

MORPHOMETRIC VARIATIONS IN SACRAL HIATUS IN TELENGANA REGION

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ABSTRACT

Introduction: The opening present 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. It is located inferior to the 4th or 3rd fused sacral spines or lower end of median sacral crest.

Material and Methods: This study was carried out on 60 dry human sacra in Hyderabad region of Telengana state, India to know the anatomical variations of sacral hiatus.

Result: Various shapes of sacral hiatus were observed which included inverted- U (40%), inverted- V (45%), irregular (1.7%), dumbbell (1.7%) and bifid (1.7%). The apex of sacral hiatus was commonly found at the level of 4th sacral vertebra in 55%. the mean length of sacral hiatus was 30.8 mm. The mean anteroposterior diameter of sacral canal at the apex of sacral hiatus was 7.25 mm.

Conclusion: The knowledge of anatomical variations of sacral hiatus is significant while administration of caudal epidural anaesthesia and it may help to improve its success rate.

KEY WORDS: Sacral hiatus, Apex, Pelvic sacral foramina, Caudal anaesthesia.

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INTRODUCTION

The opening present 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. It is located inferior to the 4th or 3rd fused sacral spines or lower end of median sacral crest. On the surface the hiatus lies about two inches above the tip of coccyx beneath the skin of natal cleft [1]. The sacral hiatus contains lower sacral and coccygeal nerve roots, filum terminale externa and fibro-fatty tissue. In recent state the hiatus

is covered by superficial posterior sacrococcygeal ligament which is attached to the margins of the hiatus and the deep posterior sacro-coccygeal ligament attached to the floor of sacral hiatus. Sacral hiatus has been utilized for administration of epidural anaesthesia in obstetrics [2] as well as in orthopedic practice for treatment and diagnosis [3]. The reliability and success of caudal epidural anaesthesia depends upon anatomical variations of sacral hiatus as observed by various authors [3,4,5,6]. The present study was undertaken to find out the anatomical variations of sacral hiatus.

MATERIALS AND METHODS

The present study was conducted in the Department of Anatomy, Osmania Medical College, Hyderabad, Telengana state. 60 dry human sacra were collected from department of anatomy. Each sacrum was studied for different features of sacral hiatus with regards to:

1. Shape of hiatus
2. Level of apex of hiatus
3. Level of base of hiatus
4. Length of hiatus – measured from apex to midpoint of the base
5. Antero-posterior diameter of sacral hiatus at the apex
6. Transverse width of sacral hiatus at the base

The measurements were taken with the help of caliper, divider and measuring tape.

Observations were noted.

RESULTS

Fig. 1: 'U'-shaped sacral hiatus.



Fig. 2: 'V'-shaped sacral hiatus.



Fig. 3: Dumble-shaped sacral hiatus.



Fig. 4: Bifid-shaped sacral hiatus.



Fig. 5: Irregular-shaped sacral hiatus.



Fig. 6: non-fusion of 1st sacral vertebra.



Fig. 7: sacrum showing five sacral foramina.



Fig. 8: Sacrum showing five sacral foramina.



Fig. 9: Sacrum showing high sacral hiatus.



The present study was conducted on 60 dry sacra in the department of anatomy. All the parameters mentioned above were taken and results are depicted. In these 60 sacra 45% showed inverted V-shape, 40% showed U-shaped, 1.7% showed bifid, 1.7% showed irregular, 1.7% showed dumble shaped sacral hiatus. The apex of sacral hiatus was commonly found at the level of 4th sacral vertebra in 55%. the mean length of sacral hiatus was 30.8mm. The mean anteroposterior diameter of sacral canal at the apex of sacral hiatus was 7.25mm.

One sacrum had variation of non fusion of upper segment (arch of 1st sacral vertebra is not fused), while remaining sacral segments are fused normally (Fig-6). Two sacra showed 5 lateral sacral foramina instead of 4 lateral sacral foramina (Fig-7,8) this could be due to ossification of lateral sacro coccygeal ligaments or could be ossification and splitting of the lateral sacrococcygeal ligament. Out of 60 sacra one showed non fusion of posterior arch of all lower four sacral vertebrae (Fig-4).

Table 1: Shape of sacral hiatus (n = 60).

S.NO	SHAPE	NO	Percentage
1	V-SHAPE	27	45%
2	U-SHAPE	24	40%
3	DUMBELSHAPE	3	1.70%
4	BIFID	3	1.70%
5	IRREGULAR	3	1.70%

Table 2: Location of apex in relation to level of sacral vertebra (n = 60).

S.NO	LOCATION OF APEX	NO	Percentage
1	4th	33	55%
2	3rd	18	30%
3	5th	6	10%
4	2nd	3	5%

Table 3: Location of base of hiatus in relation to sacral coccygeal vertebra (n = 60).

S.NO	LOCATION OF BASE	NO	Percentage
1	4th	3	5%
2	5th	36	60%
3	COCCYX	21	35%

Table 4: Anteroposterior diameter of sacral canal at the level of apex (n=60).

S.NO	DIAMETER	NO	Percentage
1	0-5 mm	12	20%
2	6-10 mm	45	75%
3	>10 mm	3	5%

Table 5: Distance between the sacral cornua at base of sacral hiatus (n = 60).

S.NO	DISTANCE	NO	Percentage
1	0-10mm	3	5%
2	11-20mm	54	90%
3	21-30mm	3	5%

Table 6: length of sacral hiatus from apex to midpoint of base (n=60).

S.NO	LENGTH	NO	PERCENTAGE
1	0-15mm	9	15%
2	16-30mm	24	40%
3	31-45mm	18	30%
4	46-60mm	9	15%

DISCUSSION

Study on the variation in anatomical features of sacral hiatus and the dorsal wall of sacral canal is related with regards to its clinical application in caudal epidural anaesthesia. Standard

textbooks [1] mentions the lower end of sacral canal is an arch shaped sacral hiatus. Sacral hiatus has a somewhat triangular outline when seen from the dorsal aspect [7]. Vinod kumar et al (1992) [6] noted various shapes of sacral hiatus, most common being inverted V and inverted U in 76.23% sacra, 7.43% were dumbbell shaped. In the present study also the shapes of sacral hiatus were variable, most common inverted U (40%) and inverted V (45%). In 1.7% its outline was like a dumbbell while in 1.7% it was irregular. Bifid hiatus was seen in 1.7% which has not been reported in earlier studies. There was complete agnesis of dorsal bony wall of sacral canal in 1.7% sacra of the present study. This is similar to that reported by previous authors namely Trotter et al (1944) [7] 1.8% and Vinod Kumar et al (1992) [6] 1.49%. In 1.7% of sacra in present study the hiatus was absent due to bony overgrowth which is also reported by Vinod kumar et al (1992) [6] in 0.99% where as in a study by Sekiguchi M et al (2004) [3] it was absent in 3% cases. In the present study the apex of sacral hiatus was seen most commonly at the level of 4th sacral vertebra. Standard textbooks (Peter L.William et al 2000) [1] states that the apex of sacral hiatus is present at level of 4th sacral vertebra. Various studies have shown similar results namely Vinod Kumar et al (1992) [6] reported in his series that the apex of sacral hiatus was most commonly (76.23%) present against 4th sacral segment, Sekiguchi M et al (2004) [3] noted the apex of sacral hiatus at S4 level in 64% cases. Earlier studies Trotter et al (1944, 1947) [7,5] and Lanier et al (1944)[8] in their series have reported the mean level of apex of hiatus to be at lower third of 4th sacral vertebra. All studies including the present study noted that location of apex can vary from upper end of S2 to lower part of S5.

The base of sacral hiatus was seen at level of S5 vertebra in 72.6% sacra, similar to Vinod kumar et al (1992, 83.17%)[6]. It extended to coccyx in 16.3% cases. These sacra had coccygeal ankylosis. The length of hiatus varied from 5mm to 6.9mm and in about 2/3 of sacra (65.8%), it was 13.55 mm in the present study. Vinod kumar et al (1992)[6] observed mean length of hiatus as 20 mm in males and 18.9 mm in females. Trotter et al (1945)[4] have

reported hiatal length as 24.8 mm in American males and 19.8 mm in females. Similar results were noted by earlier studies of Trotter et al (1944)[7] in which the length of hiatus varied from 0-60 mm with a mean of 22.5 mm and Lanier et al (1944)[8], mean length of hiatus being 25.3 ± 9 mm. The anteroposterior diameter of sacral canal at apex of sacral hiatus is important as it should be sufficiently large to admit a needle. Various diameters lead to subcutaneous deposition of anesthetic drug. In the present study the anteroposterior diameter ranged from 5 mm to 14 mm with a mean of 7.25mm. Lanier et al (1944)[8] who reported mean width at base to be 19.3 ± 0.3 mm and Vinod Kumar et al (1992)[6] who reported 5-20 mm (1.3 in mean) and 8-18mm (1.25 mm mean) in male and female sacra of his series. Seikieguchi M et al (2004)[3] have reported a lower figure of 10.2 ± 0.35 mm. However, this may be because they noted the average distance between sacral cornua. In the present study the values in 90% of sacra range from 11-20mm.

CONCLUSION

The sacral hiatus has anatomical variations and understanding of these variations may improve the success rate of caudal epidural anaesthesia. In the present study, elongated hiatus and narrowing of the sacral canal at apex of sacral hiatus was found in a significant percentage, which should be kept in mind while giving caudal anaesthesia in Telengana population.

Conflicts of Interests: None

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