Shaikh ST. GAIMS J Med Sci 2023;3(2) (Jul-Dec):80-83
Online ISSN: 2583-1763

Original Research Article

A Morphometric Study of Sacrum with Five Pairs of Sacral Foramina

Shaguphta T. Shaikh

Department of Anatomy, K. J. Somaiya Medical College & Research Centre, Sion, Mumbai - 400022

* Correspondence: Dr Shaguphta T. Shaikh (shagufta@somaiya.edu)

ABSTRACT

Introduction: The sacrum is formed by five sacral vertebrae fused into a triangle and forming the posterior upper wall of the bony pelvis. Numerous anatomical variations of the sacrum have been reported, with complete bilateral sacralization of the 5th lumbar vertebra or complete bilateral sacralization of the 1st coccygeal vertebra of various breeds producing a sacrum with five pairs of sacral foramina.

Aims and Objectives: This study was designed to determine the prevalence of sacrum with five pairs of sacral foramina.

Materials and methods: The study was conducted in the Department of Anatomy at K J Somaiya Medical College, Mumbai.100 dried human sacrum were examined out of which 12 specimens having five pairs of sacral foramina representing bilateral full sacralization of the fifth lumbar vertebra were observed and 7 specimens having bilateral full sacralization of the first coccygeal vertebra were found.

Results: The prevalence of 5-paired sacral foramen sacrum varies in the general population and has not been reported separately. The present study shows that the incidence of sacrum with five pairs of sacral holes is 12%. The prevalence of sacrum with five pairs of sacral foramina sacralization of the 1st coccyx is 7%, respectively.

Conclusion: Knowledge of this anatomical variation is of paramount importance to spine surgeons, obstetricians, radiologists, coroners, morphologists, and clinical anatomists.

Keywords: Sacrum, Sacralization, Sacral Foramina, Coccygeal vertebra

INTRODUCTION

The sacrum is composed of five large, triangular, fused sacral vertebrae that form the posterior wall of the pelvic cavity.[1,2] Its upper broad base articulates with the 5th lumbar vertebra at the lumbosacral angle, and its blunt caudal tip articulates with the coccyx. There are four pairs of sacral foramina that communicate with the sacral canal. Any kind of impairment of skeletal features, either congenital or acquired, is expected to affect the stability of the spine and its biomechanics. Developmental disorders occurring at the lumbosacral boundary result in sacralization of the 5th lumbar vertebra or lumbarization of the 1st sacral vertebra [2-4], and developmental disorders occurring at the sacrococcygeal boundary result in sacralization of the 1st coccyx.

In general, the sacrum consists of five fundamentally fused vertebrae, although numerous anatomical variations have been reported. The most common anomaly is the additional element, resulting in a six-segment sacrum, although reduction of the sacral component is less common.[2,5,6] Occasionally, the 5th lumbar vertebra fuses with the 1st sacral vertebra (L5 sacralization), or the 1st coccygeal vertebra fuses with

the apex of the sacrum (coccygeal sacrum transformation). Both conditions result in the formation of five pairs of sacral foramina.[6]

Lumbosacral transitional vertebrae (LSTV) are congenital anomalies of the lumbosacral vicinity which incorporates lumbarization and sacralization Bertolotti being the first one to discover it. This situation takes place because of disorder withinside the segmentation of the lumbosacral backbone throughout development.[2,7-9]

In the cutting-edge take a look at sacrum with 5 pairs of sacral foramina are shaped because of entire bilateral fusion of 5th lumbar vertebra with the primary sacral vertebra or entire bilateral fusion of first coccygeal vertebra with 5th sacral vertebra (Sacralization of 5th lumbar vertebra or sacralization of first coccygeal vertebra), the sacrum along with six segments. Above manner will increase one pair of sacral foramina, that's of hobby due to the fact there were no posted reviews approximately sacrum with 5 pairs of sacral foramina in Gujarati populace in Western India.

The incidence of the sacralization of 5th lumbar vertebra varies from 1.7% to 14% [10,11] and sacralization of first coccygeal vertebra varies from 7.8% to 37% in one-of-a-kind populations via way of means of origin.[11] So sacrum with 5 pairs of sacral foramina will become critical for anthropological implications, bioarcheological research and medicolegal identification. Clinical occurrence of backache, sciatica and coccydynia are growing and its correlation to sacralization is critical. This take a look at is to realize the superiority of sacrum with 5 pairs of sacral foramina in Gujarat in Western India that during turns assist in diagnostic and healing control of contamination round lumbosacral and sacrococcygeal vicinity and correct labelling of vertebral segments is vital earlier than a surgical or percutaneous process to keep away from incorrect degree publicity or injection

.MATERIALS AND METHODS

The study was conducted in the Department of Anatomy at K J Somaiya Medical College, Mumbai.100 dried human sacrum were examined out of which 12 specimens having five pairs of sacral foramina representing bilateral full sacralization of the fifth lumbar vertebra were observed and 7 specimens having bilateral full sacralization of the first coccygeal vertebra were found.

Dried human sacra were examined for numerical variability. An increase in the number of sacral elements was observed and six segmented sacra with five pairs of sacral foramina were identified. Sacralized samples were examined and recorded.

RESULTS

Examination of 100 dry human sacrum revealed 5 pairs of sacral foramina in 12 sacra. The incidence of sacrum with 5 pairs of sacral foramina is 12%. The incidence of complete bilateral sacralization of the 5th lumbar vertebra and complete bilateral sacralization of the coccygeal vertebrae is 12% and 7%, respectively.

Figure-1: Sacrum with Five Pairs of Sacral Foramina and Complete Bilateral Sacralization of Fifth Lumbar Vertebra

DISCUSSION

The prevalence of 5-paired sacral foramen sacrum varies in the general population and has not been reported individually. The prevalence of sacrum with five pairs of sacral foramina is 12% due to sacralization of the 5th lumbar vertebra and sacralization of the 1st coccyx is 7% respectively.

The importance of the sacrum in identifying a person is well known. The sacrum is involved in determining sex, age and height. The fifth pair of sacral foramen arises from the fusion of the first coccyx and the apex

of the sacrum, or the fusion of the fifth lumbar vertebra and the first sacral vertebra. This pair of foramina leads to the fifth pair of sacral and coccygeal nerves and the fifth pair of lumbar nerves, respectively. This variant is of paramount importance to surgeons and obstetricians working with these nerves.

Sacralization brings neither advantages nor disadvantages to a person and is rarely the cause of back problems. Individuals may remain asymptomatic or exhibit clinical signs, including spinal cord or nerve root pain, disc degeneration, L4/L5 disc herniation, and lumbar epidural defects. [2-4,11,12]

The appearance of the sacrum with five pairs of sacral foramina is associated with its developmental and osteological defects. The vertebrae originate from the sclerotome of the somites, which is derived from the paraxial mesoderm. Each vertebra is formed from the combination of the caudal half of a segment and the cranial half of the next segment. Inappropriate formation, migration, differentiation, and union of somites lead to vertebral segmental abnormalities. Normal patterning of lumbar and sacral vertebrae, and altered axial patterns are responsible for Lumbosacral transitional vertebrae.[2,6,13-15]

A sacrum with five pairs of sacral foramina is not contraindicated for any activity, sport, or occupation, but this area of the spine is mechanically different from normal, which can lead to increased back pain and coccyx pain.[16] In patients scheduled for surgery or interventional surgery, it is important to identify the 5th lumbar sacralization and the 1st coccygeal vertebra sacralization. From a practical point of view, failure to identify and number the lumbosacral junction during spinal surgery can have serious consequences. It can pose problems in administering epidural or intradural anesthesia in patients with LSTV.[10] In the surgical treatment of intervertebral disc disease, it is important to pay attention to the possibility of transitional vertebrae.

The coccyx is normally mobile, and in the second stage of labor, backward movement of the coccyx increases the anteroposterior diameter of the pelvic outlet, facilitating delivery. With fusion, the coccyx is fixed and there is no increase in the anterior-posterior diameter of the pelvic outlet. This can lead to prolonged second stage of labor and perineal tear.[17]

Recognition of this type of abnormality is important in the reading of X-ray, CT, and MRI films, in surgical procedures in the lumbosacral or sacrococcygeal region, and in the differential diagnosis of back pain or coccygeal pain in patients.

This knowledge is essential for spine surgeons, clinical anatomists, forensic specialists, and morphologists. We therefore presented this variation with an emphasis on its clinical relevance.

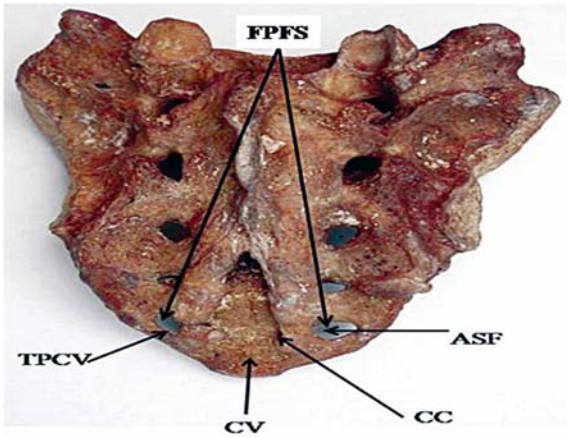

Figure-2: Sacrum with complete coccygeal sacralisation (dorsal surface). TPCV-Transverse process of First coccygeal vertebra, CV-First coccygeal vertebra, CC-coccygeal cornua, ASF-Additional sacral vertebra, FPSF-Fifth pair of sacral foramina.

CONCLUSIONS

This study shows that sacralization results in the formation of five pairs of sacral foramina instead of the four pairs that normally occur.

Sacralization results in changes in the segmental architecture of the spine that require vigilance and correction during anesthesia and surgical procedures and may be associated with non-traumatic low back pain, sciatica, coccygeal, and vertebral pathologies. Examination of the sacrum through five pairs of sacral foramina is morphologically important in the management of clinical cases involving the lumbosacral and sacrococcygeal regions and serves diagnostic and therapeutic purposes. Therefore, the prevalence of the sacrum with her five pairs of sacral foramina requires proper clinical and radiological

evaluation prior to spinal surgery and interventional procedures.

REFERENCES

1. Borley NR. True pelvis, pelvic floor and perineum. In: Standring S editor. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 40th Ed., London, Churchill Livingstone.2011; 724–728.

2. Kubavat DM, Nagar SK, Lakhani C, Ruparelia SS, Patel S,Varlekar P. A study of sacrum with three pairs of sacral foramina in Western India. Int J Med Sci Public Health 2012; 1:127-131.

3. Hollinshead WH. Anatomy for surgeons, Vol.3: The back and limbs. 1st ed. London: The back Hoeber-Harper publication; 1961:92-119.

4. Kanchan T, Shetty M, Nagesh KR, Menezes RG. Lumbosacral transitional vertebra: clinical and forensic implications. Singapore Med J. 2009 Feb;50(2): e85-87.

5. Frymoyer JW, Hadler NM, Kostuik JP, Weinsttein JN, Whitecloud TS (editors). The Adult Spine: principles and practice. vol 2. New York: Raven press, 1991: 2099.

6. Singh R. Sacrum with five pairs of sacral foramina. Int J Anat Var. 2011. 4;139-140.

7. Delport EG, Cucuzzella TR, Marley J, Pruitt C, Delport AG. Lumbosacral transitional vertebrae: incidence in a consecutive patient series. Pain physician. 2006. 9(1):53-56.

8. Eyo MU, Olafin A, Noronha C, Okanlawon A. Incidence of lumbosacral transitional vertebrae in low back pain patients. West Afr J Radiol. 2001. 8(1):1-6.

9. Kim NH, Suk KS. The role of transitional vertebrae in spondylolysis and spondylolytic spondy-lolisthesis. Bull Hosp Jt Dis. 1997;56(3):161-6.

10. Bron JL, Van Royen BJ, Wuisman PJ. The clinical significance of lumbosacral transitional anomalies. Acta Orthopaedica Belgica, 2007. 73(6):687-695.

11. Sharma VA, Sharma DK, Shukla CK. Osteogenic study of lumbosacral transitional vertebra in central India region. J Anat Soc India. 2011. 60(2): 212-217.

12. Krogman WM, Iscan MY. The Human skeleton in forensic medicine. Springfield: Charles Thomas,1986.

13. Sadler TW. Langman's Medical embryology. 11th ed. Lippincott Williams & Wilkins, Philadelphia 2010:142.

14. Carapuco M, Novoa A, Bobola N, Mallo M. Hox genes specify vertebral types in the presomitic mesoderm. Genes Dev. 2005; 19:2116-2121.

15. Wellik DM, Capecchi MR. Hox 10 and Hox 11 genes are required to globally pattern the mammalian skeleton. Science. 2003; 301:363-367.

16. Luoma K, Vehmas T, Raininko R, Luukkonen R, Riihimaki H. Lumbosacral transitional vertebra: relation to disc degeneration and low back pain. Spine 2004;29.200-205.

17. Castellvi AE, Goldstein LA, Chan DP. Lumbosacral transitional vertebrae and their relationship with lumbar extradural defects. Spine. 1984,9;493-495.

Source of support: Nil

Conflict of interest: None declared

How to cite:
Shaikh ST. A Morphometric Study of Sacrum with Five Pairs of Sacral Foramina. GAIMS J Med Sci 2023;3(2):80-83
https://doi.org/10.5281/zenodo.8192414