

Research Article**A Study on Anterior Sacral Foramina and Their Variations in South Indian Population****M. Punarjeevan Kumar¹, S. Lokanadham^{2*}, Usha Kothandaraman³**¹Faculty, Department of Anatomy, Kurnool Medical College, Kurnool, Andhra Pradesh, India²Assistant Professor, Department of Anatomy, Government Medical College, Palakkad, Kerala – 678001, India³Professor and Head, Department of Anatomy, ESIC Medical College & PGIMS, Chennai, Tamilnadu – 600078, India***Corresponding author**

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Abstract: Lumbosacral transitional vertebrae are congenital anomalies of the lumbosacral region which includes lumbarization and sacralization. We have collected 50 dry sacral bones of both the sexes from the Departments of Anatomy, ESIC Medical College and Kurnool Medical College to study the morphological features and variations of sacral bones and their foramina. We have observed 3 pairs of anterior sacral foramina with complete lumbarization in one sacrum with an incidence of 2%. The presence of 5 pairs of anterior sacral foramina with incomplete sacralization was observed in one sacrum out of 50 sacra with an incidence of 2%. Variation in the sacral foramina becomes important for anthropological implications, bio-archaeological studies and medico-legal identification. Our study gives preliminary anatomical knowledge about the sacral foramina variation and their clinical importance to the surgeons before planning any surgeries in the pelvic region.**Keywords:** Anterior, Lumbarization, Sacralization, Sacral foramina.

INTRODUCTION

There are four pairs of pelvic sacral foramina which transmit the anterior division of sacral nerves [1]. Occasionally; 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 [2]. 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 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 neighbour [3]. 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 [4].

MATERIALS AND METHODS

We have collected 50 dry sacral bones of both the sexes from the Departments of Anatomy, ESIC Medical College and Kurnool Medical College to study the morphological features and variations of sacral bones and their foramina. The sacral bones were examined carefully for the anterior and posterior sacral foramina by passing a probe into foramina. We were also observed the pattern of lumbarization and sacralization in relation to lumbar and sacral bones.

RESULTS

Out of 50 human dry sacral bones we have observed 3 pairs of anterior sacral foramina with complete lumbarization in one sacrum with an incidence of 2%. The presence of 5 pairs of anterior sacral foramina with incomplete sacralization was observed in one sacrum bone out of 50 human dry sacral bones. The incidence of 5 pairs of anterior sacral foramina was 2%. 48 sacra out of 50 were showing normal sacral foramina with normal anatomical features.



Fig. 1: Pelvic aspect of the adult dry sacrum showing Normal 4 pairs of anterior sacral foramina (ASF: Anterior sacral foramina)

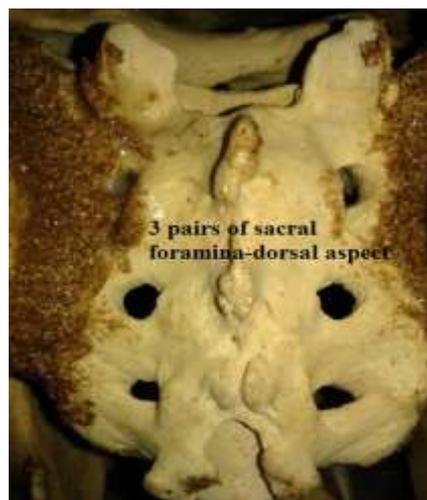


Fig. 4: Dorsal aspect of the adult dry sacrum showing 3 pairs sacral foramina



Fig. 2: Dorsal aspect of the adult dry sacrum showing Normal 4 pairs of sacral foramina

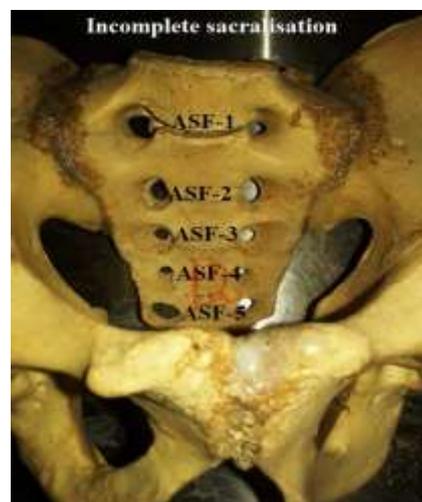


Fig. 5: Pelvic aspect of the adult dry sacrum showing bilateral incomplete complete sacralization of fifth lumbar vertebra resulting in five pairs of Anterior sacral foramina (ASF: Anterior sacral foramina)



Fig. 3: Pelvic aspect of the adult dry sacrum showing 3 pairs of anterior sacral foramina (ASF: Anterior sacral foramina)



Fig. 6: Dorsal aspect of the adult dry sacrum showing bilateral incomplete complete sacralization of fifth lumbar vertebra resulting in five pairs of sacral foramina

DISCUSSION

Sacrum with 3 pairs of sacral foramina is linked to embryological development and osteological defects. Vertebrae are derived from the sclerotome portions of the somites, which are derived from paraxial mesoderm [3, 4]. Malanga and Cooke have reported wrong level emergency decompression, in a patient with cauda equina syndrome due to neglecting complete lumbarization of S1 [5]. Incorrect numbering can theoretically lead to problems with the administration of epidural or intradural anaesthetics in patients with Lumbo Sacral Transitional Vertebra. Failure to recognize and to number lumbosacral transitional vertebra during spinal surgery may have serious consequences [6]. Rajani reported a case with five pairs of sacral foramina [7]. The fifth pair developed due to sacralization of coccyx. This pair of foramina gives passage to fifth pair of sacral and coccygeal nerves. 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 [8, 9].

In the present study we have observed one sacrum with complete lumbarization of sacral vertebra showing 3 pairs of anterior sacral foramina. We were also observed one sacrum with incomplete sacralization showing 5 pairs of anterior sacral foramina with an incidence 2% out of 50 adult dry human sacral bones. A study on the variation in number of dorsal sacral foramina was conducted in 80 adult dry North Indian sacra. Three dorsal sacral foramina were seen on the lateral side of each intermediate crest in two sacra (2.5%) and five in 2 sacra (2.5%) amongst all the sacra examined. The incidence of our study is mere to the literature; if we might have taken more number of dry sacra our study incidence may be in agreement with the literature [2].

CONCLUSION

In pelvic region surgeries sacral foramina serve as an important landmark in spinal instrumentation and can also be used for blocking sacral nerves in order to produce analgesia and anaesthesia [2]. It is essential to know the frequency of variation in the number of dorsal sacral foramina.

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