Sacral Hiatus: A Study of Its Anatomical Variations in Dry Sacra

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ABSTRACT

Objective: The purpose of the study was found out the anatomical variation in the sacral hiatus which is the sacral canal caudal opening. Its clinical significance is due to the fact that caudal epidural anesthesia is administered through the sacral hiatus and a knowledge of its anomalies is paramount to the success of epidural block.

Materials and Method: This study was of three-month duration from September 2019 to December 2019 and was carried out at Khyber Medical College, Peshawar.48 dry sacra from the Anatomy department of Khyber Medical College were studied and the shape of their sacral hiatus was observed along with the level of its apex and base.

Results: A total of 48 dry sacra were studied. The sacral hiatus shape was observed which revealed that it was inverted U shaped in 21 (43.8%) cases, inverted V shaped in 14 (29.2%) cases, irregular in 7 (14.5%) cases, M shaped in 4 (8.3%) cases and dumb bell shaped in 2 (4.2%) cases. In majority of the cases the apex was against the fourth sacral vertebrae and the base at the level of fifth sacral vertebrae.

Conclusion: Anatomical variation does exist in the shape and size of sacral hiatus and a knowledge of variation in the shape, size, level of the apex and base of sacral hiatus is of importance to the clinicians as epidural anesthesia for therapeutic and diagnostic purposes is administered through the sacral hiatus.

To cite this article
[Javed, M., Rehman, Z., Iftikhar, S., Naz, F., Rehman, P., Ahmed W. & Khan, I. M. (2020). The Association of COVID-19 Infection in Pregnancy and Vertical Transmission: Literature Review. *The Journal of Middle East and North Africa Sciences*, 6(11), 12-14]. (P-ISSN 2412- 9763) - (e-ISSN 2412-8937). www.jomenas.org**. 3**

Keywords: Sacrum, Hiatus, Epidural Anesthesia, Sacral Cornua, Filum Terminale.

1. Introduction:

The sacrum is a large bone which is triangular in shape. It is present at the base of the spine and is formed when five sacral vertebrae fuse together (Njihia et al., 2011; Collins, 1976). In its upper part, it is connected with the last lumber vertebra and in the lower part with the coccyx. It has three surfaces which are the pelvic, dorsal and lateral surface. It also has an apex and base. The pelvic surface is concave, the dorsal surface is convex and the lateral surface is broad in the upper part but then tapers into a thin edge. The base of the sacrum is directed upward and forward while the apex is directed downward. Sacral canal is formed by vertebral foramina of the sacrum and contains the coccygeal and sacral nerves, cauda equine and the spinal meninges (Moore & Dalley, 2018). The spinal canal caudal part is open and is known as the sacral hiatus and is formed when the fifth sacral vertebra laminae fails to fuse. Its shape and size is variable but it is usually inverted U or V shaped. The sacral hiatus has inferior articular surfaces on both sides with downward projection. This is known as sacral cornu. The sacral hiatus contains the filum terminale, the fifth sacral nerve and the coccygeal nerve and is covered by the skin, fatty layer and the sacrococcygeal membrane posteriorly (Sekiguchi et al., 2004; Trotter, 1947).

Sacral hiatus is of great clinical importance as caudal epidural block is administered through the sacral hiatus (Chen et al., 2004). It is marked on the body two inches above the coccyx tip at the upper end of the natal cleft. In a caudal epidural block a drug is administered in the sacral hiatus for analgesics and anaesthetic purposes (Layer et al., 2011; Aggarwal et al., 2009). It is used to relax the perianal musculature for painless birth, for chronic back ache and during orthopedic, obstetric and

surgical procedure. Variations in the shape, position and size of sacral hiatus prove to be a challenge in the administration of caudal epidural block (Ali et al., 2015). Hence it is important to have full knowledge of the variation in the shape and size of sacral hiatus so caudal epidural block success rate could be increased. The purpose of my study was to find sacral hiatus variations so anesthetists can be aware of it during epidural block and complications can be avoided.

2. Materials and Methods:

It was a three-month study carried out from September 2019 to December 2019 in which 48 dry human sacra from anatomy department were studied and there was no discrimination of sex, ethnicity and geography. The shape of the sacrum was observed along with its apex level. The base of the sacral hiatus was also observed. Sacrum in which the sacral hiatus was absent or those with wear and tear were excluded.

3. Results:

In our study the most common shape of the sacral hiatus was inverted U shape followed by V shaped sacral hiatus. Out of the 48 dry human sacra 21(43.8%) sacra had inverted U shape, 14 (29.2%) had inverted V shaped sacral hiatus and 7(14.5%) had irregular shaped sacral hiatus. There were 4 M shaped and 2 dumb bell shaped sacral hiatus. The level of the apex was between second and fifth sacral vertebrae but majority were against fourth sacral vertebrae. Out of the 48 sacra ,36 had their apex at the level of fourth sacral vertebrae (75%).The base was at the fifth sacral segment level in 47 sacra (97. 9%).

No’	Shape of Sacral hiatus	No’ of sacra	Percentage
1	Inverted U shaped	21	43.8%
2	Inverted V shaped	14	29.2%
3	Irregular	7	14.5%
4	M shaped	4	8.3%
5	Dumb bell shaped	2	4.2%

4. Discussion:

Success of caudal epidural block is dependent on the sacral hiatus so complete knowledge of its variations must be known to the anesthetist and surgeons (Faruqui, 2000; Duncan et al., 2009). Our study revealed that there was variation in the shape of sacral hiatus with five shapes observed which were inverted U and V shaped, irregular, dumb-bell shaped and M shaped. Inverted U shape was the most common shape observed (43.8%) followed by inverted V shaped (29. 2%).This was similar to the study carried out by Seema et al9 which also listed the inverted U shaped sacral hiatus (42.95%) as the most common shape followed by inverted V shaped (27.51%) sacral hiatus. Our finding was also in concordance with the study carried out by Nagar, (2004) and Clarista and Gautham, (2013) which also found the U shaped sacral hiatus the most common shape with 41.5% and 46.2% respectively. Another study carried out by Kujur and Gaikwad, (2017) also stated inverted U shape as the most common shape (40. 69%).This was in contrast to the study carried out by Mustafa et al. (2012) (76.23%) which revealed that inverted V shape was the most common shape followed by inverted U shape (27. 51%).

Studies carried out by Mustafa et al. (2012) and Biratnagar et al. (2015) revealed that inverted U and V shaped sacral hiatus occurred equally. Overall majority of the studies showed U shaped sacral hiatus the most common followed by inverted V shaped hiatus. Both of these shapes allow the needle to be easily passed to the sacral hiatus as compared to other shapes which contribute to epidural block failure rate. Our study revealed M shape and dumb-bell shaped sacral hiatus as the least common shape which is similar to the studies carried out by Nagar, (2004) and Clarista and Gautham, (2013).

Sacral hiatus apex usually lies at the level of fourth sacral vertebrae but it can lie between S2 to S5. Our study revealed that the apex was against fourth sacral vertebrae in 36 (75%) sacra. This was similar to the studies carried out by Mustafa et al. (2012) and Kujur and Gaikwad, (2017), which also showed that the apex was at the level of fourth sacral vertebrae in 76.23% and 66.5% respectively. A study carried out by Singh, (2017) revealed that the apex was at the level of fourth sacral vertebrae (80.95%) followed by fifth sacral vertebrae (7.14%). Base of sacral hiatus also show variations. In majority of the cases it occurs at the level of fifth sacral vertebrae (Parashram, 2008). Our study revealed that the base was at the level of fifth sacral vertebrae in 46 (97.9%) sacra which is similar to the study carried out by Muhammad S Mustafa et al12 but the occurrence is greater than the findings of Nagar et al16 (72.6%), Mustafa et al. (2012) (81.17%) and Singh, and Mahajan, (2013) (70.46%).

5. Conclusion:

Variations in the shape of sacral hiatus does exist. The most common is the with inverted U shaped hiatus. This is followed by inverted V shaped sacral hiatus. It is important for the anesthetist to have complete knowledge of variations in the sacral hiatus during giving of the epidural block as it can prevent complications. It can also increase the success rate of caudal epidural block which has a failure rate of 25% and is used as anesthesia and analgesia for chronic back pain, in obstetric practices, general surgery, orthopedic surgery and urology.

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Received September 30, 2020; reviewed October 15, 2020; accepted October 21, 2020; published online November 01, 2020