AN OSTEOGENIC AGENESIS STUDY ON SACRAL CANAL & ITS IMPLICATIONS

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Abstract : Sacrum is a pelvic bone forming the lower part of Vertebral column. Sacrum is formed by the fusion of 5 sacral vertebrae under 33 vertebrae of vertebral column. The osteogenic study on sacrum was carried out with n=136 dry sacra in observing the ventral wall of sacrum and dorsal wall of sacrum. The dorsal wall of the sacrum is formed by fused laminae. In our course of anatomy laboratory peculiarly 2% (approx) of dry sacra shows the absence of sacral canal due to the non-fusion of sacral laminae leads to sacral agenesis.

Keywords : Sacrum, Sacral Hiatus, Sacral canal, Sacral Agenesis.

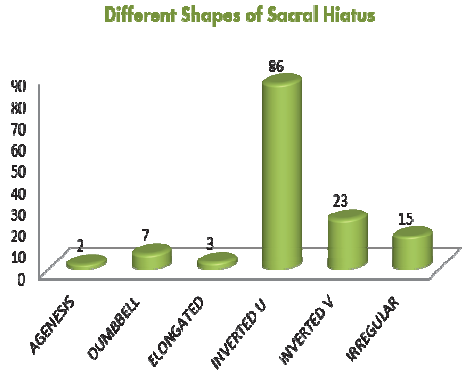
Introduction : Bones present in relation to the abdomen are the lumbar vertebrae, the sacrum and the bony pelvis. Sacrum takes part in the formation of posterior wall of bony pelvis. The sacrum is a large, flattened, triangular bone formed by the fusion of five sacral vertebrae. It forms the postero-superior part of the bony pelvis articulating on either side with right hip bone and left hip bone at the level of sacroiliac joint. As the sacrum being triangular, the sacrum has base or upper surface, an apex or lower end and four surfaces – right lateral surface, left lateral surface, dorsal surface, ventral or pelvic surface. The base is directed upwards and forwards and forms the upper surface of first sacral vertebra. It articulates with body of lumbar vertebrae (L5) forming lumbosacral joint. The apex of the sacrum is formed by the inferior surface of the body of fifth sacral vertebra and it bears an oval facet for articulation with the coccyx. Right and left lateral surfaces are formed by the fusion of transverse processes of sacral vertebrae. It appears wide above and narrow below. Dorsal surface of the sacrum is irregular and convex. In the median plane it is marked by the median sacral crest which bears spinous tubercles representing fused spines of upper four sacral vertebrae. Below the fourth spinous tubercle there is an inverted U shaped gap in the posterior wall of the sacral canal called as sacral hiatus. Sacral hiatus is formed by the non-fusion of fifth sacral vertebral laminae. Lateral to the laminae 4-pairs of dorsal sacral foramina are present. Pelvic surface is concave and in the median area is marked by four transverse ridges which indicates the lines of fusion of the five sacral vertebral bodies. Sacral canal is triangular, formed by the sacral vertebral foramina and it opens into sacral hiatus. The sacral canal contains lower sacral nerves and filum terminale which is surrounded by spinal meninges.

Aim and Objectives : To study the dry sacra and classify the various types of sacral hiatus and identify the abnormal/anomalous observations on sacrum and its implications.

Materials and Methods : Dry sacra, Vernier caliper, Inch scale, Surgical hand gloves and other stationeries.

Observations : Shapes of sacral hiatus n=136

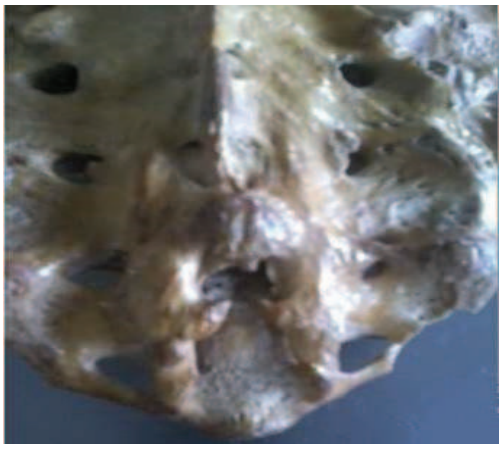
S.N	Shape	Total Sacra
1	Agenesis	2
2	Dumbbell	7
3	Elongated	3
4	Inverted U	86
5	Inverted V	23
6	Irregular	15



Normal

Agenesis

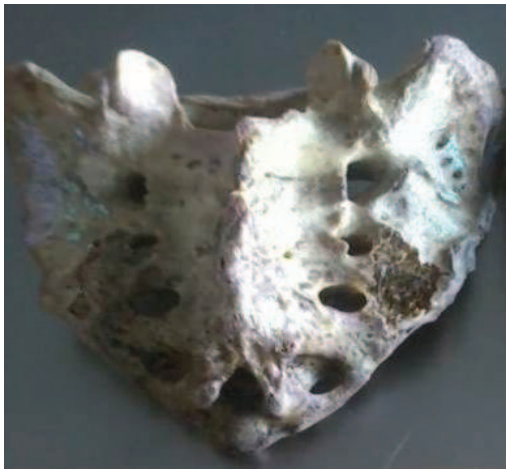
Dumbbell



Elongated

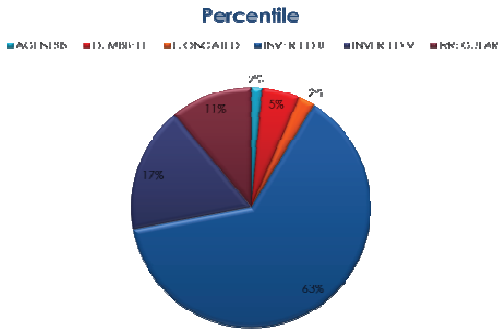
Inverted U

Inverted V



Irregular

Statistical Analysis



Normal Sacrum

Agenesis of sacrum

Discussion : In this osteogenic case study sacrum shows agenesis of dorsal surface due to the failure of fusion of right and left sacral laminae. In our study of 136 sacra various different types of sacral hiatus shapes were found with 7 percentage of dumbbell shape, 3 percentage of elongated shape, 86 percentage inverted U, 23 percentage of inverted V shape and 15 percentage of irregular shaped sacral hiatus were found. In our study of sacral group inverted U shaped were found to be predominant in south china and peculiarly found with failure of fusion of right and left sacral laminae called as agenesis of dorsal surface of sacrum. Due to the failure of fusion of sacral laminae leads to the absence of sacral canal or vertebral canal and sacral hiatus leads to the herniation of lower sacral nerves and filum terminale which is surrounded by spinal meninges. Agenesis of the total sacrum extends from first sacral laminae to fifth sacral that is at the level of sacral hiatus of a normal sacrum. The length of the agenesis of the sacrum is 10.7 cm. Also Agenesis of the sacral canal extends from first sacral laminae to fourth sacral that is at the estimated level of sacral hiatus of a normal sacrum is 7.4 cm.

According to previous researchers with our current study correlates in classifying the shapes of sacral hiatus.Vanitha et-al states that sacrum with agenesis of dorsal wall and first sacral lamina showing incomplete fusion. In our study partly correlates in agenesis of dorsum of sacrum but all the sacral laminae are completely separated or failure in fusion of sacral laminae leads to the absence of sacral canal and sacral hiatus.Manifestaion with unilateral or bilateral lesion to the S-2 or S-3 nerve roots usually leads to mild or moderate bladder, bowel and sexual dysfunction and resection of S-2 to 4 roots leads to autonomic dysfunction. Several reflex changes can be observed at neurological examination with an absence of ankle jerk, absence of plantar reflex and the absence of bulbocavernosus reflex in men or sphincter vaginae reflex in women usually when affected or compressed by S-3 or S-4 root lesions. There are number of non-neurological manifestations of sacral tumors that arise when the lesions invade neighboring structures leading to local pain at the joints. Due to the un-ossified sacral laminae remnants of the notochord represents during birth as sacrococcygeal teratoma or sacral tumor or chordoma of sacrum. And also results in caudaequina syndrome with sacral meningioma. Motor defects are not present at birth but may develop in childhood because of malignant invasion of spinal canal.

Conclusion : Due to the rare variation of agenesis of sacral canal and sacral hiatus adds the knowledge in the field of spinal surgeries, lumbar spine disorders, rectal pathology, interpreting the radiographs of sacral spine for radiologists, Orthopaedicians should be aware of such variation during administration of caudal epidural block/caudal epidural anesthesia, anthropologists and also to identify the normal anatomical variations.

References:

1. Edward W.B., Hingson R.A.; continuous caudalanesthesia in obstetrics. Am.J.Surg. 7; 459-64, 1942.
2. Harold Ellis, Patricia Collins, David Johnson, skeletal system,Gray's Anatomy; The anatomical basis of clinical practice 38th edn.; pp.533,Churchill Livingstone,London.
3. Jugeshkhanna,RenuChauhan-Unusual extension of sacral hiatus.
4. Lanier VS, McKnight HE, Trotter M. Caudal analgesia: An experimental and anatomical study. America journal of obstetrics and gynecology 1944;47 (5);633-641.
5. Nadeem.G-Importance of knowing the level of sacral hiatus for caudal epidural anesthesia.
6. Nagar SK. A study of Sacral Hiatus in dryhumansacra.Journal of Anatomical Society of India; 53(2):18-21:2004
7. Peter L William et-al-Grays anatomy 38th edition.
8. RenataJhenneberg and MacieJhenneberg; variation in the closure of sacral canal skeletal sampl from the Pompeii, Italy 79 ad: perspectives in human biology vol 4(1):177-188: 1999.
9. Seema, Singh M &Mahajan A; An anatomical study of variations of Sacral hiatus in sacra of north Indian origin and its clinical significance:Int.J.Morphol.31(1):110-114,2013.
10. SekiguchiM,Yabuki S, Satoh K. And KikuchiS.;an anatomical study of the sacral hiatus: a basis for successful caudal epidural block.clin.J.pain, 20(1):1-4, 2004.
11. Senoglu N, Senoglu M, Oksuz H, Landmarks of the sacral hiatus for caudal epidural block: an anatomical study. BritishJournal of Anaesthesia.95(5):692-5, 2005
12. SwathiPoornimaC; complete dorsal wall defect in dry human sacrum: a case report; IJMRHS; 2013:2(2); 290-292.
13. Trotter M, Lanier PF. Hiatus canalissacralis in American Whites and Negros. Human Biology 1945; 17: 368-381.
14. Trotter M, Letterman Gs. Variations of the female sacrum; their significance in continues caudal analgesia; Surg. Gynaecol. Obstet. 1944;78 (4) : 419-424.
15. Trotter M. Variations of the sacral canal.Their significance in administration of caudal analgesia. Anaesthesia and analgesia. 1947; 26(5):192-202.
16. Vinod Kumar, PandeySN,Bajpai RN et al. Morphometrical study of sacral hiatus. Anat.Soc of India1992; 41(1):7-13.
17. Vanitha1, Taqdees Fatima2, H. S. Kadlimatti3-Complete Dorsal Wall Agenesis of Sacrum: A Case Report.
18. http://www.medscape.com/viewarticle/461092_4

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