

Variation in Morphometry of Dry Human Sacral Hiatus

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Abstract

The detailed morphometrical study of sacral hiatus is of great relevance, since this route is frequently utilized for caudal epidural anaesthesia in perineal surgery & caudal analgesia for a painless delivery. The sacra were studied for sacral composition, shape of hiatus, level of apex of hiatus, level of base of hiatus, length of hiatus, AP depth of sacral canal & transverse width of sacral hiatus. The present study was done on 50 dry sacral bones. In the present study the shapes of sacral hiatus were variable; most commonly inverted-U in 16 (32%) sacra and inverted-V in 10 (20%) sacra.

Key Words

Sacrum, Sacral hiatus, Morphometric

Introduction

Opening present at the caudal end of the sacrum is called sacral hiatus & is formed due to failure of fusion of lamina of fifth sacral vertebra. It is immense importance as it contains pair of sacral nerves, coccygeal nerves, filum terminale and fibro fatty tissue. As caudal epidural anesthesia & analgesia is obtained by injecting local anesthetic through sacral hiatus. In view of its varied clinical importance the present study was done on dry sacral bones to study morphological & morphometric parameters of sacral hiatus. The reliability and success of caudal epidural anesthesia depend on anatomical variation of sacral Hiatus Suma HY *et al* (1) Administration of epidural anesthesia has been widely utilized by obstetricians, orthopaedicians for treatment and diagnosis and also for the treatment of lumbar spinal

disorders and management of chronic back pain (2,3-9)

Material and Methods

The present study was conducted in the postgraduate department of Anatomy, Government medical collage Jammu on 50 dry sacral bones of unknown sex. The equipments used for measuring different parameters were sliding caliper, divider & steel measuring tape. The sacra were studied for sacral composition, shape of hiatus, level of apex of hiatus, level of base of hiatus, length of hiatus, AP depth of sacral canal & transverse width of sacral hiatus.

Results

Shape of sacral hiatus in most of the bones were inverted U (32%), followed by inverted V (20%) and dumbbell and irregular (10% each). Study of level of apex

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of sacral hiatus revealed that in maximum sacra it was at 4th sacral vertebra (48%), followed by 26% at 3rd sacral vertebra and 12% at level of 5th sacral vertebra . In majority of sacra, the level of base of sacral hiatus was at the level of 5th sacral vertebra (56%) followed by 32% at the level of 4th sacral vertebra . Length of sacral hiatus ranged between 0.6 to 5 cm with maximum sacral bones having length between 1.0 to 1.9 cm (38%) followed by 2.0 to 2.9 cm (30%) and 0.6 to 0.9 cm (10%). AP depth of sacral canal at level of apex of sacral hiatus ranged between 0.2 to 1.4 cm with maximum number of sacra had depth less than 0.5 cm (64%) and followed by 28% between 0.6 to 1.0 cm . Transverse width of sacral

hiatus at the level of base ranged between 0.5 to 2.0 cm where maximum number of sacra had width between 1.1 to 1.5 cm (46%) followed by 24% sacra had width more than 1.5 cm while 22% had between 0.6 to 1.0 cm.(Table No. 1 & 2)

Discussion

The detailed morphometric study of sacral hiatus is of great clinical importance since this route is frequently employed for caudal epidural anesthesia in perineal surgery & caudal analgesia. The present study was undertaken to evaluate the variations in different parameters of sacral hiatus. In the current study the shape of sacral hiatus were variable.

Table.1 Comparison of Sacral Hiatus Shapes of Current Study with studies as reported by other Authors

Shape of Sacral Hiatus	Kumar Vinod 1992	Nagar SK 2004	Patel ZK 2011	Shewale SN 2013	Current Study
Inverted-U	29.70%	41.5%	49.33%	40.69%	32%
Inverted-V	46.53%	27.0%	20%	32.35%	20%
Irregular	-	14.1%	-	9.31%	10%
Dumb-Bell	7.43%	13.3%	4%	5.89%	10%
Bifid	-	1.5%	-	0.49%	2%
Complete Spina Bifida	1.49%	1.5%	2%	0.98%	4%
Absence of Sacral Hiatus	0.99%	1.1%	1%	0.98%	2%
Long	-	-	21.1%	9.31%	8%
M Shaped	-	-	-	-	8%

Table.2 Incidence of Level of Apex of Sacral Hiatus and Comparison with studies as reported by other Authors in dry Human Sacral Bones

Level of Apex of Sacral Hiatus	Kumar V 1992	Nagar SK 2004	Patel ZK 2011	Shewale SN 2013	Current Study
S2	4.95%	3.4%	0.66%	4%	8%
S3	8.91%	37.3%	26.66%	15%	26%
S4	76.23%	55.9%	59.33%	66%	48%
S5	7.43%	3.4%	12.67%	14.5%	12%

Fig. 1 Inverted-U Shaped Sacral Hiatus



Fig.2 Inverted-V Shaped Sacral Hiatus



Fig.3 Dumbbell Shaped Sacral Hiatus



Fig. 4 M- Shaped Sacral Hiatus



Fig.5 Bifid Shaped Sacral Hiatus



Fig.6 Spinabifida



Most common were of inverted U-shaped (32%), inverted v-shaped in 20%, dumbbell & irregular (10% each) and 8% were M-shaped & long. Spina bifida and agenesis of sacral hiatus was seen in 2%. Kumar *et al* (4) has examined sacral hiatus for morphometric variations. He observed the most common shape of sacral hiatus was inverted V & inverted U (76.2%), dumbbell (7.4%) and complete spina bifida 1.5%. Similarly in the current the maximum sacra were inverted V & U shaped (52%), spina bifida was seen only in 2%. Similarly Nagar SK (5), Patel (6), Aggarwal A *et al* (7) & Shewale (8) also identified inverted U & V as most shaped of sacral hiatus constituting 68%, 69%, 72% and 73% respectively. Most striking variation with previous authors with the current study that in latter had M-shaped sacral hiatus (8%) was not reported earlier.

In present study level of apex of sacral hiatus in majority was at the level of 4th (48%) followed by at level of 3rd (26%), level of 5th (12%) and at the level of 2nd vertebra (8%). Base of sacral hiatus in maximum number of sacra was at level of 5th sacral vertebra (56%) and at the level of 4th vertebra (32%). Various studies have also shown similar results. Length of sacral hiatus ranged between 0.6 to 5 cm with maximum sacral bones having length between 1.0 to 1.9 cm (38%) followed by 2.0 to 2.9 cm (30%) and 0.6 to 0.9 cm (10%). AP depth of sacral canal at level of apex of sacral hiatus ranged between 0.2 to 1.4 cm with maximum number of sacra had depth less than 0.5 cm (64%) and followed by 28% between 0.6 to 1.0 cm. Transverse width of sacral hiatus at the level of base ranged between 0.5 to 2.0 cm where maximum number of sacra had width between 1.1 to 1.5 cm (46%) followed by 24% sacra had width more than 1.5 cm while 22% had between 0.6 to 1.0 cm.

Patel *et al* (6) showed that 59.33% had apex of sacral hiatus at the level of 4th sacral vertebra, length of sacral hiatus 0.4 to 5.7 cm. Sekiguchi M *et al* (9) & Shewale (8) showed that 65% & 66% had apex of sacral hiatus at the level of 4th sacral vertebra respectively. Length of sacral hiatus 0.5 to 5.3 cm & transverse width between 0.4 to

1.8 cm. Kumar *et al* (4) showed that 76.23% had apex of sacral hiatus at the level of 4th sacral vertebra, length of sacral hiatus 0.3 to 3.7 cm, AP diameter between 0 to 1.2 cm and transverse width 0.5 to 2.0 cm. (Table No.1 & 2)

Conclusion

In maximum number of sacra, the sacral hiatus was inverted U shaped (32%) or V shaped (20%) while 8% had M shaped which has not been reported in the earlier studies. This information could be useful for conducting anaesthetic procedures.

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