

## Research Article

### A STUDY OF SACRUM WITH FIVE PAIRS OF SACRAL FORAMINA IN BHOPAL POPULATION

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#### ABSTRACT

*Sacrum is a large triangular bone. It consists of five fused sacral vertebrae. Numerous anatomical variations of the sacrum have been reported with three and five pairs of sacral foramina. There has never been reported among Bhopal population. We have collected 100 dry sacral bones of both the sexes from the Departments of Anatomy, anatomy RKDF Medical college, Chirayu Medical college, L.N. Medical college to study the variations of sacral bones and their foramina. 100 dry human sacra were studied. Sacra with three and five pairs of sacral foramina were recorded. We founded 3 specimens of sacrum with five pairs of sacral foramina and 2 specimens of sacrum with three pairs of sacral foramina. The present study shows that the incidence of sacrum with three and five pairs of sacral foramina among Bhopal population in Central India*

#### KEY WORDS

*Three pairs of sacral foramina, five pairs of sacral foramina, lumbarization, Sacralization.*

#### INTRODUCTION

The human sacrum is a large triangular bone. It consists of five fused sacral vertebrae. The fusion of the sacral vertebrae starts at puberty from below upward. Two ends –superior forming the broad base and inferior forming the blunt apex. Four surfaces, pelvic surface and dorsal surface and two lateral surfaces. Pelvic surface is concave and it consists of four pairs of pelvic sacral foramina which communicate with the sacral canal through the intervertebral foramina. Dorsal surface consists of median sacral crest, four pairs of dorsal sacral foramina and intermediate sacral crest, lateral sacral crest, sacral cornua. Sacrum is the most variable portion of spine

as a number of anatomical variations occur in this region quite frequently<sup>1</sup>.

The first sacral vertebra is not fused to other four segments of sacrum called as lumbarization of first sacral vertebra resulting in three sacral foramina. When the fifth lumbar vertebra fuses with the first sacral vertebra (sacralization of fifth lumbar vertebra) leading to formation of five pairs of dorsal sacral foramina.

Generally, the sacrum comprises five rudimentary fused vertebrae, but numerous anatomical variations have been reported. The most common anomaly is additional elements yielding a six segment sacrum, whereas reduction of sacral constituents is less common<sup>2</sup>. Sacralization of fifth lumbar

vertebra and lumbarization of first sacral vertebra are caused by the border shifts, cranial shift resulting in the sacralization of fifth lumbar vertebra and a caudal shift resulting in the lumbarization of first sacral segment<sup>3</sup>.

This study is to know the prevalence of sacrum with five and three pairs of sacral foramina in Bhopal population that in turns help in diagnostic and therapeutic management of illness and lubmosacral region and accurate labeling of vertebral segments is critical before a surgical or percutaneous procedure to avoid wrong level exposure or injection.

### **MATERIALS AND METHODS**

After obtaining permission from institutes we examined 100 dry human sacra from the department of anatomy RKDF Medical college, Chirayu Medical college, L.N. Medical college, Bhopal , Madhya Pradesh. To study the

variations of sacral bones and their foramina. 18 sacra were damaged therefore were excluded from the study. Ultimately 82 sacra were seen. The number of pelvic and dorsal sacral foramina in each of the remaining sacrum was counted. The sacral bones were examined carefully for the anterior and posterior sacral foramina by passing a probe into foramina. The result obtained was analyzed and discussed.

### **RESULTS**

82 human sacra were examined. The presence of five pairs of anterior sacral foramina with incomplete sacralization was observed in three sacrum bone out of 82 human dry sacral bones (Figure 2). Three pairs of anterior sacral foramina observed in two sacra (Figure 1). 77 sacra out of 82 were showing normal sacral foramina with normal anatomical futures.



**Fig No:1 Pelvic aspect of the dry sacrum. Three pairs of Anterior Sacral Foramina.**



**Fig No: 2 Pelvic aspect of the dry sacrum. Five pairs of Anterior Sacral Foramina.**

### **DISSCUSION**

Vertebrae are derived from the sclerotome portions of the somites, which are derived from paraxial mesoderm. In the present study we observed two sacrum with

complete lumbarization of sacral vertebra showing 3 pairs of anterior sacral foramina. However, Pamela suggested that the patients are frequently told that a spinal anomaly observed in their radiograph is the

cause of their back problems. But the anomalies in the lumbar and sacral spine are simply variants of the normal bony architecture and are typically of no consequence<sup>4</sup>. DharatiKubavatetal<sup>5</sup> result shows that the prevalence of sacrum with three pairs of sacral foramina is 1.58 %. Prevalence of sacrum with three pairs of sacral foramina is 0.86% and 2.7% in male and female, respectively. He did not report unilateral complete lumbarization in any specimen.

Sacrum with 3 pairs of sacral foramina is linked to embryological development and osteological defects. During fourth week, sclerotome cells migrate around spinal cord and notochord to merge with cells from the opposing somite on the other side of the neural tube. The sclerotome portion of each somite undergoes a process called resegmentation. Resegmentation occurs when the caudal half of each sclerotome grows into and fuses with the cephalic half of each subjacent sclerotome. Thus each vertebra is formed from the combination of the caudal half of one somite and the cranial half of its neighbor<sup>6,3</sup>. Radiographic studies conducted by Paul (1938) on one thousand patients who complained of pain in the lower part of the back and legs suggested that approximately 30 per cent showed an anomaly of the lumbosacral spine. In that cases fourth sacral nerve roots also passes through the sacral hiatus along with the fifth sacral, coccygeal roots and the filum terminale exiting through it<sup>7</sup>.

A sacrum with three pairs of sacral foramina is one such congenital anomaly that has clinical and medicolegal implications. During medicolegal investigations, some congenital abnormalities are of vital importance in identification, especially when antemortem records are available<sup>8</sup>.

In the present study we observed three sacrum with incomplete sacralizations showing 5 pairs of anterior sacral foramina. When fifth

lumbar vertebra fuses with the first sacral vertebra, it is known as sacralization of lumbar vertebra and when first coccygeal vertebra fuses with the apex of sacrum, it is known as sacralization of coccygeal vertebra. The processes described above leads to formation of an additional fifth pair of sacral foramina<sup>9</sup>. Rajani reported a case with five pairs of sacral foramina<sup>10</sup>. Sadler is of the opinion that HOX gene is responsible for patterning of the shapes of vertebra. Sacralization of the fifth lumbar vertebra or lumbarization of the first sacral vertebra as seen in the present study could have been due to mutation of HOX gene as was suggested by Sadler<sup>6</sup>.

Khanna J et al is of the that all the sacra seen with five pairs of sacral foramina were male specimen. No sacrum belonging to a female possessed five pairs of dorsal sacral foramina<sup>11</sup>. Malanga and Cooke have reported wrong level emergency decompression, in a patient with cauda equina syndrome due to neglecting complete lumbarization of S1<sup>12</sup>.

## CONCLUSION

The study of sacrum with three and five pairs of sacral foramina is of morphological importance in dealing with clinical cases related to lumbosacral region and is helpful for diagnostic and therapeutic purposes. Obstetricians, radiologists, anaesthetists, neurologists and orthopedic surgeons must know about the existence of this variation to be able to correctly investigate, diagnose and treat the patients presenting with unusual signs and symptoms.

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