



ORIGINAL RESEARCH PAPER

Anatomy

STUDY OF VARIATIONS OF SACRAL HIATUS.

KEY WORDS:

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ABSTRACT

Sacrum is formed by the fusion of five sacral vertebrae and forms the lower part of vertebral column. The opening present at the lower end of sacral canal is known as sacral hiatus. Anatomical variations in morphology of sacral hiatus are important clinically as 25% failure rate of caudal epidural block has been reported in literature. The failure rate of this procedure may be due to variant anatomical features of sacral hiatus. Hence knowing the anatomical variations in shape,size, level of apex and base of sacral hiatus is of paramount importance to clinicians to reduce failure rate of caudal epidural block. For this reason literature search was done on 50 dry clean human Sacra which were taken from Department of Anatomy, Govt Medical College Srinagar j and k india. Various shapes of sacral hiatus were observed which included inverted U (36%), inverted V (22%), irregular (16%), dumbbell (8%) and agenesis (4%). The apex of sacral hiatus was commonly found at the level of 4th sacral vertebra in 60 % of cases while base was commonly found at 5th sacral vertebrae in 86 % of the cases. The length of the hiatus was between 11 to 20 mm in 28 sacrum (56%).

INTRODUCTION:-

In human anatomy sacrum is a large, triangular bone at the base of the spine that is formed by the fusing of sacral vertebrae S1–S5¹. The sacrum is considered to be sacred because it occupies the lower part of the back which is always covered as a mark of respect². The sacrum has a base, an apex, and three surfaces – a pelvic, dorsal and two lateral surfaces. On the dorsal surface there is a sacral hiatus which is formed by the failure of fusion of lamina of fourth or fifth sacral vertebra with the median plane which has many variations³.

The Sacral hiatus was named by romans which is a direct translation from the older greek hieron osteon⁴. sacral hiatus is palpable in living subjects as it lies 2 inches away from the tip of the coccyx. Certain structures pass through it which include 5th sacral nerve, a pair of coccygeal nerve, filum terminale and fibrofatty tissue^{5,6}.

The shape and extent of sacral hiatus is of great clinical importance because caudal epidural anaesthesia is given through it⁷. It is performed by inserting a needle through the sacral hiatus to gain entrance into the sacral epidural space.

caudal anaesthesia is done to carry out urgent procedures such as reduction of incarcerated hernias -superficial operations such as skin grafting, perineal procedures, orthopaedic procedures on pelvic girdle and lower limbs⁸. Using conventional blind technique, the failure rate is high in adults even in experienced hands. This high failure rate could be attributed to anatomic variations that make locating sacral hiatus difficult.

However nowadays it is recommended to use ultrasound guided needle placement for caudal block thus increasing the overall success rate to 100%⁹. Recently fluoroscopy is considered as gold standard for placing needle in the sacral hiatus correctly^{10,11}. But in order to perform these sophisticated procedures, the clinicians must have a good knowledge of anatomical variations of sacral hiatus. Thus an attempt has been made to study the various dimensions of sacral hiatus.

Materials and Methods:-

The study was conducted on 50 dry human sacra obtained from Postgraduate Department of Anatomy GMC Srinagar. Only

bones complete in all aspects and with clear sacral hiatus were studied. Measurements were taken in millimeters with the help of vernier caliper. Following parameters were studied:

1. Shapes of Sacral Hiatus.
2. Level of Apex of Hiatus.
3. Level of Base of Hiatus.
4. Length of Sacral Hiatus.

RESULTS:

In our present study we found a lots of variation in sacral hiatus. All findings are discussed under following headings.

Apex of sacral hiatus:

The apex of sacral hiatus extends between 2nd to 5th sacral vertebra. In present study two (4%) sacrum was found to have sacral agenesis. Level of apex of sacral hiatus at S4 was found in 30 (60%), followed by S3 which was present in 15 sacrum (30%), followed by S5 which was present in 3 sacrum (6%). The different levels of apex are shown in table (table 1).

Table 1: level of apex of sacral hiatus with respect to sacral vertebra.

Sl.No	Apex	Number (n=50)	Percentage
1	3rd Sacral Vertebra	15	30%
2	4th Sacral Vertebra	30	60%
3	5th Sacral Vertebra	03	6%

Base of sacral hiatus:

The level of base was found between 4th and 5th sacral vertebra. No cases were found at the level of 2nd and 3rd vertebra. In 43 sacrum (86%) base was found at the level of S5 and only 5 sacrum (10%) has base at the level of S4 whereas 2 sacrum (4%) was found to have sacral agenesis. The different levels of base is shown in table (Table 2).

Table 2: level of base of sacral hiatus with respect to sacral vertebra

Sl.No	Base	Number (n=50)	Percentage
1	4th Sacral Vertebra	5	10%
2	5th Sacral Vertebra	43	86%

Shape of sacral hiatus:

In present the most common shapes were inverted U (36%) and inverted V (22%) and the least common shapes were irregular (16%) followed by elongated (14%) , dumbbell (8%) and complete agenesis in 4%.The different shapes are shown in table (Table 3)

Table 3: Shape of sacral hiatus

Si.No	Shape	Number (n=50)	Percentage
1	Inverted U	18	36%
2	Inverted V	11	22%
3	Irregular	08	16%
4	Elongated	07	14%
5	Dumbbell	04	8%
6	Agenesis	02	4%



Figure-1(a)-Irregular shape



Figure-1(b) – V - shape



Figure -1(c)-Agenesis

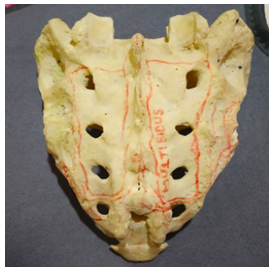


Figure -1(d) -Ushape



Figure- 1(e) Elongated



Figure – 1(f) – Bifid

Length of sacral hiatus:

The length of the hiatus was between 11 to 20 mm in 28 sacrum (56%) , 21 to 30 mm in 12 sacrum (24%), 31 to 40 mm in 7 sacrum (14%) ,41 to 50 mm in 2 sacrum (4%) and only 1 sacrum lies in the range of 0 to 1 mm. Length of the sacral hiatus is shown in table.(table 4)

Table 4 : length of the sacral hiatus

Si. no	Length of sacral hiatus	Number (n=50)	Percentage
1	0-10mm	01	2%
2	11-20mm	28	56%
3	21-30mm	12	24%
4	31-40mm	07	14%
5	41-50mm	02	4%



Figure-2- Measuring length of Sacral Hiatus

Discussion:

With the growth of an individual there are some bones which exhibit variations and sacrum is one among them because its axis changes with the growth thus making it difficult to locate hiatus in adults. Since caudal epidural anaesthesia is given through this space for various purposes for that reason one should have sound knowledge about the same.

Nagar (2004)¹² observed various shapes of sacral hiatus in Indian sacra, with maximum number of cases were found with Inverted U (41.5%) and Inverted V (27.0%), in (13.3%) cases, it was dumb-bell and in (1.14%) cases it was irregular. In present study, results obtained were in agreement with above study, most common shapes were Inverted U (36%) and Inverted V (22%), in (8%) cases it was dumb-bell, irregular in (16%) cases and elongated in (14%) cases. Patel et al. (2011)¹³ also worked on shapes and found most common type being Inverted U in (49.33%) cases and Inverted V in (20%) cases, in (4%) cases the shape was dumb-bell and (2%) cases with elongated sacral hiatus. In present study,complete agenesis of dorsal wall of sacrum is seen in two sacra (4%), similar to previous studies of Sekiguchi (2004)¹⁴ with 3% cases.

Nagar (2004)¹² found apex lying against fourth sacral vertebra in (55.9%) cases which is similar to present study, apex was found at the level of fourth sacral vertebra in (64%) cases, also were in agreement with previous studies like Sekiguchi (2004)¹⁴ in (64%) cases.

Seema et al.(2013)¹⁵ found base at the level of fifth sacral vertebra in (70.46%) cases, at fourth sacral vertebra in (13.42%) cases and coccyx in (16.10%) , similar to the present study were base lies at fifth sacral vertebra in (86%) cases and at fourth sacral vertebra in (14%) cases.

Sinha et al. (2014)¹⁶ found length of sacral hiatus between 10.01 to 20mm in (44%) cases. Nagar (2004)¹² reported length of sacral hiatus was 11mm to 30mm in (65.8%) cases which were in agreement with the present study showing length of sacral hiatus between 11 to 20mm in (56%) cases and 21 to 30mm in (24%) cases.

Conclusion:

The sacral hiatus has anatomical variations and understanding of these variations may improve the success of caudal epidural anaesthesia. The present study gives information about the variations of sacral hiatus with respect to its shape, length and various bony landmarks, which will be helpful especially for anesthetists, surgeons and gynecologists (spinal analgesia) while giving caudal epidural block.

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