

Case Report

## Sacrococcygeal Synostosis - A Case Report

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### ABSTRACT

A sacrum is a triangular, flat bone formed by fusion of five sacral vertebrae creating four pairs of sacral foramina which transmit sacral nerves. Fusion of sacrum cranially with 5th lumbar vertebra or caudally with 1st coccygeal vertebra is some rare anatomical variations that results in the increase of number of sacral foramina and thus variation in the passage way of sacral and coccygeal nerves. A dry specimen of sacrum bone with 5 pairs of sacral foramina was observed during osteology demonstration at Department of Rachana Sharir, Sri Dharmasthala Manjunatheshwara College of Ayurveda and Hospital, Hassan, Karnataka. Extra 5th pair of sacral foramina in this bone was formed due to synostosis of 1st coccygeal vertebra with lower end of sacrum. Such type of variation has paramount importance in clinical field because it may cause prolonged second stage of labour or perineal tear and influence the caudal epidural block anaesthesia during surgical interventions.

**Key Words:** sacralization, sacrum, coccyx, coccydynia, sacral hiatus, synostosis.

### INTRODUCTION

A normal sacrum is a wedged shaped, large, triangular fusion of sacral vertebrae forming the posterosuperior wall of pelvic cavity. Its apex blunt and articulates caudally with coccyx and its wide base articulates cranially with fifth lumbar vertebra. On either side, it articulates with ileum of the hip bone. The concave pelvic surface of sacrum has four pairs of pelvic sacral foramina communicating with the sacral canal through intervertebral foramina and transmits the ventral rami of the upper four sacral spinal nerves. Its convex dorsal surface consists 3 to 4 spinous tubercles representing fused sacral spines of upper sacral vertebrae. Below the third or fourth tubercle, there is an arched gap in the posterior wall of the sacral canal called sacral hiatus. It is formed due to failure of fusion of fifth pair of laminae posteriorly and transmit the fifth sacral

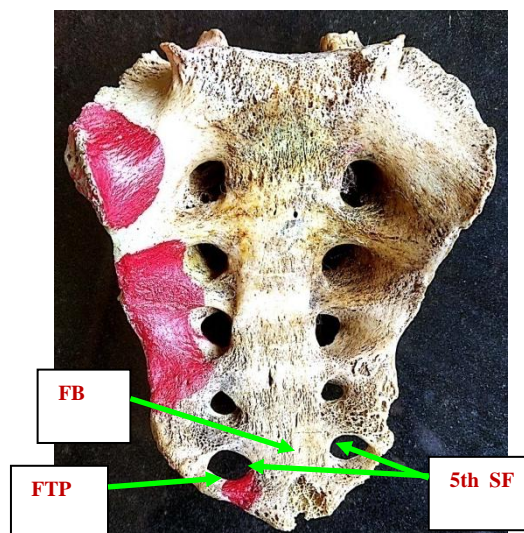
nerves, a pair of coccygeal nerves and filum terminale. Lateral to the fused laminae, there are four pairs of dorsal sacral foramina which communicate with sacral canal through intervertebral foramina and transmit the dorsal ramus of upper sacral nerves. Medial to these foramina, there is a row of four small tubercles representing the fusion of articular processes. The fifth inferior articular processes are free, project caudally and flank the sacral hiatus and called sacral cornua which articulate with the coccygeal cornua. A rudimentary transverse process projecting superolaterally from each side of the first coccygeal body may articulate or fuse with the inferolateral sacral angle to form the fifth sacral foramina. [1,2] Sacrum supports and transmits weight of the body to lower limbs thus plays an important role in posture and locomotion. [3]

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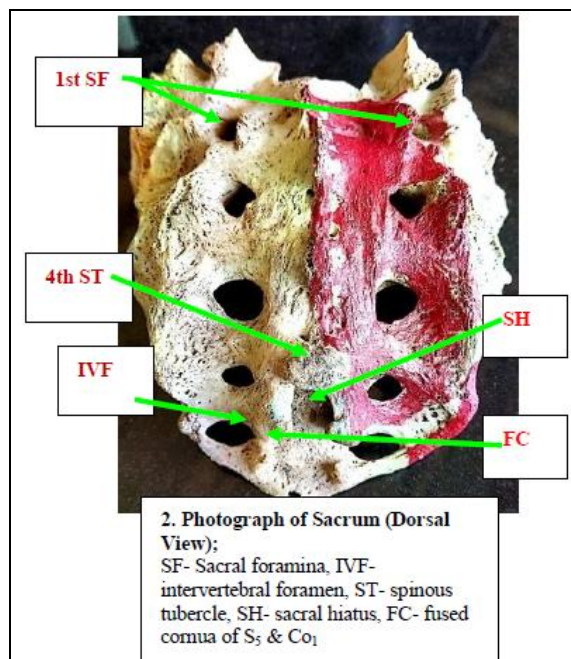
During the routine demonstration of osteology class at Department of Rachana Sharir, Sri Dharmasthala Manjunatheshwara College of Ayurveda and Hospital, Hassan, Karnataka, a sacrum bone with 5 pairs of sacral foramina was found. It was observed that the body of first coccygeal vertebra was completely fused with lower end of the body of the 5th sacral vertebra on both the sides. The transverse processes of first coccygeal and that of fifth sacral vertebrae were also fused resulting in formation of fifth pair of sacral foramina. These fifth pair of sacral foramina was observed on distal part of the ventral surface. On the dorsal aspect of left side, superior articular process of first coccygeal vertebra was joining with inferior articular process of fifth sacral vertebra forming the left intervertebral foramen which was communicating between sacral hiatus and left fifth sacral foramen. Fusion point of articular processes was damaged on the right side. The hiatus was inverted U shaped inferior to fourth spinous. The fourth tubercle was very prominent. The cornua of first coccygeal vertebra was fused with cornua of fifth sacral vertebra.

## DISCUSSION

Detail study about incidence and categorization of sacrococcygeal synostosis has not been done yet and most of standard literatures also lack this information. Singh R observed 13.6 % sacralization of coccyx in a study of 66 dry sacra. [4] The prevalence rate of sacralization of fifth lumbar vertebra is 1.7 to 14 % while that of sacralization of first coccygeal vertebra is 7.8 %. [5] One of study of 189 dry sacra in Gujarati population shows the incidence of sacralization of coccygeal vertebra is 23.8 % with male 22.6 % and female 25.7 %. [6] N Balchandra et al observed 7% of incidence with five pairs of sacral foramina in the study of 100 dry sacra [7] while Nagar SK et al claimed 8.9 % of incidence of sacralization of first coccyx in a study of 302 sacra. [8] All these were small scale studies, so results cannot be generalized.



1. Photograph of Sacrum (Ventral View);  
FB- fused body of S<sub>5</sub> & Co<sub>1</sub>, SF- sacral foramina, FTP- fused transverse processes



2. Photograph of Sacrum (Dorsal View);  
SF- Sacral foramina, IVF- intervertebral foramen, ST- spinous tubercle, SH- sacral hiatus, FC- fused cornua of S<sub>5</sub> & Co<sub>1</sub>

Vertebral column develops from the ventromedial portion of somite known as sclerotomes. [4] Each sclerotome divides into cranial, middle and caudal part. A vertebra is formed by fusion of the caudal part of one sclerotome and cranial part of the next sclerotome. Thus, it is intersegmental in position. Intervertebral disc is formed from middle part of sclerotome. [9] The five sacral vertebrae thus formed fuse together by the 25 years of age. [2] Failure of resegmentation causes inappropriate vertebral fusion which results in anomalous vertebral or spinal

fusion. It may also be acquired due to number of other causes like tuberculosis, juvenile rheumatoid arthritis, trauma etc. [10,11] Occurrence of 5 pairs of sacral foramina is generated due to inclusion of extra vertebra either by synostosis with 5th lumbar vertebra at cranial end called lumbar sacralization or with 1st coccygeal vertebra at caudal end and called coccygeal sacralization. [4]

The Hox 10 and 11 paralogous genes are known to regulate axis patterning of the vertebral column. Mutations in these genes can cause abnormal development of sacrum. [12] Wellik and Capecchi claims that the Hox 11 group gene is responsible for the genesis of sacral and caudal vertebrae and their over expression in somite stage causes coccygeal sacralization with apex of sacrum. [13]

Sacro-coccygeal synostosis is one of an important anatomical variant with very little information available in texts. It may be asymptomatic or associated with coccydynia. Sacral hiatus is one of important bony landmarks in sacrum. This sacral hiatus has been utilized for caudal epidural anaesthesia by inserting a needle through sacral hiatus to gain entrance into epidural space in the field of obstetrics as well as surgical practices like hernia repairs, lower limb surgery, surgery below umbilicus etc. In addition to it, this route is also used for giving post-operative analgesia in children. The sacrococcygeal synostosis may affect the shape and extent of sacral hiatus. So, lack of awareness of such type of variation increases the rate of failure of caudal anaesthesia. [4,5,14-18]

Usually the coccyx is mobile and it is pushed posteriorly during second stage of labour resulting in antero-posterior diameter of the pelvic outlet. It facilitates the delivery of baby. In case of fusion, coccyx becomes fixed restricting the increase of diameter of pelvic outlet. This may lead to prolonged labour or perineal tear. [19]

## CONCLUSION

Sacrococcygeal synostosis is an important anatomical variant with very little

information available in standard texts. Successful management of any clinical ailment demands clinical and radiological assessment prior to any interventional spinal anaesthetic, obstetric and surgical procedures. So, physicians, surgeons, obstetricians, pediatricians should be well aware of this variant for understanding and proper management of ailments related to sacrococcygeal region. Critical study is needed for detail information of this variant.

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