

**Original Article**

**FUSION DEFECT IN THE MEDIAN SACRAL CREST IN DRY HUMAN SACRUM IN WEST BENGAL POPULATION**

**<sup>1</sup>Dr. Dona Saha , <sup>2</sup>Dr. Reshma Betal , <sup>3</sup>Dr. Joydip Saha**

<sup>1</sup>Demonstrator, Department of Anatomy, Nilratan Sircar Medical College, Kolkata – 700014, West Bengal, India.

<sup>2</sup>Junior resident, Department of Anatomy, National Medical College, Kolkata – 700014, West Bengal, India.

<sup>3</sup>Demonstrator, Department of Anatomy, IQ City Medical College, Durgapur – 713206, West Bengal, India

Corresponding author : Dr. Dona Saha

---

**ABSTRACT**

Background: Sacrum forms the posterior-superior wall of the bony pelvis. Sacrum is generally formed by fusion of 5 pieces of sacral vertebrae. Methods: During routine study in osteology classes unusual variation of dry human sacrum was noted where there was non-fusion of lamina of first sacral vertebrae and absence of first sacral spine. Results: Other features of that sacrum, including the sacral hiatus was absolutely normal. Non-fusion of lamina of first sacral vertebrae may be associated with spina bifida occulta and may lead to painful condition of back. Conclusions: This type of anomaly is quite rare and knowledge of this may help in diagnosis of low back pain. So, reporting of this case may be worthwhile.

Keyword: sacrum, vertebrae, non-fusion of lamina.

---

**INTRODUCTION**

Sacrum is a triangular, wedge shaped, large bone which forms the postero-superior wall of bony pelvis and is formed by fusion of five sacral vertebrae. The number of sacral vertebrae may be increased in sacralisation of lumbar vertebrae and the number of sacral vertebrae may be decreased in lumbarisation of sacral vertebrae. Sacrum articulates with lumbar vertebrae above, coccyx below and hip bones in both sides. Sacrum has a triangular sacral canal which is bound posteriorly by fusion of posterior element, known as lamina, spine, ossified ligamentum flavum. Each sacral vertebrae is ossified from five centres of ossification- one for body, two for epiphyseal plate and two for vertebral arches. Bony deformity of deficiency may happen at several sites in posterior element depending upon the degree of deviation of

normal development.<sup>1</sup> These bony deformity may or may not be associated with underlying neural tube defect. So these types of anatomical variation may lead to neurological disorders, or painful condition of back or some procedure failure. Therefore the knowledge of the variation is essential for orthopedicians, neurologists, neurosurgeons and anesthesiologists.

**MATERIALS AND METHODS**

The present study has been carried out on 115 completely ossified undamaged dry human sacra of undetermined age and sex in the department of Anatomy in NRS Medical College and Hospital, Kolkata during one year time. Each sacrum is examined for any dorsal wall defect. Representative photographs of different sacrum having fusion defect of the dorsal wall were taken using a digital camera.

## RESULTS

Sacrum with fusion defect of dorsal wall was found in 3 among 115 sacrum (1. %). In one sacrum there was non-fusion of lamina of first sacral vertebrae with absence of first sacral spine. So there was opening of the upper part of median sacral crest upto the midpart of body of second sacral vertebrae. The shape of sacral hiatus was inverted U shaped. The apex and base of sacral hiatus was located on fifth sacral vertebrae. In another two sacrum there were gap in the upper part of median sacral crest with presence of first sacral spine. No other unusual feature of the sacrum was found.

## DISCUSSION

Each half of sacral vertebrae develops similar to the development of other vertebrae. One primary centre for body and one for each vertebral arch develops at 10-12<sup>th</sup> weeks. Primary centers for each costal element of upper three or four sacral vertebrae develops at six to eight prenatal months. The secondary centers appear after puberty. The fusion of all the parts are completed at the age of 25 years.<sup>1</sup> Any defect in formation of primary centre which give rise to vertebral arch will lead to incomplete formation of sacral canal and incomplete ossification of lamina. Anatomical variations occur frequently in this region making the sacrum the most variable portion of the spine.<sup>2</sup> Developmental malformations can occur ranging from variations in sacral hiatus to caudal agenesis.<sup>3</sup> The sacral hiatus is variable in its extent and form.<sup>4</sup>

If halves of embryological cartilagenous neural arch fails to fuse then it presents as a major birth defect-spina bifida. This type of defect ranges from 0.04%-0.15% and more frequent in girls than boys.<sup>5</sup> The lamina may be defective fully or partly or only the spinous process may be absent. These defect may or

maynot be associated with underlying meninges and spinal cord defect and overlying soft tissue defect.

In spina bifida occulta, most minor form of neural tube defect, the vertebral arch fails to fuse and commonly occurs at L5 or S1 vertebrae. The overlying skin may presents a skin dimple or a tuft of hair but underlying meninges and spinal cord are normal.<sup>5</sup> Generally it produces no symptoms but may be associated with muscles imbalance or muscles wasting of lower limb or foot deformity or backache due to tethering of cord with undersurface of skin. These kind of anatomical variations will lead to painful condition of the back.<sup>6</sup> It also lead to some clinical procedural failure.<sup>7</sup> Thus the knowledge of this anomaly should be kept in mind especially by anaesthetists and orthopaedicians while performing surgical procedures.

In literature there are many reports regarding complete dorsal wall agenesis to various shapes of hiatus. But these type of anomaly is very rare. Vishal K. reported a case of nonfusion of lamina of first sacral vertebrae with high sacral hiatus in South Indian population.<sup>8</sup>

Neural tube defect is polygenic in inheritance. Most of the cases can be detected by antenatal USG. The non-fusion of the first lamina of the sacral vertebra can be found in spina bifida occulta, which occurs due to a deficiency of folic acid during pregnancy.<sup>9</sup> These kind of anomaly can lead to low back ache, due to the pressure of spinous processes of the fifth lumbar vertebra on the nerve roots through the membrane closing spina bifida.<sup>10</sup> Additionally, lack or hypoplasia of posterior elements in spina bifida occulta can also lead to low backache.

## CONCLUSION

Knowledge of vertebral arch defect is of great importance to orthopedician, neurologist and

neurosurgeons. Finding of such defect in adult sacrum is rare, so, reporting of this case is very useful.



Fig 1: Sacrum showing non-fusion of lamina of first sacral vertebrae with absence of first sacral spine



Fig 2: Sacrum showing gap in the median sacral crest with presence of first sacral spine.



Fig 3: Sacrum showing small gap in the median sacral crest with presence of first sacral spine.

## REFERENCES

1. Standring S, Newell RLM, Collins P, Healy JC. The Back. In: Gray's anatomy. The anatomical basis of clinical practice, 40th ed. Edinburgh, Churchill Livingstone Elsevier, 2008:724-8.
2. Esses SE, Botsford DJ. Surgical Anatomy and Operative Approach to the Sacrum, in Frymoyer JW, Ducker TB, Hadler NM et al (ed): The Adult Spine: principals and Practice, 2<sup>nd</sup> Ed. Philadelphia: Lippincott-Raven, 1997;2, 2329-41.
3. Estin D, Cohen AR. Caudal agenesis and associated caudal spinal cord malformations, Neurosurg Clin N Am 1995; 6: 377-91.
4. Trotter M, Letterman GS. Variations of female sacrum: Their significance in continuous caudal anaesthesia. Surg. Gynecol. Obstet 1944; 78(4):419-24.
5. (Keith L. Moore et al, The Developing Human. Clinically oriented Embryology, 9<sup>th</sup> ed. Saunders Elsevier, Philadelphia 2013: 354.

6. Mehmet S, Johongir MM, Ali D. Evaluation of Congenital Lumbosacral Malformations and Neurological Findings in Patients with Low Back Pain, Turkish Neurosurgery 2009; 19(2): 145-8.
7. Vishal K et al., Sacral hiatus in relation to low back pain in South Indian population. Bratisl Lek Listy 2009; 110 (7): 436-41.
8. Visal k., Vinay K. V., remya k., arunanchalam k,shishi k, High sacral hiatus with nonfusion of lamina of sacral vertebrae: a case report,NUJHS, vol 2, no4,dec 2012, p60-2.
9. Naveen NS, Muralimanju, Vishal K, Maligi AM. Craniorachischisis totalis. Journal of Neurosciences in Rural practice 2010; 1 (1): 54-5.
10. Anquin CE. Spina bifida occulta with engagement of the fifth lumbar spinous process. Journal of bone and joint surgery 1959; 41(B): 486-90.