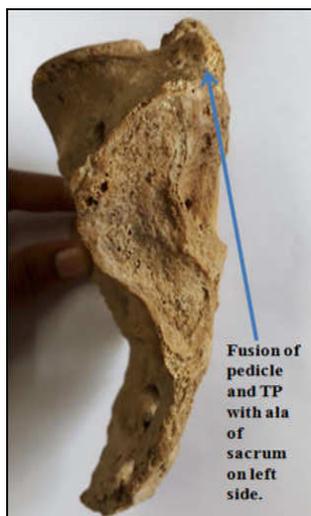
**Image 1: Pelvic surface of sacrum**



**Image 2: Dorsal surface of sacrum**



**Image 3: Left lateral surface of sacrum**



**Image 4: Right lateral surface of sacrum**



L<sub>5</sub> - 5<sup>th</sup> lumbar vertebra, S<sub>1</sub> - 1<sup>st</sup> sacral vertebra, TP - Transverse process

One sacrum with partial fusion of lumbar (L5) vertebra was observed in Department of Anatomy, B. J. Medical College, Ahmedabad, Gujarat. As shown in **Image – 1**, it has been observed that body and transverse process of the fifth lumbar vertebra was fused with the base of the sacrum partially on left side, thus five sacral foramina were observed. On the right side, there was no fusion of transverse process with ala, thus four sacral foramina were observed.

**Image – 2** depicts that tip of the lower end of the fifth lumbar spinous process and lamina were not fused with the median sacral crest and the lamina of the sacrum respectively, resulting in a gap between the sacral canal and fifth lumbar vertebral canal. It was also found that both inferior articular processes were fused with sacrum. Fusion of pedicle and left sided transverse process with sacrum was observed, as shown in **Image - 3**. Clear cut line between transverse process and alawas observed, as shown in **Image - 4**.

### **Discussion:**

To understand the LSTV or sacralisation, we need to know the embryological origin of lumbar vertebrae. It commences at 3<sup>rd</sup> week of intrauterine life. All vertebrae originate from somites that form along the cranial-caudal axis, on either side of the notochord, from paraxial mesoderm. These somites differentiate further into dorsi-lateral part, the dermomyotome (future inner dermis and muscle) and ventro-medial part, the sclerotome. Each sclerotome consists of loosely packed cells cranially and densely packed cells caudally. Some densely packed cells move cranially opposite the center of myotome where they form intervertebral disc. The remaining densely packed cells fuse with the loosely arranged cells of immediately caudal sclerotome to form mesenchymal centrum, body of vertebra. The mesenchymal cells surrounding the neural tube form neural arch. Ossification of vertebra begins in 8<sup>th</sup> week & ends by 25<sup>th</sup> year. There are three primary centres & five secondary centers present in each vertebra<sup>10</sup>. Secondary centers are one for the tip of spinous process, one for the tip of each transverse process & two each for annular epiphyses. These processes are considered to be regulated by the respective homeobox and paired-box genes (pax 1 and pax 9) in the control of cell proliferation during early sclerotome development. As revealed in mice, there were deficiency for one functional copy of pax 1, heterozygosity and homozygosity of the pax 9 mutation which result in vertebral malformations in the lumbar region, such as fused vertebrae<sup>11</sup>. This may occur as congenital anomaly causing lumbosacral transitional vertebrae<sup>12</sup> where the cartilage between L5 and S1 vertebrae calcified to become a sacralisation of the fifth lumbar vertebra<sup>11</sup>. This is due to the cranial shift of the last lumbar vertebra<sup>12</sup>. It is fairly common to have two successive vertebrae fuse asymmetrically causing partial shift by unilateral fusion of transverse processes<sup>12</sup>.

So, various studies had been done to find out the causes, factors responsible for it, incidents among different races and families, and clinical features of sacralisation of fifth lumbar vertebra. Kharinar and Nachale found 6.6% of cases in their study<sup>12</sup>, which correlate with the observations done by Chet Savage (7%, 2005)<sup>13</sup>. Magora and Schwartz found 20.8% sacralisation in their study<sup>14</sup>. Sacralisation was found in 11.1% cases by Kubavat Dharati et al<sup>15</sup>. Peter et al reported 6.2% sacralisation<sup>16</sup>. Otani et al. stated that a lumbosacral transitional vertebra was found more often in patients with disc herniation (17%) than in the control

group (11%)<sup>17</sup>.

So, LSTV therefore may be one of the causative factors for low backache<sup>18</sup>. Unilateral defect types gave rise to increased intensity of pain due to uneven weight-bearing. The incidence of disc herniation was found to be higher and can occur even at young ages. The discs immediately above the transitional vertebra were significantly more degenerative causing disc protrusion or extrusion, compared with the disc found between the transitional vertebra and the sacrum. Complications of sacralisation of 5<sup>th</sup> lumbar vertebra causes pain where there is actual pressure on nerves or nerve trunks, ligamentous strain around the sacralisation, compression of soft tissues between bony joints due to arthritis of a joint if present and bursitis if a bursa was present. Pelvis might fail to expand in sacralisation during delivery of baby<sup>19</sup>.

### **Conclusion:**

Sacralisation is one of the important factors for lumbar disc herniation (LDH) in patients with low backache, which frequently occurs at the level above the lumbosacral transitional vertebra due to altered facet morphology. The sacralisation, existing from the time of development deserves attention of orthopaedic surgeons, obstetrician, clinical anatomist, radiologists, forensic experts and anthropologists to differentiate the gender, sacral index etc. Knowledge of sacralisation of 5<sup>th</sup> lumbar vertebra helps to understand the possible complications such as low back pain, spinal or radicular pain due to pressure on the spinal nerve, strain of ligaments around the lumbosacral joint, compression of the soft tissue. Hence, we have presented this as a case report to emphasize on its clinical relevance and to avoid serious consequences due to faulty counting of vertebrae in planned spinal surgeries.

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