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Sacralization : Sacrum with Five Pairs of Sacral Foramina

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Abstract

Context : *The sacrum generally is composed of five vertebrae fused to form a triangular bony mass with four pairs of sacral foramina. The sacrum may contain six vertebrae, by development of an additional sacral element or by incorporation of the fifth lumbar or first coccygeal vertebrae produces five pairs of sacral foramina. Sacralization is entirely undiagnosable without an X-ray examination and rarely present any symptoms. Sacra of six bodies with five pairs of sacral foramina are found frequently in the department of anatomy during routine study of bones.*

Material and Methods: *The present study was performed on 218 (two hundred eighteen) adult human dry sacra of unknown sex. The study samples were distributed into male and female sex groups by discriminant function analysis The study was descriptive type and was conducted in the department of Anatomy, Dhaka Medical College, Dhaka, from January 2011 to December 2011. The sacrum was examined to assess the number of its vertebral segments and sacral foramina.*

Result : *A typical sacrum consisting of 5 segments with four pairs of sacral foramina was observed in 78.9 % cases, while sacralisation with five pairs of sacral foramina was seen in 21.10 % of cases.*

Conclusion: *The number of vertebrae in sacrum may be increased by fusion of fifth lumbar vertebra or first coccygeal vertebra producing sacralization. The knowledge of significant number of sacralization is necessary in managing spinal surgery and for diagnostic and therapeutic purpose in low back pain.*

Key words : *Sacralization, sacral foramina, low back pain*

Introduction

The sacrum is a large, triangular fusion of five vertebrae, wedged between the two hip (innominate) bones. Its blunted, caudal apex articulates with the coccyx and its superior, wide base with the fifth lumbar vertebra at the lumbosacral angle. Normally, sacrum is generated by fusion of five sacral vertebrae constituting four pairs of sacral foramina. The sacrum may contain six vertebrae, by development of an additional sacral element or by incorporation of the fifth lumbar or first coccygeal vertebrae. Inclusion of the fifth lumbar or 1st coccygeal vertebra with the sacrum produces sacralization which is usually incomplete and limited to one side[1].

When the fifth lumber vertebra is fused to the sacrum completely (sacralization of L_5), there are only four lumbar vertebrae, whereas when S_1 is separated from the sacrum (lumbarisation of S_1), there are six lumbar vertebrae and many intermediate variations are reported. Complete sacralization consists of a complete bony union between the abnormal transverse process and the sacrum. Incomplete sacralization shows a well defined joint line between the process and the sacrum. Both forms may be either unilateral or bilateral[2]. It was reported that there is a strong relationship between sacralization and low back pain (LBP). Low back pain is quite a common

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ailment affecting about 80% of the population in their life time[3]. It is possible that L_5 sacralization contributes to the development of orthopedic diseases like degenerative spondylolisthesis, lumbar disc degeneration, herniation and low back pain[4].

Lumbosacral transitional vertebrae (LSTV) is common in spine but its association with low back pain is debated. LSTV is a congenital anomaly of lumbosacral spine. It is defined as sacralization of lower lumbar vertebrae or lumbarization of superior segment of sacral spine. Its prevalence is 4-30% in general population[5].

Sacralization is not always related to low backache, it can remain asymptomatic for many years, however sometimes, it gives rise to pain which begins slowly and gradually gets worse which may be due to actual pressure on nerve / nerve trunks, ligamentous strain, compression of soft tissues between bony joints, by an actual arthritis if a joint is present or by bursitis if a bursa if present[6].

The sacrum is clinically important for caudal epidural block which is performed for the diagnosis and treatment of lumbar spine disorders. Caudal anesthesia is given in different surgical procedures like hernia repairs, lower limb surgery, surgery below umbilicus, etc. In this procedure, sacral cornua are identified. However, in case of sacralization of coccygeal vertebra, it will be difficult to mark the landmark and this may lead to caudal block failure. In addition to it, this route is also used for giving postoperative analgesia in children. Due to this variant there may be insufficient analgesia[7].

Materials and Methods

A total of 218 (two hundred eighteen) dried completely ossified , grossly normal adult human sacra of unknown sex was assessed. The sacra were collected from Department of Anatomy of Dhaka Medical College, Sir Salimullah Medical College and Shaheed Suhrawardy Medical College, Bangladesh Medical College, Medical College for Women and Hospital, Ibrahim Medical College and H M Somorita Medical College, Dhaka. For this study adult sacra of both sexes were included. The study samples were distributed into male and female sex groups by discriminant function analysis The sacrum was examined to assess the number of its vertebral components and the number of sacral foramina were counted. Non-sacralization was regarded as sacrum showed four pairs of foramina and five vertebral segments. On the other hand sacralization was regarded as sacrum showed five pairs of foramina and six vertebral segments[6] (Fig.-1,2).

Ethical Clearance

This study was approved by the Ethical Review Committee of Dhaka Medical College, Dhaka.

Results

Sacralization was found in 21.10% of cases irrespective of sex (Table-I). It was observed that presence of sacralization is more in case of male (43 out of 126) than female (3 out of 92) (Fig.-3). A typical sacrum consisting of 5 segments or four pairs of sacral foramina was observed in 78.9% of cases, while sacralization of fifth lumber vertebra was seen in 6.9% cases and sacralization of 1st coccygeal vertebra was seen in 14.2% cases (Table-II).

Table-I

Frequency distribution of sacralization

Sacra	Male (n)	Female (n)	Total n(%)
Normal sacra	83	89	172 (78.9%)
Sacralization	43	3	46 (21.1%)
Total (n)	126	92	218 (100%)

Table-II

Frequency distribution of lumbar and coccygeal sacralization

Sacra	Frequency n=218	Percent (%)
Normal sacra	172	78.9
Sacralization of lumbar vertebra	15	6.9
Sacralization of coccyx	31	14.2
Total (n)	218	100%

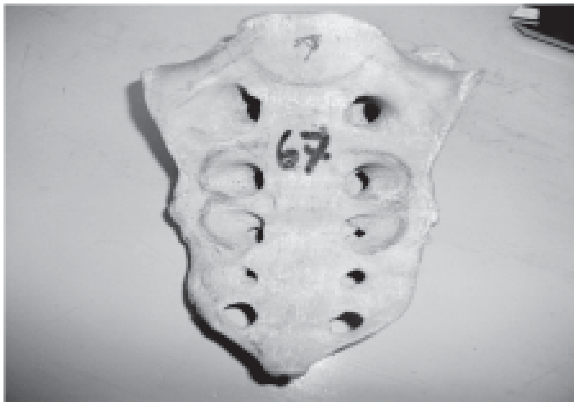

Fig.-1: *Photograph showing sacrum (Ventral surface) with five sacral foramina (sacralization.*

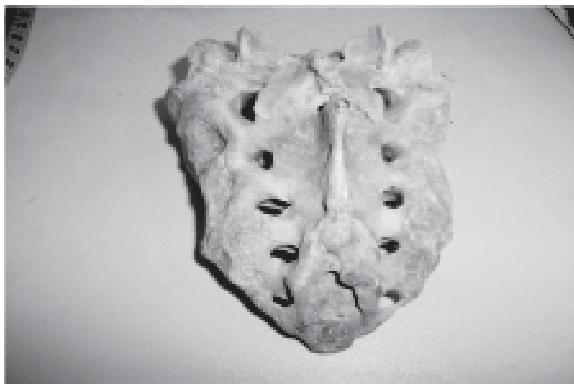

Fig.-2: *Photograph showing sacrum (Dorsal surface) with five sacral foramina (sacralization)*

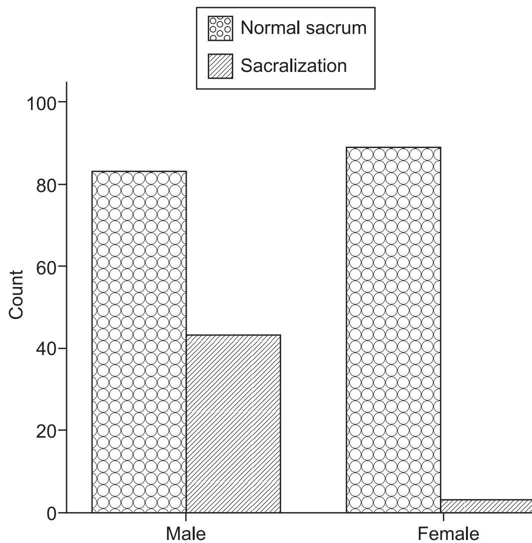

Fig.-3: *Bar diagram showing sacralization in case of male and female*

Discussion

In the present study 218 (two hundred and eighteen) dried completely ossified adult human sacra of both sexes (126 male and 92 female) were included. The incidence of sacralization was more incase of male than female, which was similar to the study done by Murlimanju,B.V. et al in Mangalore, India[4]. As compare to lumbarization, sacralization is more painful .The lumbosacral spine protect the spinal cord and spinal nerves. It plays a role in posture, locomotion and transmit body weight. It suffer more abuse then other skeleton of body. Integrity of all vertebrae should be mentioned otherwise it will affect the stability and biomechanics. In upright position major weight of trunk is borne by skeletal structure. Lumber spine experience more abuse. To this integrity of vertebrae should be maintained. Any congenital or acquire pathology will affect the stability of spine therefore LSTV can produce low back pain, is the commonest rheumatological symptom to general practitioner. In LSTV intervertebral disc is narrow, disc herniation may occur, spondylolisthesis can occur, it may be painful. It is important to assess accurate level of LSTV to eliminate surgical and procedural error, because wrong level surgery on patients with variant anatomy[5]. In the present study sacralization was found 21.10% cases, while sacralization with lumber vertebra was found in 6.9% cases. Dharati K found sacralization of fifth lumber vertebra in 11.10% of cases among the Gujrat population of India[8]. The vast majority of people affected by this spinal abnormality are born with it, i.e., it is congenital. As HOX gene is responsible for patterning of shapes of vertebra[9]. So probably mutation in this gene could lead to sacralization. Exact cause is not known although genetics may play an important role. Less common reasons could be traumatic injury, extreme arthritic changes and purposeful spinal fusion surgery. The incidence of sacralization in the present study was higher than that the 18%, 16%, 10% found among Australian aboriginals, subcontinent Indians and Arabs, respectively[10].

Conclusion

Sacralization is important in counting vertebral levels during planning spinal surgery. Although it is debatable but it is fairly convincing evidence of an

association of low back pain and sacralization. Accurate identification of sacralization can help to avoid complication in treating patients.

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