

STUDY OF VARIATIONS IN LEVELS OF SACRAL HIATUS

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ABSTRACT

Background and Aims: The name of sacrum is direct translation from Greek hieron osteon. The dorsal surface presents a sacral hiatus which is produced by the failure of laminae of the fourth or fifth sacral vertebra to meet in median plane, leaving an inverted U shaped or V shaped gap called sacral hiatus.

Materials and Methods: for the present study, dry unknown human sacra were obtained from North Karnataka. The level of apex of sacral hiatus was noted.

Results: Many variations in the level of apex were found. The apex of sacral hiatus extended between 2nd to 5th sacral vertebrae. The sacral hiatus exhibits many variations in level of apex and base of sacral hiatus.

Conclusion: In the present study, the rate of impossible caudal epidural anesthesia through sacral hiatus is 2% as the sacral hiatus was closed leading to absent hiatus, and needed to be considered before giving caudal anesthesia. The efficient and accurate caudal block depends upon the knowledge of degree and extent of variations in sacral hiatus especially in levels of apex & base.

KEY WORDS: Sacral Hiatus Morphometry, Variations In Sacral Hiatus, Caudal Epidural Anesthesia, Painless Deliveries.

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INTRODUCTION

The sacral hiatus was named by Romans, a direct translation from the older Greek hieron osteon. Sacred or holy in the past have included the Greek word hieron, use of the bone in sacrificial rites, and role of bone in protecting the genitalia [1].

The holiness of the sacral bone was an attribute borrowed from ancient Egyptians who considered this bone to Osiris, the god of resurrection and agriculture [2]. The sacrum is considered to be sacred because it occupies the lowest part of back which is invariably covered as a mark of respect [3].

The dorsal surface presents a sacral hiatus which

is produced by the failure of the laminae of the fifth sacral vertebra or sometimes fourth to meet in median plane which has many variations [4]. This deficiency leaving an inverted U shaped or V shaped gap called sacral hiatus [5].

The dorsal surface of the sacrum shows three longitudinal crests. The median sacral crest is formed by incomplete fusion of three or four sacral spines. The fourth and or fifth spines and parts of the corresponding lamina are usually missing. This produces the sacral hiatus, a dorsal opening into the lower part of sacral canal. The sacral hiatus is of variable length [6].

The apex of sacral hiatus is usually at the level of 4th sacral vertebra and the base is seen at 5th

sacral vertebra [7]. On the dorsal surface of sacrum, a median crest ends below as sacral hiatus and present cornua on each side of it. The sacral hiatus is found by palpation of sacral cornua [8].

Sacral hiatus contains fifth sacral nerve, filum terminale externa, coccygeal nerve roots and fibrofatty tissue. The shape and extent of sacral hiatus was proved important because in caudal epidural anesthesia, the approach is made through sacral hiatus. The laminae of all the sacral vertebra may fail to fuse resulting in incomplete bony dorsal wall of sacral canal or may fuse in midline giving rise to absent hiatus [9].

In 1900, caudal epidural anesthesia was performed for the first time which involved injection of a drug into the epidural space through sacral hiatus for many clinical procedures as analgesia [10]. In 1901, technique of caudal epidural injection developed [11]. In 1942 Continuous caudal epidural anesthesia was introduced [12].

In epidural anesthesia or caudal anesthesia, a local anesthetic agent is injected into the sacral canal. If the sacral hiatus is large, care is taken as the needle may enter lumbar cistern which extend to the second segment of the sacrum [13].

There is considerable variation in anatomy of sacral hiatus in connection with sacral canal roof. The sacral hiatus extends from sacral cornua to fused arch of S₄. The anatomy of infants and children is similar to that of adults [14].

It can be stated that about 20% of all sacra have anomalies of significance. From the standpoint of performing caudal anesthesia about 10% of the sacra have abnormalities which preclude this technique [11].

MATERIALS AND METHODS

Source of data: For the present study, dry unknown human sacra were obtained from North interior Karnataka region. Study has done for the period of one year (2014-15) at Gadag, Karnataka, India.

Inclusion criteria: For the present study dry unknown human sacra which are well formed, fully

ossified were taken.

Exclusion criteria: Fragmented, deformed bones were excluded from the study.

RESULTS

Apex of Sacral hiatus: With respect to sacral vertebra, the level of apex of sacral hiatus was noted. Many variations in the level of apex were found. The apex of sacral hiatus extended between 2nd to 5th sacral vertebrae.

The apex was found at the level of 2nd sacral vertebra in 1 (1.03%) case. Here the apex was much elongated. In 17 (17.52%) cases the apex was found at the level of 3rd sacral vertebra. In 77 (79.88%) cases, the apex was found at the level of 4th sacral vertebra. In 2 (2.06%) cases the apex was found at 5th sacral vertebra. Level of apex was not considered in three sacra as they had complete spinabifida and absent hiatus. The different levels of apex are shown in table (Table 1).

Table 1: Apex of Sacral hiatus (Level of apex of sacral hiatus with respect to sacral vertebra).

Sl.No.	Apex	Number (n=97)	%
1	2 nd sacral vertebra	1	1.03%
2	3 rd sacral vertebra	17	17.52%
3	4 th Sacral vertebra	77	79.38%
4	5 th sacral vertebra	2	2.06%

Base of Sacral hiatus: The base of sacral hiatus was noted with respect to sacral vertebrae and the level of base was found between 4th and 5th sacral vertebrae. No cases were found at the level of 2nd and 3rd sacral vertebrae.

In 1 (1.03%) case the level of base of sacral hiatus was at 4th sacral vertebra. In 96 (98.96%) cases, the level of base was found at 5th sacral vertebra. Three sacra were not considered for the base because they had complete spinabifida and absent hiatus. The different levels of base are shown in table (Table 2).

Table 2: Base of Sacral hiatus (Level of base of sacral hiatus with respect to sacral vertebra).

Sl.No.	Base	Number (n=97)	%
1	2 nd sacral vertebra	0	0.00%
2	3 rd sacral vertebra	0	0.00%
3	4 th Sacral vertebra	1	1.03%
4	5 th sacral vertebra	96	98.96%

Fig. 1: Length of sacral hiatus (Lowest Value).



Fig. 2: Length of sacral hiatus (Highest Value).



Fig. 3: Width of sacral hiatus (Lowest Value).



DISCUSSION

The sacrum is one of the bones which exhibit many variations especially in sacral hiatus. The sacral hiatus is a variable space through which caudal epidural anesthesia is given for various purposes.

But it had a limited expansion because it was a complex technique and results were not completely satisfactory, especially because of limited anatomical knowledge of variations in sacral hiatus. Now a day's caudal epidural block is an essential technique in anesthesiology [15].

This technique provided accurate data for pre-operative localization of sacral hiatus and found to increase the success rate of caudal anesthesia [16].

Level of apex of sacral hiatus: Different levels of apex of sacral hiatus were noted in the present study with respect to sacral vertebra. Most common level was found at the 4th sacral vertebra.

Table 3: Level of apex.

Sl. No.	Level of Apex	Vinod kumar et al. 1992 [17]	Nagar S.K. 2004 [18]	Sekiguchi M et al. 2004 [19]	Present Study
1	2 nd Sacral vertebra	4.95%	3.40%	4%	1.03%
2	3 rd Sacral vertebra	8.91%	37.30%	15%	17.52%
3	4 th Sacral vertebra	76.23%	55.90%	65%	79.38%
4	5 th Sacral vertebra	7.43%	3.40%	15%	2.06%

Level of Base of Sacral hiatus: Different levels of base were noted with respect to sacral vertebrae. The base of sacral hiatus was at the level of 5th sacral vertebra in 168 (83.17%) case, and in 191 (72.6%) cases.

In the present study the level of base was found at fifth sacral vertebra in 96 (98.96%) cases.

Which was more compared to the studies done by Vinod kumar et al¹⁸ and Nagar S.K [18].

CONCLUSION

The sacral hiatus exhibits many variations in level of apex and base of sacral hiatus. The sacral hiatus transmits fifth sacral and coccygeal nerves. The efficient and accurate caudal block depends upon the degree and extent of variations in sacral hiatus especially in levels of apex, base. The caudal anesthesia is given through sacral hiatus for various purposes like for painless deliveries, Postoperative pain relief, perineal surgeries, and continuous caudal epidural anesthesia and in various clinical settings hence the morphometrical study of variations in sacral hiatus is of great relevance. The detail anatomical knowledge of variations of sacral hiatus is very helpful to the anesthetists to increase the success rate of caudal anesthesia.

Hence these variations should be considered before giving caudal anesthesia in north Karnataka. 10% of cases showed irregular shape. The rate of impossible caudal anesthesia was found to in 2%cases. The findings are to be considered before giving caudal anesthesia in north Karnataka, India.

Conflicts of Interests: None

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