

A Cross Sectional Study of Morphological & Morphometric Parameters of Sacral Hiatus and it's Importance in Caudal Epidural Block

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Abstract

Background: To evaluate the morphological & morphometric parameters of sacral hiatus in order to study the anatomical variations of sacral hiatus which will be useful for administering caudal epidural block and improve its reliability and success rate.

Methods: After approval from Institutional Ethics Committee, this study was conducted in the Department of Anatomy, SMS Medical College and attached group of Hospitals, Jaipur, Rajasthan.

Results: Most commonly sacrum is made up of five vertebrae. Present study also documented similar composition in 46 (92%) sacra whereas 2(4%) cases were made up of 4 segments. The most common shape of sacral hiatus encountered in present study was Inverted-V (48%) followed by Inverted-U (32%) cases and in rest of the cases the shape of sacral hiatus was dumbbell shape (4%) and irregular (16%). Apex of sacral hiatus was mostly seen at 4th sacral vertebra in 74% of cases, at 3rd and 2nd sacral vertebra in 24% and 24% of cases respectively.

Conclusion: The opening at the caudal end of sacral canal is known as sacral hiatus. It is formed due to the failure of fusion of laminae of the fifth (occasionally 4th) sacral vertebra. The sacral hiatus transmits the fifth sacral nerve and coccygeal nerves. The dural sac ends at the level of second sacral vertebra above the sacral hiatus. Therefore, it forms a convenient region for caudal epidural anaesthesia of structures innervated by these nerves.

Keywords: Caudal, Epidural, Vertebra.

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Introduction

Sacrum is a large triangular bone. It is formed by fusion of five sacral vertebrae and forms the caudal end of the vertebral column. It forms posterosuperior wall of the pelvic cavity wedged between the two innominate bones. [1]

The word sacrum means "sacred" in Latin. In English it is the large heavy bone at the base of the spine. The name is derived

from the Latin sacer, "sacred" a translation of the Greek hieron (osteon), meaning sacred or strong bone. The Romans called the bone, the "Os Sacrum" which literally meant the "holy bone". The Greeks termed it the "Hieron osteon" which means the same "holybone".

In Greek "hieron" meant not only sacred but also a "Temple". It was in the sense

that its bony concavity laid the sacred organs of procreation, the ovaries and uterus. Due to its great size, the sacrum is usually the last bone of a buried body to rot. The ancients may thus have believed the sacrum to be the focal point around which the body could be reassembled in the afterlife. There is some archeological evidence to support the use of sacrum as a vessel to hold the sacrifice in ancient sacred rites. [2] Egyptians considered this bone sacred to "Osiris" the God of resurrection and of agriculture. [3]

Material and Method

Study Place –Department of Anatomy, S.M.S. Medical College and attached group of Hospitals, Jaipur, Rajasthan.

Study Population- The present study was conducted on 50 adult dry human sacrum bones.

Study Period – After approval from Institutional Ethics Committee, this study was conducted in the Department of Anatomy, SMS Medical College and

attached group of Hospitals, Jaipur, Rajasthan.

Study Type – Descriptive type of observational study.

Study Design – Cross-sectional study.

Inclusion criteria:

- All intact dry adult human sacral bones were included in the study.
- Adult dry sacral bones showing lumbarization and sacralization were also included in the study. Exclusion criteria:
- Eroded, broken and neonatal sacral bones were excluded from the study.

Statistical Analysis:

- Qualitative data was expressed in proportion and percentage and quantitative data was expressed in terms of mean + S.D
- Data collected was thus entered in Microsoft Excel software in the form of Master Chart.

Result

Variable	No. of Specimens	Percentage (%)	
Composition of Sacrum	4 segments	2	4.00
	5 segments	46	92.00
	6 segments	2	4.00
shapes	Inverted -U	16	32.00
	Inverted -V	24	48.00
	Dumbbell	2	4.00
	Irregular	8	16.00
Level of Apex	S2 level	1	2.00
	S3 level	12	24.00
	S4 level	37	74.00
Level of Base	3rd Sacral vertebra	nil	0.00
	4th Sacral vertebra	3	6.00
	5th Sacral vertebra	47	94.00
Length of hiatus	22.21±9.20		
AP diameter of hiatus at apex	4.10±0.95		

Most commonly sacrum is made up of five vertebrae. Present study also documented similar composition in 46 (92%) sacra whereas 2(4%) cases were made up of 4

segments. The most common shape of sacral hiatus encountered in present study was Inverted-V (48%) followed by Inverted-U (32%) cases and in rest of the

cases the shape of sacral hiatus was dumbbell shape (4%) and irregular (16%). Apex of sacral hiatus was mostly seen at 4th sacral vertebra in 74% of cases, at 3rd and 2nd sacral vertebra in 24% and 24% of cases respectively.

Discussion

Study on the variation in anatomical features of sacral hiatus of sacral canal is related with regards to its clinical application in caudal epidural block, perineal surgery and for painless delivery. Sacral approach to epidural space produces reliable and effective block of sacral nerves. Epidural injection of corticosteroids and local anaesthetic agents were widely used to provide symptomatic relief in patients with low back disorder. Caudal epidural block has 25% failure rate. It is mostly due to the anatomical variations at the level of apex of sacral hiatus, difficulty in palpating in some patients and also includes dorsal wall deficient cases.

Identification of the caudal epidural space is not always possible even for experienced clinicians, and anatomical variation may be an influence. The apex of the sacral hiatus is an important bony landmark in the success of CEB but it may be hard to palpate, particularly in obese patients. Hence other prominent anatomical bony landmarks should be used. Composition of Sacrum In the present study 46 (92%) sacrum was made up of 5 segments whereas 2 (4%) cases showed 4 segments.

Vinod Kumar et al [5] and Shewale et al [6] noted 5 segmented sacra in 141(69.80%) and 69.6% cases and 4 segmented sacra in 1.48% and 2.45% cases respectively.

However, Trotter and Lanier [3] (1945) observed 4 segments in sacrum in 8(0.7%) cases only. The findings of the present study are higher when compared with those of Vinod Kumar et al and Shewale et al. Partial sacralisation of 5th lumbar

vertebra was observed in 2 (4%) cases in the present study.

Shewale et al [6] observed sacralisation of 5th lumbar vertebra in 9.8%. Trotter and Lanier [3] (1945) observed sacralisation of 5th lumbar vertebra in 12.6%.

Shape of sacral hiatus In the present study the shapes of sacral hiatus were variable; most commonly Inverted-V in 24 (48%) sacra and Inverted-U in 16 (32%) sacra. Both the above types were considered as normal. In 2 (4%), its outline was like a Dumbbell which was very low when compared to previous workers namely Nagar SK [5] in 36 (13.3%) sacra and Vinod Kumar et al [5] in 15 (7.43%) sacra. Nagar SK. also noted various shapes of sacral hiatus most common being Inverted-U in 112 (41.5%) sacra and Inverted-V in 73 (27%) sacra.

Vinod Kumar et al also noted various shapes of sacral hiatus, most common being Inverted-V in 94 (46.53%) and Inverted-U in 60 (29.70%). The shape of the sacral hiatus was irregular in 8 (16%) sacra in the present study which was again similar when compared to Nagar SK. in 38 (14.1%) sacra. [7] Apex of Sacral Hiatus Susan Strandring et al [8] states that the apex of sacral hiatus is present at the level of 4 th sacral vertebra.

In the present study the apex of sacral hiatus was seen most commonly at the level of 4th sacral vertebra in 37 (74%) sacra, which was almost similar to Vinod Kumar et al [6] in 154 (76.23%) sacra, but was lower in study conducted by Sekiguchi M et al [9] in 60 (65%) sacra and much lower in study observed by Nagar SK in 147 (55.9%) sacra.

Earlier studies by Trotter et al (1944) and Lanier et al [10] in their series have reported the mean level of apex of sacral hiatus to be at lower third of 4th sacral vertebra.

Conclusion

The opening at the caudal end of sacral canal is known as sacral hiatus. It is formed due to the failure of fusion of laminae of the fifth (occasionally 4th) sacral vertebra. The sacral hiatus transmits the fifth sacral nerve and coccygeal nerves. The dural sac ends at the level of second sacral vertebra above the sacral hiatus. Therefore, it forms a convenient region for caudal epidural anaesthesia of structures innervated by these nerves.

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