Study of the sacral hiatus in various samples in order to investigate caudal epidural block accuracy for anesthesia and analgesia

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Abstract:

Caudal epidural block is a popular technique for paediatric, surgical, anaesthesia, and chronic pain management in adults. It is carried out by introducing a needle via the sacral hiatus into the sacral epidural region. The use of fluoroscopy and ultrasound to guide needle placement has significantly improved the success rate of caudal epidural blocks. The anatomical features of the sacral hiatus and the dorsal wall of the sacral canal vary according to its clinical application in caudal epidural anaesthesia. This article will provide a brief overview of the necessary anatomy and techniques for administering the caudal epidural block.

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Introduction:

The epidural space is commonly utilised not just for surgical anaesthesia and analgesia in paediatric patients, but also for the management of a wide range of chronic pain disorders in adults. The caudal epidural block was originally used as a blind, landmark-based approach. The blind approach has a success record of more than 96 percent in children [1, 2]. Even in experienced hands, it was just 68–75 percent in adults [3,4]. The sacrum is a big triangular fusion of five vertebrae that sits between the two hip (innominate) bones. At the lumbosacral angle, its caudal apex articulates with the coccyx, and its superior, broad base articulates with the fifth lumbar vertebra (5). The sacral hiatus is the opening at the caudal end of the sacral canal. The sacral hiatus is palpated as a prominent dip in the midline around 4 cm above the tip of the coccyx in the upper section of the buttock cleft. The sacral cornua borders the hiatus laterally (6). In obstetrics (7), sacral hiatus has been used for epidural anaesthetic administration, as well as in orthopaedic practise for treatment and diagnosis (8).

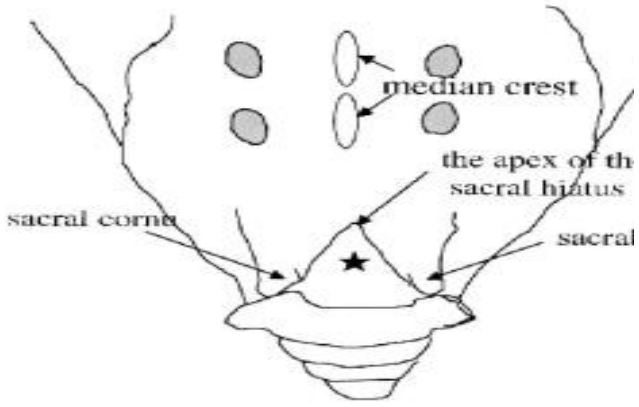
It has been observed that an absence hiatus was one of the anatomic explanations for CEB failure, and the frequency of absent hiatus was 7.7 percent. 9 A comprehensive grasp of the typical architecture of the sacral hiatus and associated structures may be one of the most essential components in successful CEB.

The goal of this study was to elucidate the anatomic variability of the sacral hiatus utilising

sacral bone markers in order to improve the reliability of CEB.

Material and methods:

A total of 86 (34 were female and 52 were male) dried completely ossified, grossly normal adult human sacra of unknown sex was assessed. The sacra were collected from Department of Anatomy Index medical college hospital and research center, Madhya Pradesh, Indore. Adult sacra of both sexes were included in this investigation. Using discriminant function analysis, the study samples were divided into male and female groups. Each sacrum was examined for sacral hiatus features such as shape, level of base and apex, length of hiatus, anteroposterior diameter of sacral hiatus at the apex, and transverse width of sacral hiatus at the base. Digital slide calipers were used to take the measurements. The sacral hiatus, sacral cornua, and median sacral crest were the bone landmarks employed in this investigation.



The bony landmarks: the sacral hiatus, sacral cornua, medial sacral crest.

Results:

The Sacral Cornu Existence or Absence Ratio occurred in 32 of 86 sacra (37%), while absent cornua occurred in 43 of 86 sacra (40%). (50 %). Bilateral sacral cornua occurred in 19 of 55 sacra (45%) while unilateral cornua occurred in 23 of 45 sacra (45%). (55 %).

Sacral Hiatus Morphologic Types The incidences of each morphologic type of sacral hiatus were as follows: Type A: 44 of 86 sacra (51%); Type B: 49 of 86 sacra (56%); Type C: 10 of 86 sacra (11%); and Type D: 12 of 86 sacra (12%). (9 percent)

Sacral Canal Diameter at the Apex of the Sacral Hiatus The diameter of the sacral canal ranged from 1.7 mm to 10.8 mm. The sacral canal's average diameter standard deviation (SD) was 6.3 1.8 mm. In one of 86 sacra, the diameter of the sacral canal at the apex of the hiatus was less than 2 mm (1 percent).

Distance Between Bilateral Cornua:

The distance between the bilateral cornua ranged from 2.2 mm to 18.4 mm. The average SD of bilateral sacral cornua distance was 10.2 0.35 mm. The gap between the bilateral cornua was smaller than 5 mm in 5 of 92 sacra (5 percent).

Table 1: Length, anterior-posterior diameter at the apex and transverse diameter at the base of sacral hiatus in male and female

Measurement in m

Sex	Length of sacral hiatus Mean±SD	Anterior-posterior diameter of sacral hia apex Mean±SD
Male (n=52)	20.76±10.02 (6.51-50.31)	4.76±1.73 (0.50-4.57)
Female (n=34)	29.63±13.46 (7.17-43.11)	4.92±2.13 (0.16-13.19)
P value	<0.001***	<0.001***
Total (n=86)	23.02±13.28 (7.57-53.31)	4.03±1.02 (0.23-15.59)

Discussion

We observed considerable changes in the sacral hiatus's anatomic structure. Because its apex indicates the presence of the sacral canal, the sacral hiatus is the most significant bone landmark for caudal epidural steroid injection (9) As a result, a successful injection begins with an accurate diagnosis of the sacral hiatus (10) The needle should be passed through the sacrococcygeal ligament between both cornua during blind injection. The caudal epidural space is detected during injection by sensing the characteristic "give" or "pop" when the sacrococcygeal ligament is pierced.

The diameter of the sacral canal and the thickness of the sacrococcygeal ligament were found to have significant negative relationships with age in our study. Degenerative alterations caused the

sacral canal's height to diminish and the thickness of the sacrococcygeal ligament to thin with age. These findings are significant in assessing whether blind caudal epidural steroid injections should be used in older patients due to the short sacral canal and thin sacrococcygeal ligament, which can lead to erroneous needle placement. There were no differences between men and women in the diameter of the sacral canal, the ideal angle for needle insertion, or the actual angle of needle insertion in this investigation. A prior investigation on children utilising magnetic resonance imaging found no difference in sacral canal diameter between boys and girls. The mean optimum angle for needle insertion in our study was 16.7° (range, 1.3°–35.9°), which was less than 10° due to a flat posterior bony surface of the sacrum. Although our study's findings are comparable to those of earlier studies, there were several limitations to our research.

Initially, the number of women outnumbered the number of men. Second, no evidence of intravenous injection was found. Inadvertent intravenous injection, which has been documented to occur in 5% to 9% of surgeries, cannot be avoided with this approach.

Conclusion

The sacral hiatus and surrounding structures have anatomic differences between patients of different sexes and ages. Therefore, understanding these anatomic differences in patients of different sexes and ages may improve the safety and reliability of caudal epidural steroid injection. Understanding of these variations may improve the success of caudal epidural anesthesia. Insertion of a needle into the SH for caudal block is suggested to be done at its base to avoid the anatomic variations of its apex. Lumbosacral spine radiographs may be helpful in identification of SH absence, other shapes, and level of SH apex and base. Further morphometric studies can be done to understand the landmark of sacral hiatus and their clinical importance.

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