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Original Research Article

STUDY OF SACRAL HIATUS IN DRY BONES

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ABSTRACT

Background: Sacral hiatus is used for giving caudal epidural anaesthesia. Detailed knowledge of the anatomy of the sacral hiatus and its variations is essential to prevent the failure of caudal epidural anaesthesia and also while performing procedures like transpedicular or lateral mass screw placement in the sacrum.

Materials and Methods: 110 dry human sacra was used for the study. The shape of sacral hiatus and location of the apex of the hiatus in relation to the level of sacral vertebra was noted.

Results: Sacral hiatus presented an inverted 'U' shape in 39.09%, inverted 'V' in 29.09%, dumbbell in 10%, bifid in 5.45%, irregularly shaped in 9.09%, elongated in 5.45% and in 1.81% total spina bifida occulta was observed.

Apex was located at the level of 4th sacral vertebra in 57.40%, at the level of 3rd sacral vertebra in 35.18% at 2nd sacral vertebra in 5.55% and at 5th sacral vertebra in 1.85%.

Conclusion: Variations in the anatomy of the sacral hiatus is one of the reason for the failure of caudal epidural block. Variations also pose a problem in transpedicular or lateral mass screw placement in the sacrum. Absence of the sacral hiatus, complete absence of the dorsal wall (total spina bifida occulta) should be kept in mind while performing any procedures in this region.

KEY WORDS: Sacrum, Sacral Hiatus, Spina Bifida Occulta.

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INTRODUCTION

The speciality of the vertebrae in the sacral region is their fusion. The five sacral vertebra fused to form a single bone that is sacrum. The sacrum articulates on either side with the innominate or hip bone to complete the pelvis from postero superior aspect. Lamina, pedicle and spines of the sacral vertebra fuses with each other and encloses the sacral canal.

The sacral canal contains cauda equina, filum terminale and the spinal meninges [1]. The sacral canal opens at the caudal part through an opening known as sacral hiatus. Sacral hiatus is the result of failure of fusion of the laminae of sacral vertebra in the caudal part [2].

Lower sacral spinal nerves, coccygeal nerves and filum terminale externa emerge from the sacral hiatus which is filled by fibro fatty tissue [1]. In recent state the hiatus is covered by sacrococcygeal membrane/ ligament [2].

The clinical importance of sacral hiatus is for the fact that it is utilised for caudal epidural anaesthesia. Caudal epidural block is performed for the diagnosis and treatment of lumbar spine disorders [3]. Edward and Hingson in 1941 for the first time used the lower end of sacral canal for continuous caudal analgesia during labour [4].

The knowledge of anatomy and variations of sacral hiatus is important for such anaesthetic procedures Anatomical variations may possibly contribute to the failure of caudal epidural anaesthesia, transpedicular and lateral mass screw placement in sacrum [5].

The present article addresses the anatomical evaluation of the sacral hiatus which will be of importance for anaesthetists, neurologists, neurosurgeons and orthopedicians in addition to adding to the present knowledge of morphology of sacrum.

MATERIALS AND METHODS

The study was conducted in the Department of Anatomy, BGS Global Institute of Medical Sciences, Bengaluru, Karnataka. 110 dry human sacra was used for the study.

The shape of the sacral hiatus was noted along with the location of the apex of the hiatus in relation to the level of the sacral vertebra. Results were noted and dorsal aspect of the sacrum was photographed.

RESULTS AND DISCUSSION

Fig. 1: Inverted U shaped sacral hiatus

Sacral hiatus presented an inverted 'U' shape in 43 bones (39.09%), inverted 'V' in 32 (29.09%), dumbbell in 11 (10%), bifid in 6 (5.45%), irregularly shaped in 10 (9.09%) and elongated in 6 cases (5.45%). In 2 cases (1.81%) complete absence of posterior wall i.e., total spina bifida occulta was observed.

Fig. 2: Inverted V shaped sacral hiatus

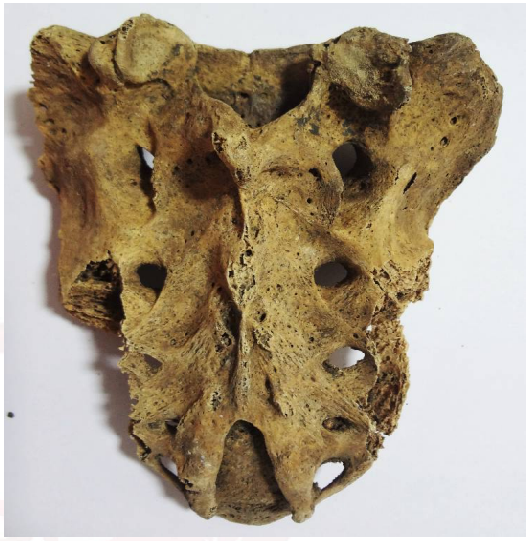

Fig. 3: Irregular sacral hiatus

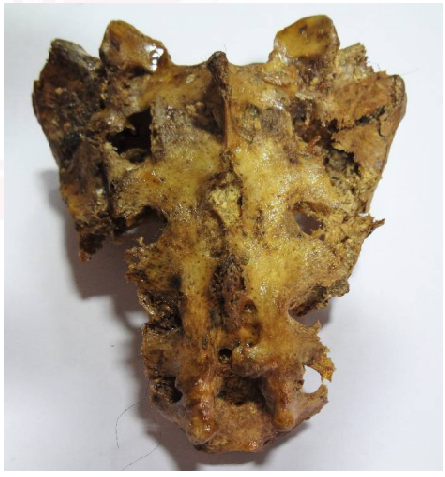

Fig. 4: Dumbbell shaped sacral hiatus

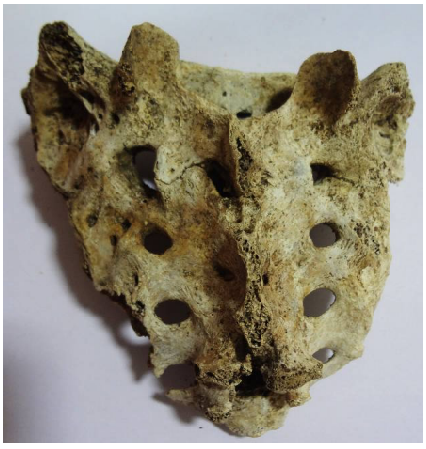

Fig. 5: Bifid sacral hiatus

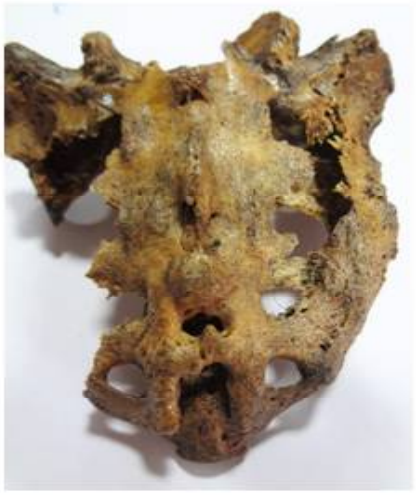

Fig. 6: Total spina bifida occulta.

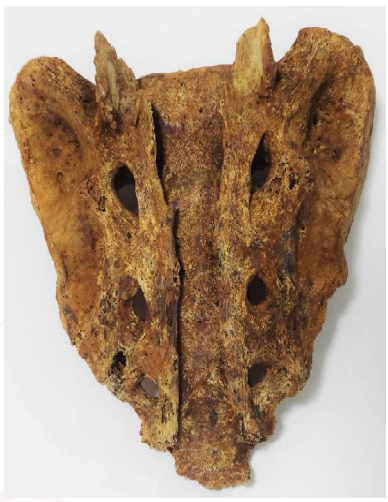

Fig. 7: Elongated sacral hiatus.

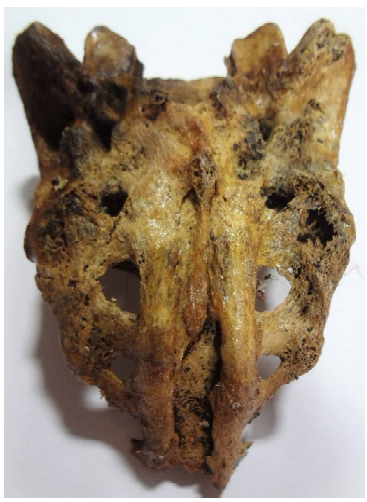

Table 1: Shape of sacral hiatus compared with other studies (in percentage).

Shape	Nagar S K [2] (n=270)	Shilpa Nilesh Shewale et al [6] (n=204)	Osunwoke E A et al [8] (n=54)	Dr Simriti et al [4] (n=50)	Vandana. K Punase et al [7] (n=66)	Present study (n=110)
Inverted U	41.5	40.69	24.1	32	33.33	39.09
Inverted V	27	32.35	33.1	20	33.33	29.09
Irregular	14.1	9.31	13	10	24.24	9.09
Dumbbell	13.3	5.89	9.3	10	-	10
Bifid	1.5	-	5.6	2	3.03	5.45
Spina bifida	1.5	0.98	-	4	-	1.81
Elongated	-	9.31	14.8	8	6.06	5.45
M – Shaped	-	-	-	8	-	-
Very low	0.4	-	-	4	-	-
Absent hiatus	0.7	0.98	-	2	-	-

Table 2: Location of apex compared to other studies (in percentage).

Location in relation to sacral vertebra	Nagar S K [2]	Shilpa Nilesh Shewale et al [6]	Osunwoke E A et al [8]	Vandana. K Punase et al [7]	Present study
2nd sacral vertebra	3.4	4	5.6	3.03	5.55
3rd sacral vertebra	37.3	15	20.4	40.9	35.18
4th sacral vertebra	55.9	66	66.6	51.51	57.4
5th sacral vertebra	3.4	14.5	7.4	4.54	1.85

Apex was located at the level of 4th sacral vertebra in 62 bones (57.40%), at the level of 3rd sacral vertebra in 38 bones (35.18%). In 6 bones (5.55%) apex was located at the level of 2nd sacral vertebra and in 2 bones (1.85%) at the level of 5th sacral vertebra.

Shape of the sacral hiatus is compared with other studies in Table 1. In our observation inverted U shaped sacral hiatus was most common type followed by inverted V. Same observations was also noted by Nagar SK [2], Shilpa Nilesh Shewale [6] and Dr Simriti [4] in their studies of shape of sacral hiatus on various population of Indian origin. Vandana K Punase [7] observed same number of inverted U and inverted V shaped hiatus. However, Osunwoke E A [8] who studied sacral hiatus shape in Nigerian population shows that the common type is Inverted V, followed by inverted U. This is of significance as it indicates the effect of race on the shape of sacral hiatus. Very low sacral hiatus was observed by Nagar SK et al and Dr Simriti et al. Absence of hiatus was observed by Nagar SK et al, Shilpa Nilesh Shewale et al and Dr Simriti et al. Dr Simriti et al reported M shaped sacral hiatus. Total Spina bifida occulta where there is

complete absence of entire posterior wall was observed by Nagar SK et al, Shilpa Nilesh Shewale et al and Dr Simriti et al. Even in the present study we found total spina bifida occulta in 2 cases (1.81%).

Spina bifida occulta is a developmental anomaly which occurs because of abnormal neurulation. This results in incomplete closure of bony tissues of vertebra in dorsal midline [9]. It typically affects the 5th lumbar and 1st sacral vertebra [10]. In total spina bifida occulta where there is complete absence of fusion of dorsal wall of all sacral vertebra contents of the sacral canal is exposed. Incidence of total Spina bifida occulta is more in females when compared to males [11]. Clinically the patient might be completely asymptomatic or it could lead to many neurological deficits [9]. Spina bifida occulta of sacral region could also be a reason for nocturnal enuresis in children [10], functional disorders of lower urinary tract [12], backache and neurological abnormalities of foot [9]. Presence of spina bifida increases the chances of damage to sacral nerves and also pose a problem in internal fixation via screws [5].

Textbooks states the location of apex of sacral hiatus at the level of 4th sacral vertebra [1]. Various studies conducted previously and our present study observed similar results. Apex at the level of 4th sacral vertebra is most common followed by apex at the level of 3rd sacral vertebra. Comparison of location of apex of sacral hiatus is given in Table 2. The level of the apex varies from 2nd sacral vertebra to 5th sacral vertebra.

Understanding the normal anatomy of sacral hiatus, its shape and position of the apex in relation to the sacral vertebra is an important factor to decide the success of caudal epidural block. Anatomic variation is one of the factors which leads to failure of caudal epidural block. Palpation of the apex of the sacral hiatus shows the position of the sacral hiatus. The palpation of sacral hiatus, its apex sometimes becomes a difficult task for the clinicians. According to Sekiguchi et al failure of caudal epidural block in 3-11% of patients is because of anatomical abnormalities [3]. According to Senoglu et al deficient dorsal wall may be a cause of failure of caudal epidural block in about 6.2% cases [13]. Hence, understanding the anatomical variations in dry bones is of importance for clinical practice [11].

CONCLUSION

Shape of the sacral hiatus and location of the apex in relation to the sacral vertebra was studied in dry sacrum. Caudal epidural block is performed for the diagnosis and treatment of lumbar spine disorders and is given through the sacral hiatus. Variations in the anatomy of the sacral hiatus are one of the reasons for the failure of caudal epidural block. Variations also pose a problem in transpedicular or lateral mass screw placement in the sacrum. Absence of the sacral hiatus, complete absence of the dorsal wall (total spina bifida occulta) should be kept in mind while performing any procedures in this region.

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Conflicts of Interests: None

REFERENCES

[1]. Susan Standring. Gray's Anatomy: The anatomical basis of clinical practice. 40th Edition. Churchill Livingstone Elsevier; 2008:724-728

[2]. Nagar S K. A study of sacral hiatus in dry human sacra. J. Anat. Soc. India 2004;53(2): 18-21.

[3]. Sekiguchi M, Yabuki S, Saton K, Kikuchi S. An anatomical study of the sacral hiatus: a basis for successful caudal epidural block. Clin. J. Pain 2004;20(1):51-54.

[4]. Dr Simriti, Dr Bias Dev, Dr Deepa Hans, Dr SunandaRaina. Morphology of sacral hiatus in dogra region of India. International Journal of Advanced Research 2015;3(10):605-609.

[5]. Srijit D, Shipra P. Spina bifida with higher position of sacral hiatus: a case report with clinical implications. Bratisl Lek Listy 2007;108(10-11):467-469.

[6]. Shilpa Nilesh Shewale, Mohammad Laeeque, P R Kulkarni, Chaya Vijay Diwan. Morphological and morphometrical study of sacral hiatus. International Journal of Recent Trends in Science and Technology 2013;6(1):48-52.

[7]. Vandana K Punase, Natwar Lal Agarwal. Morphometric study of sacral hiatus for caudal epidural block (Ceb) in adult human dry sacrum in central India 2016;5(3): 224-227.

[8]. Osunwoke E A, Oladipo G S, Allison T A, Orlu E. A study of sacral hiatus in dry human sacra in southern Nigeria. Journal of Health, Medicine and Nursing 2014;3:51-55.

[9]. Nimet Senoglu, Mehmet Senoglu, Yakup Gumusalan. Total spina bifida occulta of the sacrum. International Journal of Anatomical variations 2008;1:26-27.

[10]. Sang Hee Shin, Young Jae Im, Mi-Jung Lee, Yong Seung Lee, Eun Kyoung Choi, Sang Won Han. Spina bifida occulta: Not to be overlooked in children with nocturnal enuresis. International Journal of Urology 2013;20:831-835.

[11]. Vishal Kumar, Soubhagya Ranjan Nayak, Bhagath Kumar Potu, Thejodhar Pulakunta. Sacral hiatus in relation to low back pain in south Indian population. Bratisl Lek Listy 2009;110(7):436-441

[12]. A Fidas, H L MacDonald, R A Elton, A McInnes, S R Wild, G D Chisholm. Prevalence of spina bifida occulta in patients with functional disorders of the lower urinary tract and its relation to urodynamic and neurophysiological measurements. BMJ 1989; 298:357-359.

[13]. N. Senoglu, M. Senoglu, H. Oksuz, Y. Gumusalan, K. A. Yuksel, B. Zencirci, M. Ezberci, E. Kizilkanat. Landmarks of the sacral hiatus for caudal epidural block: an anatomical study. British Journal of Anaesthesia 2005;95(5):692-695.

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