

A Study of the Incidence of Fifth Pair of Sacral Foramina

Dr. Balachandra N^{*1} Dr. Poonam D N², Dr. B.R.Ramesh³

^{*1}Associate Professor, DR B R Ambedkar Medical College, K G Halli, Bengaluru 560045

²Assistant Professor, DR B R Ambedkar Medical College, K G Halli, Bengaluru 560045

³Professor and Head, Department of Anatomy, DR B R Ambedkar Medical College, K G Halli, Bengaluru 560045

Abstract:

Low backache is a common condition affecting majority of the population. One of the causes is sacralization of lumbar vertebra. These are called lumbosacral transitional abnormalities which occur as a result of congenital anomaly in the segmentation of the lumbosacral spine. It includes either the involvement of L5 in sacrum or S1 into the lumbar vertebrae Bertolotti 1st observed the LSTV and stated that these abnormal vertebrae may produce low back pain due to arthritic changes which occur at the site of false articulation. LSTV are common with the prevalence ranging from 1-20%.

Context and purpose of the study:

Lumbosacral transitional vertebrae occur as a congenital anomaly in the segmentation of the lumbosacral spine. Some previous workers have suggested the role of LSTV in low back pain, whereas others have contradicted the role of LSTV. This study helps clinicians to rule out LSTV/ Sacralization while diagnosing a case of low back pain. Presence of 5 pairs of ventral and dorsal sacral foramina has been observed. Such an increase in the number of foramina has been noticed quite frequently, hence the present study

Results:

Additional sacral foramina were found in 07 sacra

Clinical implications:

Sacralization is not related to low backache, it can remain asymptomatic for many years, however sometimes, it gives rise to pain which begins slowly and gradually gets worse which may be due to - actual pressure on nerve / nerve trunks; ligamentous strain; compression of soft tissues between bony joints; by an actual arthritis if a joint is present; by bursitis if a bursa is present. There is no difference between the two sexes in the prevalence of sacralization contradicting previous claims that neither is more common in females nor was spondylolisthesis found more frequently in men. Investigations to diagnose such condition in clinical practice are plain x-rays, CT scan, and MRI.

Keywords: Low backache, Lumbosacral transitional vertebrae, sacralization, lumbarization.

Background:

Sacralization is the incorporation of the transverse process of the last lumbar vertebra (L5) to the sacrum on one side or both, or to ilium, or both. The incorporation of the fifth lumbar vertebra with the sacrum may be unilateral or bilateral producing partial or complete sacralisation. Complete sacralization consists of complete bony union between the abnormal transverse process and the sacrum. Incomplete sacralization shows a well defined joint line between the process and the sacrum.

Materials and Methods

One hundred (100) dry human sacra were studied.

These were obtained from the Department of Anatomy of Dr. B. R. Ambedkar Medical College, Bangalore

Observations and Results

Additional sacral foramina were found in 07(seven) sacra which are as follows:

Bilateral ventral sacral foramina were present in four bones. Unilateral ventral sacral foramina were found in three bones.

Similar observations were made on the dorsal surfaces. The incidence of the presence of the fifth pair of sacral foramina was seen in 7% of 100 dry human sacra studied.



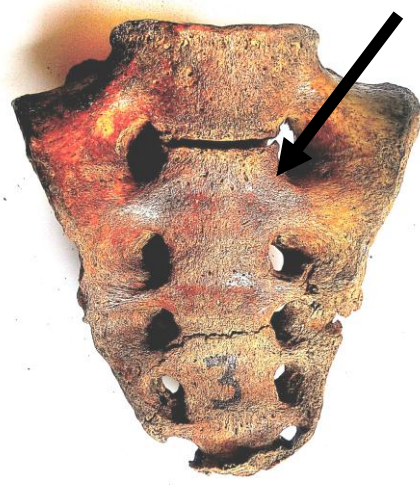
Picture 1: 4 sacral foramina on the right side and 5 on the left side (Ventral surface)



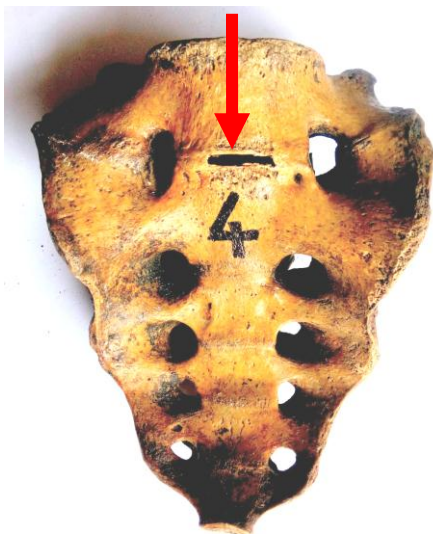
Picture 2: 4 sacral foramina on the right side and 5 on the left side (Dorsal surface)



Picture 3: 5 pairs of sacral foramina (Dorsal surface)



Picture 4: 5 pairs of sacral foramina (Ventral surface). (Arrow) Incomplete fusion between 5th lumbar & 1st sacral vertebrae



Picture 5: 5 pairs of sacral foramina (Ventral surface) Incomplete fusion between 5th lumbar & 1st sacral vertebrae (arrow)



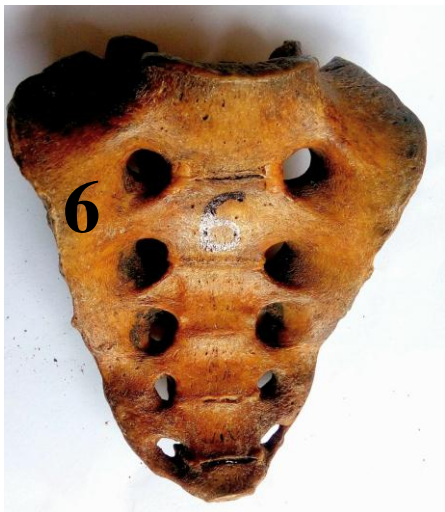
Picture 6: 5 pairs of sacral foramina (Dorsal surface) Incomplete sacral canal (arrow)



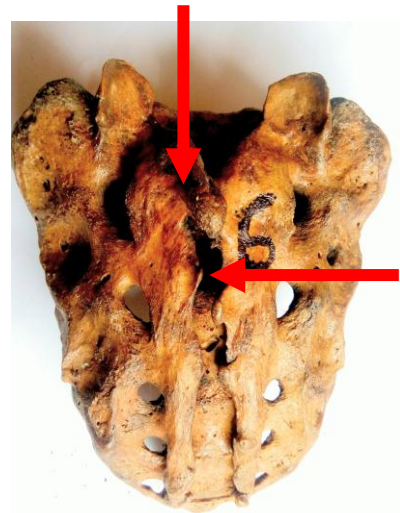
Picture 7: 5 pairs of sacral foramina (Ventral surface)



Picture 8: 5 pairs of sacral foramina (Dorsal surface)



Picture 9: 5 pairs of sacral foramina (Ventral surface)



Picture 10: 5 pairs of sacral foramina (Dorsal surface) Gaps in the sacral canal



Picture 11: 5 pairs of sacral foramina (Ventral surface)



Picture 12: 5 pairs of sacral foramina (Dorsal surface)



Picture 13: 5 pairs of sacral foramina (Ventral surface)



Picture 14: 5 pairs of sacral foramina (Dorsal surface)
Incomplete sacral canal (arrow)

Discussion

Bertolotti M 1917: Lumbosacral transitional vertebrae were reported for the first time by Bertolotti. He observed that Lumbo-sacral transitional vertebrae (LSTV) are common congenital anomalies which include lumbarization and sacralization. The association of lumbosacral transitional vertebra and low back pain is named after him & is known as Bertolotti's syndrome.

Arey L.B 1965; Reported the incidence of LSTV in 8% in Whites & 11% in non-Whites

Hollinshead/Rosse: 1986 reported an incidence of presence of five pairs of sacral foramina in 5.5% of the population

Bergman et al 1988, Their study revealed that the number of vertebrae comprising the sacrum may be increased to six, resulting from the fusion of the first coccygeal (50% in whites, 30% in Negroes) or, less often, of the last lumbar (sacralization) (8% in whites, 11% in Negroes); or it may be increased to seven, resulting from the fusion of the first coccygeal and the last lumbar (4% in whites, 1.5% in Negroes). The number may be reduced to four, apparently by the lumbarization of the first sacral (0.4% in whites, 1.5% in Negroes) (Trotter and Lanier).

O, Rahilly et al 1990 - Observed that sacralisation of the last lumbar vertebra (L.V.6 or L.V.5) is found in perhaps about 7-11 % of adult columns. They also observed that the term, however, is frequently used to include lumbarisation because of the difficulty of identifying precisely a transitional vertebra unless the entire column is available, so that the term 'lumbosacral transitional vertebra' is preferable. The term sacralisation is used also for the incorporation of coccygeal vertebra with the sacrum. An increase in the number of

vertebrae, e.g. 25 presacral units (true epistasis), is distinguished by Duhamel (1966) from transitional variations, which include caudal (lumbarisation) and cranial (sacralisation) types.

Jeffrey M. Muir in 2012 reported 2 cases of unilateral sacralization. He observed that, the exact role of transitional vertebrae in low back pain is unknown, with some studies suggesting that transitional vertebrae increase the likelihood of, and are therefore reliable predictors of, low back pain whereas others suggest that there is no greater prevalence of low back pain in those patients with transitional vertebrae when compared with the population at large

Diana Laishram et al studied 155 sacra and they found sacralization of lumbar vertebra in 23.22%. Among these, they found non-union of transverse process of L5 with S1. Of these, 3.22% were Unilateral & 1.93% were Bilateral.

Present Study - 07% in South Indians

Embryological basis

The fifth pair of sacral foramina is generated either due to fusion of first coccygeal vertebra to apex of sacrum or fifth lumbar vertebra with first sacral vertebra. However, in the sacrum under study, the fifth pair of sacral foramina was developed due to sacralization of first coccyx with the fifth sacral vertebra. This pair of foramina gives passage to fifth pair of sacral nerve and coccygeal nerve Sacralization of the fifth lumbar vertebra. The vast majority of people affected by this spinal abnormality are born with it, i.e., it is congenital. As HOX gene is responsible for patterning of shapes of vertebra, probably mutation in this gene could lead to sacralization of vertebra. Exact cause is not known although genetics may play an important role. Less common reasons

could be traumatic injury, extreme arthritic changes and purposeful spinal fusion surgery.

Clinical Implications

Low backache is a common condition affecting majority of the population. One of the causes is sacralization of lumbar vertebra. The sacrum is clinically important for caudal epidural block which is performed for the diagnosis and treatment of lumbar spine disorders. Bertolotti observed the LSTV and stated that these abnormal vertebrae may produce low back pain due to arthritic changes which occur at the site of false articulation. LSTV are common with the prevalence ranging from 1-20%. Lumbosacral transitional vertebrae occur as a congenital anomaly in the segmentation of the lumbosacral spine. Anomalies in the region include Lumbosacral transitional anomalies, Scoliosis, Hyperphosis, Hyperlordosis, Rectification, Vertebral Arthritis, Spondylolysis, Spondylolisthesis, Facet Arthritis, Spinal Stenosis & Inclination Dystocia

Conclusions

Sacralization is the incorporation of the transverse process of the last lumbar vertebra (L5) to the sacrum on one side or both, or to ilium, or both. The incorporation of the fifth lumbar vertebra with the sacrum may be unilateral or bilateral producing partial or complete sacralisation. Complete sacralization consists of complete bony union between the abnormal transverse process and the sacrum. Incomplete sacralization shows a well defined joint line between the process and the sacrum.

Conflict of Interest: None

References

- [1] Bertolotti M. Contributo alla conoscenza dei vertebrae di differenziazione del rachide con speciale riguardo all'assimilazione sacrale della v. lombare. *La Radiologia Medica* 1917; 4:113-44
- [2] Bull Fed Soc Gynaecol Obstet Lang Fr. 1963 Jan-Mar; 15: 128-30. Sacralization of fifth lumbar vertebra, relatively frequent cause of Inclination Dystocia
- [3] Arey L B 1965 Developmental Anatomy 7th edition p 189 W B Saunders London
- [4] Rene Caillet Low Back pain syndrome 4th edition 1981 p 288-289 Jaypee FA Davis
- [5] Hollinshead / Rosse 1986, Textbook of Anatomy 4th edition p 285-286 Harper & Row.

- [6] Ronald Bergman et al, (1988). Compendium of Human Anatomic Variation (Urban & Schwarzenberg), p 198
- [7] Anson McVay 1991, Surgical Anatomy 5th edition, W B Saunders p 736.
- [8] Susan Standring, Grays Anatomy 39th Edition Elsevier Churchill Livingstone, 2005, p 754.
- [9] Jeffrey M. Muir, Partial lumbosacral transitional vertebrae: 2 cases of unilateral sacralization *J Chiropr Med.* 2012 Jun; 11(2): 77-83.
- [10] Khairnar, Dr. Manisha Bhausaheb Rajale "Sacralization of lumbar vertebra" *Indian Journal of Basic & Applied Medical Research*; March 2013: Issue-6, Vol.-2, P. 510-514.
- [11] Dr. Diana Laishram, Dr. Aniruddha Ghosh, Dr. Deepti Shastri, A Study on the Variations of Sacrum And Its Clinical Significance, *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, Volume 15, Issue 6 Ver. IX (June. 2016), PP 08-14.