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MRI study of variation in dural sac length in Gwalior region

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Abstract
The spinal cord is a vital organ in human body. Dura mater is outermost layer extends from foramen magnum to lower border of S2 vertebra. Dural sac length was measured from for a man magnum till its termination. Space it & b/n vertebral canal termed epidural space. Because of variation in termination in dural sac length of dural sac may varied it also varies according to gender and race. In present study MRI images of 71 individuals in the age group of 20-65 years in which 38 males & 33 females taken & length of dural sac measured with help of di com works software. The mean dural length of males was 57.39 cm and SD was 2.541 and it ranged from 52.20 cm to 61.80 cm and in females the mean dural sac length was 52.78 cm and SD was 1.345 found. The present study is an attempt to provide data base for a range of dural sac length, in Indian population on MRI which is helpful in different clinical procedures.

Keywords: Dura mater, MRI, for a man magnum, termination

1. Introduction
Specific knowledge of regional anatomy is necessary for successful performance of any clinical procedure. The spinal cord is a vital organ in human body. It is the only communication link between the brain and the various parts of the body. It is vulnerable to traumatic spinal cord injury and various diseases such as tumors, infections, inflammatory diseases and degenerative diseases [1]. Dura mater is outermost layer extends from foramen magnum to lower border of S2 vertebra. Dural sac length was measured from for a man magnum till its termination. Space it & b/n vertebral canal termed epidural space. The conus medullaries or "medullary cone" is the terminal end of the spinal cord and then spinal nerves continue as dangling nerve roots called cauda Equina with the nerve roots extending caudally in an enclosed sac known as the dural sac (DS). The DS protects the dangling nerve roots and is made up of two distinct but tightly bound layers called the dura mater and arachnoid mater. There are changes in position of conus medullaris with gender and race. It is also known that the conus ascends from its early fetal location in the sacral canal to the eventual adult position [2]. Because of variation in termination in dural sac length of dural sac may varied it also varies according to gender and race. After the invention of MRI, scientists found that there is wide range of termination of dural sac and dural sac length. Advantages of MRI are it identifies possible disorders and provide wide range in live healthy subjects [3]. A caudal approach to the extradural space (caudal block) is used for intra- and postoperative analgesia in a variety of operations, as well as the management of chronic pain. A detailed understanding of the anatomy of the caudal region of the extradural space and dural sac length is therefore desirable for clinicians using this technique.

2. Material and methods
This is an observational study in which MRI images of 71 adult individuals in the age group of 20-65 years of either sex were chosen with 38 males & 33 females, who attended the Vidya Health Imaging, Gwalior for spinal MRI Scan. Patients with intervertebral disc diseases and abnormalities of vertebral column like kyphoscoliosis. Patients, tumors or leptomeningeal seeding, history of previous spine surgery, congenital spinal anomalies like spinabifida are excluded from study. MRI of whole spine of patients were performed on Siemens essenza 1.5 Telsa super can 16 channel machine.

Study done in T1 & T2 weighted sagittal spin echo and SS Myelo MRI sequences of whole spine with patient in supine position. All measurements were performed with the help of di com works software. Each patient's age, sex, race and location of the lower limit of the DS were recorded Dural sac length were measured from foramen magnum to the termination. Length dural sac were taken in small fractions along with the curve of the vertebral column to minimize the error.

3. Result and observation

The mean dural length for Males was 57.39 cm and SD was 2.541 and it ranged from 52.20 cm to 61.80 cm. For the Females the mean dural sac length was 52.78 cm and SD was 1.345 and it ranged from 49.50 cm to 55.80 cm. The 'F' value to compare variance was 3.570 as calculated by Analysis of Variance. The 't' value was calculated by Unpaired t- test came out to be 9.337. The difference of the means of two sample was Highly Significant statistically ($p<0.01$).

Table 1: Dural sac length (In Cm) In Diff Groups of Male & Female

Statistics	Males	Females
Mean	57.39	52.78
Std. Deviation	2.541	1.345
Std. Error	0.2341	0.2341
Coefficient of variation	2.55%	2.55%
Range	52.20 to 61.80	49.50 to 55.80
t value	9.337	
F value	3.570	
P value	0.0002	
Significance	Highly Significant	

4. Discussion

In our study The mean length of spinal dura for Males was 57.39 cm and SD was 2.541 and it ranged from 52.20 cm to 61.80 cm. For the Females the mean spinal cord length was 52.78 cm and SD was 1.345 and it ranged from 49.50 cm to 55.80 cm. The 'F' value to compare variance was 3.570 as calculated by Analysis of Variance. The 't' value was calculated by Unpaired t-test came out to be 9.337. The difference of the means of two sample was Highly Significant statistically ($p<0.002$).

In a study done by Nikolenko [4] in 1985 in which he studied 94 persons (59 male and 35 female) length of the spinal dura mater sac has been studied. The average length of the sac is 621 +/- 3 mm. In men its average length is 636 +/- 4 mm, it makes 40 mm more in length than that in women (596 /- 4 mm).The length of various parts in the dura mater sac is not the same: the cervical part makes 23% of the whole length, the thoracic-47%, the lumbar--23%, the sacral--7%. In men the cervical part of the sac in average is 6 mm longer than the lumbar part, and in women--quite the reverse, it is 7 mm shorter than the lumbar part. The sacral part of the sac in women is 3 mm longer than that in men. The sex differences noted are statistically significant.

5. Conclusion

Spinal dural sac terminate around S1 & S2 vertebral level. Maximum number of termination occurs at S2 Lower level variations are in present in dural sac length. The difference in dural sac length of male and female were also found statistically significant The results obtained were compared with the previous studies done by Nikolenko VN *et al.* [4] some differences were present in results which are probably due to many factors like different Ethnic & Racial groups, Genetic factors; Environmental conditions, anatomical variations. The present study is an attempt to provide data base for a range of dural sac length, in Indian population on MRI. Which is helpful in clinical procedures like lumbar puncture and accurate localization in cranial spinal irradiation & anaesthesiologist practicing regional anaesthesia.

6. References

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