

Complete Non-fusion of the Sacral Spines: A Rare Phenomenon.

Archana Rani*, Jyoti Chopra, Anita Rani, Navneet Kumar, Rakesh Kumar Verma and Arvind Kumar Pankaj.

Department of Anatomy, King George's Medical University, Lucknow-226003, Uttar Pradesh, India.

Short Communication

Received: 03/08/2013
Revised : 26/08/2013
Accepted: 29/08/2013

*For Correspondence

Department of Anatomy, King George's Medical University, Lucknow-226003, Uttar Pradesh, India.
Mobile: +91 9451950799.

Keywords: sacrum, spine, spina bifida occulta, vertebrae.

ABSTRACT

Complete non-fusion of sacral spines is simply an incomplete vertebra. It is a type of medical condition in which the spinal cord, brain or meninges are under developed in a child at birth. The condition also termed as Spina bifida occulta can affect any level of the spine, but is usually found in the lower part of the back. Out of 137 dried sacrum, we noticed total spina bifida occulta in one case. Presence of this abnormality can lead to accidental injury of neural structures which are normally covered by the sacral canal.

INTRODUCTION

The sacral bone has been considered to be an integral part of the pelvis and constitutes the undistorted part of the spinal curve ^[1]. Sacral canal may be open dorsally to a greater degree than normally and the sacral hiatus is variable in extent and form ^[2]. Occulta literally means "not seen". Spina bifida occulta is hidden split spine. It is a congenital disorder caused by incomplete development of the spinal column during the first month of pregnancy. It is the mildest form of spina bifida, in which one or more vertebrae, usually involving L5 and S1, are not closed but there is no protrusion of spinal cord and meninges. It can be associated with other developmental abnormalities of the spinal cord, such as syringomyelia, diastematomyelia, and a tethered cord. It is a common condition, occurring in 10-20% of otherwise healthy people. This abnormality is clinically important for caudal epidural block which is usually performed in diagnosis and treatment of lumbar spine disorder ^[3]. The knowledge of exact topographical anatomy of the sacrum is important for such procedure. Presence of anatomical variations may possibly contribute to the failure rate of caudal epidural block. Spina bifida occulta causes failure of caudal epidural block in 7% cases.

MATERIALS AND METHODS

Case report

Out of 137 sacrum obtained from the osteology lab of Anatomy department of King George's Medical University, Lucknow, Uttar Pradesh, India, we came across an adult sacrum in which the posterior laminae of all sacral vertebrae were not fused. The space in sacrum was more likely a groove rather than a canal (Figure 1). No other abnormality was noted.

OBSERVATIONS AND RESULTS



Figure 1: Posterior view of sacrum showing nonfusion of all the sacral spines

DISCUSSION

The human nervous system develops from a small, specialized plate of cells along the back of an embryo. Early in development, the edges of this plate begin to curl up toward each other, creating the neural tube, which is a narrow sheath that closes to form the brain and spinal cord of the embryo. As development progresses, the top of the tube becomes the brain and the remainder of the tube becomes the spinal cord. This process is usually complete by the 28th day of pregnancy. Normally the closure of the neural tube occurs around the 23rd (rostral closure) and 27th (caudal closure) day after fertilization. However, if problems occur during this process, the result can be brain disorders called neural tube defects. Spina bifida is a type of neural tube defect that is caused by the failure of the fetus spine to close properly during the first month of pregnancy.

The mesenchymal basis of the vertebra is converted into cartilage by the appearance of several centres of chondrification. Three primary centers of ossification appear in the cartilaginous model for each vertebra, one for each neural arch and one for centrum. At birth the centrum and the two halves of the neural arch are joined by cartilage. These are termed neurocentral joints. Posterolateral parts of vertebral body are formed from the neural arch. When the two halves of the neural arch fail to fuse in the midline the condition is termed as Spina bifida [4]. Researchers suspect that this disorder is caused by genetic, environmental and nutritional factors. Risk factors associated with spina bifida occulta are family history of spina bifida occulta, advanced maternal and paternal age, folic acid deficiency during or before the 1st month of pregnancy.

In spina bifida occulta, there is non-fusion of posterior laminae of one or two vertebrae, commonly at L5 & S1 level. But in our case there was nonfusion of all the posterior laminae of sacral vertebrae. The present case is similar to as observed by Senoglu et al in Caucasian population [5]. This condition is a result of a spinal deformity and is associated with abnormal development of the spinal nerve roots and spinal cord. Like most conditions, there are different severities of spina bifida occulta. In the most minor form of spina bifida occulta, the plates of bone that form the spinal arch fail to fuse completely. This variation generally only affects one vertebra, particularly the vertebra lying lowest in the back. In more severe cases, the bodies of several of the vertebra may be fused together. This may cause the person's back to be slightly short and often stiff. The natural curves of the back may be exaggerated and there may be an abnormal curvature of the spine or a bony protrusion in the midline of the back. There may be a bony peg at one level of the spinal canal, or a fibrous band running across it and dividing it into two. The spinal cord may become excessively wide because of abnormal fat or fibrous tissue lying inside the spinal canal. There may also be leg, bladder, or bowel problems.

Although plain X-rays of the back will generally show the bony deformity, it is necessary to carry out further investigation in order to see the abnormalities lying within the spinal canal. Magnetic Resonance Imaging

(MRI) is most helpful, and can be used to measure the whole length of the spinal cord. MRI also measures the nerve roots and any soft tissue swelling that lies within the spinal canal at the level of the bony abnormality.

The spine of the sacrum is a well-known site for internal fixation especially from the clinical point of consideration [6]. The anatomy of the sacrum is essential especially for placement of screws in the pedicle [7,8]. Presence of spina bifida, as in the present case can lead to accidental injury of neural structures which are otherwise covered by the sacral canal.

CONCLUSION

The present work deals with the anatomical evaluation of the spina bifida which may be clinically important for anesthetists, neurologists, radiologists and orthopedicians.

REFERENCES

1. Marty C, Boisaubert B, Descamps H, Montigny JP, Hecquet J, Legaye J et al. The sagittal anatomy of the sacrum among young adults, infants, and spondylolisthesis patients. *Europ Spine J.* 2002; 11(2):119-25.
2. Schaeffer's JP. Osteology In: Morris' Human Anatomy: A Complete Systematic Treatise. 10thed, The Blakiston Company, Philadelphia, Toronto, p 96; 1942.
3. Sekiguchi M, Yabuki S, Satoh K, Kikuchi S. An anatomic study of the sacral hiatus: a basis for successful caudal epidural block. *Clin J Pain.* 2004; 20: 51-4.
4. IB Singh. An introduction to Human Embryology. 5thed, Macmillan India Limited, Delhi, Madras, p 136; 1986.
5. Senoglu N, Senoglu M, Gumusalan Y. Total spina bifida occulta of the scarum. *Intl J AnatVar.* 2008; 1: 26-7.
6. Peretz Am, Hipp JA, Heggeness MH. The internal body architecture of the sacrum. *Spine.* 1998; 23(9): 971-4.
7. Ebraheim NA, Xu R, Challgren E, Heck B. Location of the sacral pedicle, foramina and ala on the lateral aspect of the sacrum: a radiographic study. *Orthopedics.* 1998; 21(6): 703-6.
8. Lehman Jr RA, Kuklo TR, Belmont Jr PJ. Advantage of pedicle screw fixation directed into the apex of the sacral promontory over bicortical fixation: a biomechanical analysis. *Spine.* 2002; 27(8): 806-11.