**ORIGINAL ARTICLE**

# A STUDY OF SACRALISATION OF FIFTH LUMBAR VERTEBRA IN GUJARAT

**Kubavat Dharati[1], Nagar SK[2], Malukar Ojaswini[3], Trivedi Dipali[4], Shrimankar Paras[4], Patil Sucheta[5]**

[1]Assistant Professor, Department of Anatomy, M.P. Shah Med. College, Jamnagar [2]Professor, [3]Associate Professor, Department of Anatomy, GMERS Medical College, Gotri, Vadodara [4]Associate Professor, B. J. Medical College, Ahmedabad [5]Professor, Department of Anatomy, GMERS Medical College, Patan, Gujarat

**Corresponding Author:**
Dr. Ojaswini Malukar,
402 Heritage Residency Ellora Park
Vadodara
Email: drmalukar@yahoo.com

## ABSTRACT

**Introduction:** In the lumbosacral region anatomical variations are related with change in the number of sacral vertebra by union of fifth lumbar vertebra or first coccyx with sacrum or deletion of first sacral vertebra. This study is carried to know the prevalence of sacralisation of fifth lumbar vertebra in Gujarat
**Method:** The present study of sacralisation of fifth lumbar vertebra was carried out on 189 dry human sacra of gujarati population,115 male and 74 female.
**Result:** A typical sacrum consisting of 5 segments was observed in 165 (87.3 %) specimen, while sacralisation of fifth lumbar vertebra was seen in 21(11.1 %)cases and lumbarisation of first sacral vertebra was seen in3 (1.3 %)cases**.**
**Conclusion**: The significant number of sacralisation can have a bearing on counting of vertebral levels specially during planning of spinal surgey, this study can be of use as a prelude to any type of experimental work in biomechanics, for diagnostic and therapeutic purpose in low back pain.

**Key words:** Anatomic variations, low backpain, Transitional vertebra

## INTRODUCTION

The lumbosacral spine not only protects the spinal cord and spinal nerves but also support and transmits weight of the body to the inferior extremity and thus plays an important important role in posture.

Lumbosacral transitional vertebrae (LSTV) are congenital anomalies of the lumbosacral region, which includes sacralisation of fifth lumbar vertebra and lumbarisation of first sacral vertebra observed for the first time by Bertolotti in 1917. This condition occurs due to defect in the segmentation of the lumbosacral spine during development.

In sacralisation of fifth lumbar vertebra the transverse process of last lumbar vertebra (L5) becomes larger than normal on one side or both sides, and fuses to the sacrum,or ilium and or both. This anomaly is observed in about 3.6 % to 18 % of people and is usually bilateral. Although, sacralisation may be as one of the causes of low back pain (LBP), but is asymptomatic in many cases (specially bilateral type). Probably low back pain occurs due to chronic faulty biomechanics. In sacralisation, usually L5-S1 intervertebral disc becomes thin and narrow, this abnormality is found by X-ray

This study is to know the prevalence of sacralisation of fifth lumbar vertebra in Gujarat region and to understand the series of morphological changes during lumbosacral transition that in turn help in diagnostic and therapeutic management of illness around lumbosacral region

## METHODS AND MATERIAL

The present study includes 189 human sacra of known sex (115 male & 74 female) were studied from Department of Anatomy, B.J.Medical college Ahmedabad, Government Dental college Ahmedabad,Medical college Vadodara and Government Medical college Surat in Gujarat. All the sacra were of adult but precise age was not known. Any increase in the number of elements of the sacrum were investigated and the identification of the six-segmented sacrum with five sacral foramina was noted.

The sacra consisting of six vertebra, by incorporation of the fifth lumbar, were selected. Those with fusion of the first coccygeal vertebra were excluded.We used two-fold subdivision of sacralisation.(1) Bi-lateral sacralisation(2) Uni-lateral sacralisation.


**Figure- 1.1, Transverse process of both side Is completely fused (Bi-lateral sacralisation)**


**Figure – 1.2, Transverse process of Right side is completely fused (Uni-lateral sacralisation)**

Bi-lateral sacralisation (fig-1.1) consists of a bony union between the abnormal transverse process and the sacrum on both sides.Uni-lateral sacralisation(fig-1.2) shows a bony union between the abnormal transverse process and the sacrum either on right side or left side.

The various measurements of all the sacra were made with the help of sliding caliper, divider, thread and steel measuring tape(scale).

Skeletal variations like sacralisation of fifth lumbar vertebra, lumbarisation of first sacral vertebra, number of sacral vertebra were recorded. The data were analysed using descriptive statistic and gross anatomy observation.

## OBSERVATION

In present study of 189 dry human sacra, 115 (60.8 %) were male and 74 (39.2%) were female sacra.24 cases (12.7 %) of lumbosacral transitional vertebra and 165 (87.3 %) normal vertebra are found including the sacra of coccygeal fusion.

**Table 1: Frequency distribution of sacralisation of fifth lumbar vertebra and lumbarisation of first sacral vertebra**

| | Male (%) | Female (%) | Total (%) |
|---|---|---|---|
| Subjects(Sacra) | 115 | 74 | 189 |
| Sacralisation | 14 (12.2) | 7(9.5) | 21 (11.1) |
| Lumbarisation | 1 (0.7 ) | 2(2.7) | 3(1.6) |

There was a greater tendency towards the reduction of length of vertebral column. Therefore the incidence of sacralisation is higher than lumbarisation.

**Table 2: Classification of sacralisation of fifth lumbar vertebra**

| Sex | Unilateral sacralisation | | | Bilateral sacralisation |
|---|---|---|---|---|
| | Right | Left | Total | |
| Male | 1 | 0 | 1 | 13 |
| Female | 2 | 1 | 3 | 4 |
| Total | 3 | 1 | 4 | 17 |

## DISCUSSION

The present study shows that the incidence of sacralisation of the fifth lumbar vertebra among Gujarati population is 11.1 %, which is more in males than female. Based on the literature, sacralisation varied by race and incidence, in our study was close to the Arabs 10 % reported by Bustami (1989)[1], 9.2 % reported by Hughes et al (2006), Notwithstanding, the incidence in our study was much lower than that the 18 % among Australian aboriginals, 16 % Indians and 14 % reported by Vandana Sharma(2011)[2] in central india region. The incidence in our study was much higher than that the 3.6 % reported by Moore and Illinosis (1925)[3] and 6.2 % reported by Peter et al (1999)[4], 7.8 % reported by Hald et al (1995)[5], Natives of Britain 8.1 % reported by Brailsford(1928)[6].

**Table 3: Incidence of sacralisation of fifth lumbar vertebra from previous study**

| Race | Incidence | References |
|---|---|---|
| Australian aboriginals | 18 % | Mitchell, 1936 |
| Indians | 16 % | Bustami, 1989[1] |
| Arabs | 10 % | Bustami, 1989[1] |
| Natives of Britain | 8.1 % | Brailsford, 1928[6] |
| Americans | 3.6 % | Moore & Illinois, 1925[3] |

The occurrence of lumbosacral transitional vertebra is linked to its embryological development and osteological defects. Embryologically,the vertebra receives contribution from caudal half of one sclerotome and from the cranial half of succeeding sclerotome

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 poriferation during early sclerotome development. As reveled in mice that were deficient for one functional copy of Pax 1, heterozygosity and homozygosity of the Pax 9 mutation result in vertebral malformations in the lumbar region, such as fused and split vertebrae, as well as ossified fusions between vertebrae and neural arches. Thus, the cartilage between L5 and S1 vertebrae calcified to become a" sacralisation" of the fifth lumbar

vertebra, may be caused by some genetic determinants of these morphological changes from the somite to vertebrae. This hypothesis was supported by a previous study of Tini (1977)[7] as increased incidences of lumbrosacral transitional vertebrae were observed occurring within families.

Due to sacralisation of fifth lumbar vertebra, the fusion of lumbosacral joint may cause greater difficulty during labour because of less mobile pelvis and it may be the reason of low back pain problem.

Bertolotti(1917)[8] described the relationship between the low back pain and sacralisation of fifth lumbar vartebra. In young patients with back pain the possibility of Bertolotti's syndrome should always be taken in account. Some authors proposed that sacralisation of fifth lumbar vertebra may cause symptoms such as lumbar disc herniations, spinal pain, radicular pain or lumbar scoliosis. But their pathophysiology or mechanics is still unknown. Sacralisation is one of the important factors in the emergence of lumbar disc herniation (LDH). LDH frequently occurs at the level above the lumbosacral transitional vertebra rather than at the level of transitional vertebra in patient with low back pain. Some evidence suggests that L5-S1 transitions possess altered facet morphology.These alterations are possibly related to low back pain situations.The sacralisation existing from the time of development,the condition may be painless for a large number of years and the history frequently given is pain for a few years only for even much less.

The various causes for low back pain in sacralisation have been put forward and these may be summarized as follows:

1. Actual pressure on nerves or nerve trunks.
2. Ligamentous strain.
3. Compression of soft tissue between bony joints.
4. By an actual atthritis if a joint is present.
5. By a bursitis if a bursa is present.

The sacralized transverse process may form a pseudarthrosis with the ilium and degenerative sclerosis may appear around the false joint. This may be a site of low back pain. The lumbar nerve roots may be altered when a lumbrosacral transitional vertebra is present and this probably could be a risk factor of low back pain.

Knowledge of sacralisaiion is not only enlightening for the orthopaedic surgeons, also vital for the (The condition of sacralisation of fifth lumbar vertebra deserves attention of )clinical anatomist, Radiologists, Forensic experts and morphologists,Architectures. Hence we are presenting such variation with emphasize on its clinical relevance Incorrect numbering during the planning of spinal surgery may have serious consequences. LSTV does affect the position of the intercrestal line (the line connecting the highest points of the iliac crests, also called 'Tuffier's line'), and on the location of the conus medullaris. The intercrestal line normally corresponds with the level L4/L5 and is therefore used as a landmark for needle insertion

Anatomically and architecturally, the sacralised formation appears stronger and more able to resist strain than the usual arrangement

## REFERENCES


1. Bustami F. The anatomical features and functional significance of lumbar transitional vertebra. Jordan Med J 1989;23:49-59
2. Vandana A.Sharma,D. K.Sharma,C.K.Shukla. Osteogenic study of lumbosacral transitional vertebra in central india region.J.Anat.Soc.India 2011; 60(2):212-217.
3. Moore BH, Illinois C. Sacralization of the fifth lumbar vertebra. J Bone Joint Surg 1925; 7: 271-278.
4. Peter H, Wilm B, sakai N, Imai K, Maas R, Balling R. Pax 1 and Pax 9 synnergistically regulate vertebral column development. Development 1999;126:5399-408.
5. Hald HJ,Danz B, Schwab R, Burmeister K,Behren W. Radiographically demonstrable spinal changes in asymptomatic young men. Rofo 1995; 163: 4-8
6. Brailsford JF. Deformities of the lumbosacral region of the spine. Brit J Surg 1928; 16: 562-627.
7. Tini PG, WISes G, Ainn WM. The transitional vertebrae of the lumbrosacral spine: Its radiological classification, incidence, prevelence, and clinical significance. Rheumatol Rehabi 1977;16:180-5.
8. Bertolotti M. Contributto alla conoscenza dei vici di differenzarione regionale del rachide con speciale riguards all asimilazzione sacrale della v. lombare. Radiologique Medica 1917; 4:113-44.