

INTRODUCTION

Epidural analgesia is widely used in infants and children for intraoperative and postoperative pain management. Effective and safe use requires expertise in placement and subsequent management.

Distance from dura to spinal cord varies across vertebral levels.

Dura to spinal cord distance may be a critical factor in avoiding potential for neurological injury caused by needle trauma after a dura puncture. A greater distance increases the safety margin.

The present study evaluated MRI-based thoraco-lumbar spine images in children to measure dura to spinal cord distances at different vertebral levels to better understand spinal canal anatomy in children.

Primary aim was to identify level at which this distance was greatest.

METHODS

Observational retrospective study of 88 children under age 8 years

MRI images of thoraco-lumbar spine evaluated

Patients excluded: Spinal anatomic abnormalities

Distance from dural side of ligamentum flavum to posterior margin of spinal cord was defined as **Dura to Spinal Cord** distance.

Sagittal T₂-weighted images of thoraco-lumbar spine were used to measure dura to spinal cord distance at T₆₋₇, T₉₋₁₀, and L₁₋₂ interspaces. Measurements were perpendicular to long axis of vertebral body.

Distances were compared by gender, age, height, and weight.

RESULTS

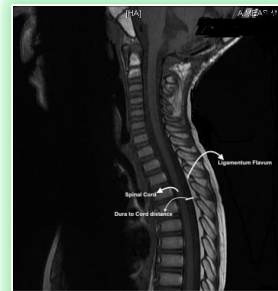
Dura to spinal cord distance was
5.9 ± 1.6 mm at T₆₋₇ (range: 1.4- 9.9 mm)
5.0 ± 1.6 mm at T₉₋₁₀ (1.2-8.1 mm)
3.6 ± 1.2 mm at L₁₋₂ (1.2 - 6.8 mm)

There were no differences in dura to spinal cord distance by gender, age, height, or weight.

Dura to spinal cord comparison at various levels according to patient gender

Levels	Female (n = 32) Mean, mm (SD; range)	Male (n = 56) Mean, mm (SD; range)
T ₆₋₇	5.9 (1.7; 3.5-9.9)	5.9 (1.5; 1.4-9.3)
T ₉₋₁₀	4.9 (1.3; 2.4-7.1)	5.0 (1.2; 1.2-8.1)
L ₁₋₂	3.4 (1.2; 1.5-6.5)	3.7 (1.2; 1.2-6.8)

SD, standard deviation.



MRI showing dura to cord distance

DISCUSSION

Dura to spinal cord distance progressively decreases from mid-thoracic to the upper lumbar region

Midline approach using loss of resistance technique at lower thoracic and upper lumbar levels could imply greater risk because of shorter dura to spinal cord distance compared to upper thoracic spaces.

Knowing dura to spinal cord distance between adjacent thoracic levels provides valuable information in choosing the appropriate insertion site

The dura to cord distance may be especially important in children as **most epidural catheter insertions are performed under general anesthesia**

CONCLUSION

- This evidence challenges traditional teaching that performance of epidural anesthesia at lumbar level is safer than at thoracic level.
- There is substantially more room in dorsal subarachnoid space at the thoracic level compared to lumbar
- Risk of spinal cord damage resulting from accidental epidural needle advancement may be greater in the lumbar region due to a more dorsal location of the spinal cord in vertebral canal compared to thoracic region.

References

- Giafre E et al. Anesth Analg. 1996;83:904-912.
Llewellyn N, Moriarty A. Pediatr Anesth. 2007;17:520-533.