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STUDY OF DORSAL SURFACE OF SACRUM

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Conflicts of Interest: Nil

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Abstract:

Introduction: *Sacrum is a large triangular bone formed by fusion of five sacral vertebrae. It is place as a wedge between two innominate bones at superior posterior part of pelvic cavity. There is an opening present at the caudal end of sacral canal called sacral hiatus. It is formed by the nonfusion of the lamina of the fifth (occasionally fourth) sacral vertebra. For the perception it is bony concavity laid the sacred organs of procreation, the ovaries and uterus. The sacrum is usually last bone of a buried body to disintegrate because of its greater size. Some evidence of the archaeology reported that to support the use of sacrum as a vessel to hold the sacrifice in ancient sacred rites. In the ancient period of Egypt it was considered as "Osiris" the god of resurrection and of agriculture. The application on knowledge and its Clinical application depend on availability of the variations seen in the sacrum. There are important when interpreting the radiographs and when considering the particular sites of the pathological features of bone and soft tissue. Therefore on the basis of surface anatomy sacral region is supposed to be an important aspect.*

Objective: *The main objective of this study is to observed the variations of sacral hiatus in both sex that help for better reliability of caudal epidural block.*

Material and method: *In this study total 100 human dry sacra of both sexes were used which was divided as male and female as 50 each. Morphometrical studies of dorsal surface of sacrum were done with respect to different parameters like level of sacral hiatus, composition of sacrum and deficiencies and apertures level of apex & base of sacral hiatus.*

Result: *Level of apex of sacral hiatus at S4 (62%) was most common. 5% of the cases were Elongated sacral hiatus at the level of S2. 70% of cases showed normal 5 segments whereas 4 segmented sacra were observed in 4% of cases and 6% in sacralization of 5th lumbar vertebra and 20% as coccygeal ankylosis. Normal sacral cornua on both sexes were present in 41% followed by unilateral cornua in 21%. 13% of the cases showed absent of Sacral cornua and 25% cases of sacra showed deficiencies apertures in the bony dorsal wall of sacral canalwhich is most prevelanve to male gender.*

Conclusion: *Dorsal wall of sacrum has various anatomical variations. Hence there is a great importance of the normal sacral hiatus and their variation is of great clinical significance. These variations improved understanding reliability and success of caudal epidural anesthesia. The features of sacral hiatus associated with sexes reflected the structural and functional differences sacra and pelvis in both sexes.*

Keywords: *Sacral hiatus, Sacral canal, Sacrum, Caudal epidural anesthesia (CEA)*

Introduction

Sacrum is a large triangular bone formed by fusion of five sacral vertebrae. It is place as a wedge between two innominate bones at superior posterior part of pelvic cavity. There is an opening present at the caudal end of sacral canal called sacral hiatus. It is formed by the nonfusion of the lamina of the fifth (occasionally fourth) sacral vertebra. Components and variations in sacrum features on its dorsal surface, have been reported[i,ii]. In Latin the word sacrum means "Sacred". This Latin word, "sacred" name is derived which is a translation of the Greek word hieron (osteon), meaning sacred or strong bone. In English it means the large heavy bone at the base of the spine. In Greek it is known as "hieron" which meant not only sacred but also a "Temple". In Romans it is also called the "Os Sacrum" which literally meantthe "Holy bone". For the perception it is bony concavity laid the sacred organs of procreation, the ovaries and uterus. The sacrum is usually last bone of a buried body to disintegrate because of its greater size. Some evidence of the archaeology reported that to support the use of sacrum as a vessel to hold the sacrifice in ancient sacred rites. In the ancient period of Egypt it was considered as "Osiris" the god of resurrection and of agriculture[iii, iv]. In the structure of dorsal wall of sacral

canal are numerous and have different vibrations. There is an opening which may be low lying lamina of first sacral vertebra. It is found that there is much other variation such as obliteration of lumen of sacral canal, deficiencies between its superior and inferior limits and bony overgrowth obliterating the hiatus[v]. The application on knowledge and its Clinical application depend on availability of the variations seen in the sacrum. There are important when interpreting the radiographs and when considering the particular sites of the pathological features of bone and soft tissue. Therefore on the basis of surface anatomy sacral region is supposed to be an important aspect[vi]. One of the studied reported in 1942 that in in obstetrics, the sacral hiatus region is selected for the administration of continuous caudal epidural anesthesia (CEA)[vii]. The presence of large hiatus may prove to owing to the risk of puncturing the dural sac, making an intradural injection and dangerous to life. Therefore because of the possibility of puncturing the dura complete agenesis of the dorsal wall may be one of the rare contraindication to CEB[viii]. Hence for the clinician in determining the location of sacral hiatus and increases the success rate of CEB practical guide will be of benefit[ix]. The main aim of this study is to observed the variations of sacral hiatus in both sex that help for better reliability of caudal epidural block.

MATERIAL AND METHOD:

This study was conducted in the Department of Anatomy at Madhubani Medical College Keshopur Bihar. In this study total 100 human dry sacra of both sexes were used which was divided as male and female as 50 each. By calculating the sacral index Sexing of sacrum was done.

$$\text{Sacral Index} = \frac{\text{Maximum breadth}}{\text{Maximum height}} \text{ X } 100$$

Note:

a. Maximum breadth of sacrum: the distance between straight lines between two points at the lateral most point of the ala of the sacrum by dial caliper.

b. Maximum height of sacrum: straight distance between the sacral promontories in the mid sagittal plane to the corresponding lowest point on the anterior margin of the sacrum by dial caliper.

According to sacral indices measurement sacra were divided into 2 groups as its depending upon sexes. Less than (<) 105 sacral indices note as male sacra whereas sacra with more than (>)115 were noted as female sacra and SI between 105 and 115 were not considered. For separation of male and female sacrum various parameters of each sacrum were studied under the following headings:

a) Sacral composition

b) locations of the apex and the base of the sacral hiatus

c) Presence and absence of sacral cornua

d) the shape of the sacral hiatus based on the upturned end of its apex

e) Deficiencies in the dorsal wall of sacrum

RESULT:

The observation features on the dorsal surface shows the variation as the level of apex of sacral hiatus from upper part of S2 to lower part of S5. Level of apex of sacral hiatus at S4 (62%) was most common. 5% of the cases were Elongated sacral hiatus at the level of S2. 70% of cases showed normal 5 segments whereas 4 segmented sacra were observed in 4% of cases and 6% in sacralization of 5th lumbar vertebra and 20% as coccygeal ankylosis as shown in table no 1 and 2 respectively below.

Table 1: Showing level of apex of sacral hiatus with respect to sacral vertebra in both gender

Level of apex of sacral hiatus	Male	Female	Percentage (N=100)
Level of apex of sacral hiatus at S2	2	3	5
Level of apex of sacral hiatus at S3	7	11	18
Level of apex of sacral hiatus at S4	30	32	62
Level of apex of sacral hiatus at S5	6	4	10
Complete spina bifida	4	0	4
Absent hiatus	1	0	1
Total	50	50	100

Table 2: Showing sacral composition with respect to gender

Sacral composition	Male	Female	Percentage (N=100)
5 segment sacra	36	34	70
4 segment sacra	1	3	4
Sacralization of 5th lumbar vertebra	6	0	6
Coccygeal ankylosis	7	13	20
Total	50	50	100

Normal sacral cornua on both sexes were present in 41% followed by unilateral cornua in 21%. 13% of the cases showed absent of Sacral cornua and 25% cases of sacra showed deficiencies apertures in the bony dorsal wall of sacral canalwhich is most prevelanve to male gender as shown in table no 3 below.

Table 3: Showing presence or absence of sacral cornua with respect to gender

Sacral cornua	Male	Female	Percentage (N=100)
Bilateral sacral cornua	22	19	41
Unilateral sacral cornua	7	14	21
Absent sacral cornua	6	7	13
Deficiencies in the dorsal wall	15	10	25
Total	50	50	100

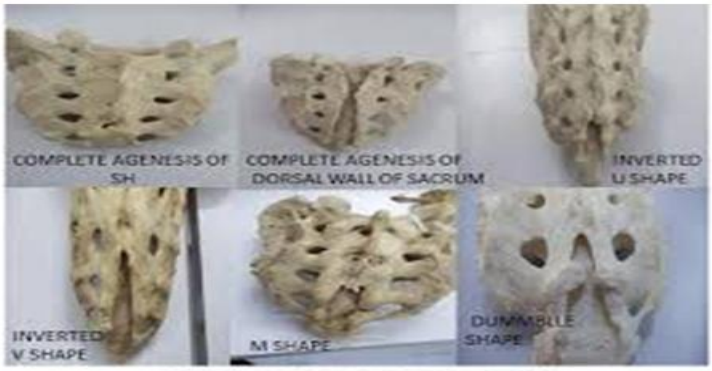

Figure 1: Different Shapes of Sacral Hiatus

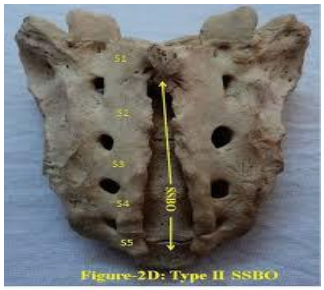

Figure 2: Showing type-III SSBO. level of apex of sacral hiatus is at S2 vertebra. SSBO- Sacral spina bifida occulta, D- dorsal surface of sacrum, S1, S2, S3... are level of sacral spines

Figure 3: Showing type-III SSBO. Level of apex of sacral hiatus is at S2 vertebra. SSBO- Sacral spina bifida occulta, D- dorsal surface of sacrum, S1, S2, S3... are level of sacral spines

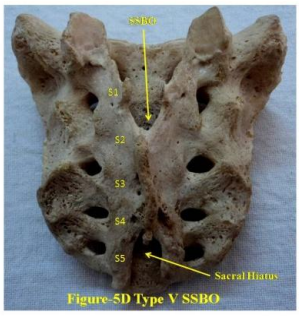

Figure 1: Showing Type-V bifida on dorsal surface of sacrum. S1, S2, S3, S4 and S5 show sacral spine1 to spine 5 and SSBO stands for sacral spina bifida occulta.

DISCUSSION:

In this study the detailed morphometric study of sacral hiatus was done. In this route is frequently employed for caudal epidural anaes thesia. In this study common location of level of apex of sacral hiatus was found to be 4th sacral vertebra 62% followed by 3rd sacral vertebra 18% in both sexes sacrum which is compared with the study done by Trotter and Letterman[x]. complete agenesis of sacral hiatus in about 3% of sacra which were all male sexes which is little bit higher that other studied as Vinod Kumar[xi] 1.49%, Nagar SK[xii] 1.5%. in this study Absent hiatus is rare and observed in only one male sacra which is little bit more as comparable to studied of Nagar[xiii] 0.7%, and little bit less as comparable to studied of Seikiguchi M[xiv] 3%. In this study observation of sacrum had normal 5 segment composition as 70%, four segmented sacra as 4%, Sacralization of 5th lumbar vertebra as 6% and Coccygeal ankylosis as 20% which is also similar to the studied done by Vinod Kumar. There are many studies which showed the incident of coccygeal ankylosis to be much greater than sacralization of 5th lumbar vertebra. In this study four segmented sacra were observed 3% in female and 1% in male. The percentage of four segmented sacra in female was more which may be due to an evolutionary change in reduction of vertical dimension of female pelvis to facilitated labour which is also similar to the studied of Vinod Kumar[xv]. For the identification of sacral hiatus during CEB Sacral cornua act as important landmark. This study showed normal sacral hiatus was present in 41%, unilateral sacral cornua in 21% which is similar to studied of Black[xvi] whereas some difference from Seikiguchi [xvii]which may be due to influence the palpation of sacral hiatus. Bony dorsal wall of sacral canal is less observed as 25% with higher prevalence to male and this is almost similar to the studied of trotter[xviii]. Apertures in the dorsal wall of sacral canal although closed by ligaments which may supply getaway for the tip of needle leading to subcutaneous infusion.

CONCLUSION:

Opening at the caudal end of sacral canal is called sacral hiatus which is formed due to the failure of fusion of laminae of the fifth (occasionally fourth) sacral vertebra. Dorsal wall of sacrum has various anatomical variations. Hence there is a great importance of the normal sacral hiatus and their variation is of great clinical significance. These variations improved understanding reliability and success of caudal epidural anesthesia. The features of sacral hiatus associated with sexes reflected the structural and functional differences sacra and pelvis in both sexes.

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