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Ultrasound Guided Neuraxial Block in Pediatric Patients

Essay
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Anesthesia

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Haitham Mamdouh Omara Mustafa

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List of Abbreviations

ALL	:	Anterior longitudinal ligament
CSF	:	Cerebrospinal fluid
DRG	:	Dorsal root ganglion
ECG	:	Electrocardiographic
IASP	:	International Association for the Study of Pain
LOR	:	Loss of resistance
NMDA	:	N-methyl-Daspartate
PCEA	:	Patient-controlled epidural analgesia
PLL	:	Posterior longitudinal ligament
PRA	:	Pediatric regional anesthesia
PRA	:	Pediatric regional anesthesia
PRF	:	Pulse repetition frequency

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Introduction

Pediatric anesthesia and pediatric regional anesthesia are intertwined. Almost all surgeries unless contradicted could be and should be supplemented with a regional block. The main objective of this review is to elaborate on the recent advances of the central neuraxial blocks, such as application of ultrasound guidance. Recent advances have brought a lot of objectivity to central neuraxial blocks, making them safer and effective. Technically, central neuraxial blocks have various approaches. These blocks can be given as single shot or as continuous techniques depending on the nature and severity of the surgical procedure ***(Bosenberg, 2012).***

The benefits of pediatric regional anesthesia are many, although nerve blocks, especially at the neuraxis, can be challenging. The safety margin for needle placement is narrow within the spinal canal; the anatomical structures are tightly positioned and the epidural space can be as narrow as 2 mm for epidural blocks. Because of the large variation of each patient's body habitus due to age, it can be difficult to predict the puncture depth to reach either the epidural or intrathecal spaces ***(Arthurs et al., 2008)***.

In recent years, anatomically based ultrasound is one of the most exciting advances in technology in relation to pediatric regional anesthesia. The use of ultrasound in neuraxial anesthesia in adults is somewhat limited because of the reduced visibility of the spinal canal resulting from poor ultrasound beam penetration through the ossified bony vertebral column. In theory, ultrasound could be of much greater value in the young pediatric population where there is limited ossification, thus allowing good visual resolution of the anatomy and block-related equipment or solutions ***(Tsui and Suresh, 2010).***

Ultrasound scanning (US) can offer several advantages when used to guide placement of the needle for centroneuraxial blocks (CNBs). It is noninvasive, safe, simple to use, can be performed expeditiously, provides real-time images, is devoid from adverse effects, and it may be beneficial in patients with abnormal or variant spinal anatomy. When used for chronic pain interventions, US also eliminates or reduces exposure to radiation. In expert hands, the use of US for epidural needle insertion was shown to reduce the number of puncture attempts, improve the success rate of epidural access on the first attempt, reduce the need to puncture multiple levels, and improve patient comfort during

the procedure. These advantages led the National Institute of Clinical Excellence (NICE) in the United Kingdom to recommend the routine use of ultrasound for epidural blocks ***(Grau et al., 2004)***.

Aim of the Work

The aim of this work is to illustrate the benefits of neuro-axial block in providing peri-operative analgesia and to demonstrate the advantages of U/S guided technique for neuro-axial block versus conventional technique in pediatric age group.

Anatomy

Introduction :

A thorough knowledge of the regional anatomy and its specific anatomical landmarks is an essential for performing successful nerve block and it cannot be substituted by probing with a needle attached to a nerve stimulator ***(Dalens and Mansour,1994).***

The anatomy described in adults is not always applicable to children as anatomical landmarks in children vary with growth. landmarks, commonly used in adults, tend to lack definition in young children partly because of poorer muscle development and patient cooperation which used to locate them and most children are under a light general anesthesia when the nerve block is being performed ***(Clergue and Auoryet., 2002)***.

Anatomy of the vertebral column and the spinal cord:

The spinal canal is surrounded by 3 protective sheaths. From the outside to the inside they are: dura mater, arachnoid and pia mater. The potential space between the dura and arachnoid is called subdural space. The cerebrospinal fluid

(CSF) flows between the arachnoid and pia mater in the space called subarachnoid space. ***(Young and Young, 2007).***

The spinal cord begins cranially at the foramen magnum, as a continuation of the medulla oblongata and ends caudally as the conus medullaris, at the level of the lower border of L1 in adult, and at the upper border of L3 in children (fig. 1). From this end, a prolongation of the pia mater called the filum terminale attaches the spinal cord to the coccyx. The dura ends at the level of S_2 ***(Young and Young, 2007)***.

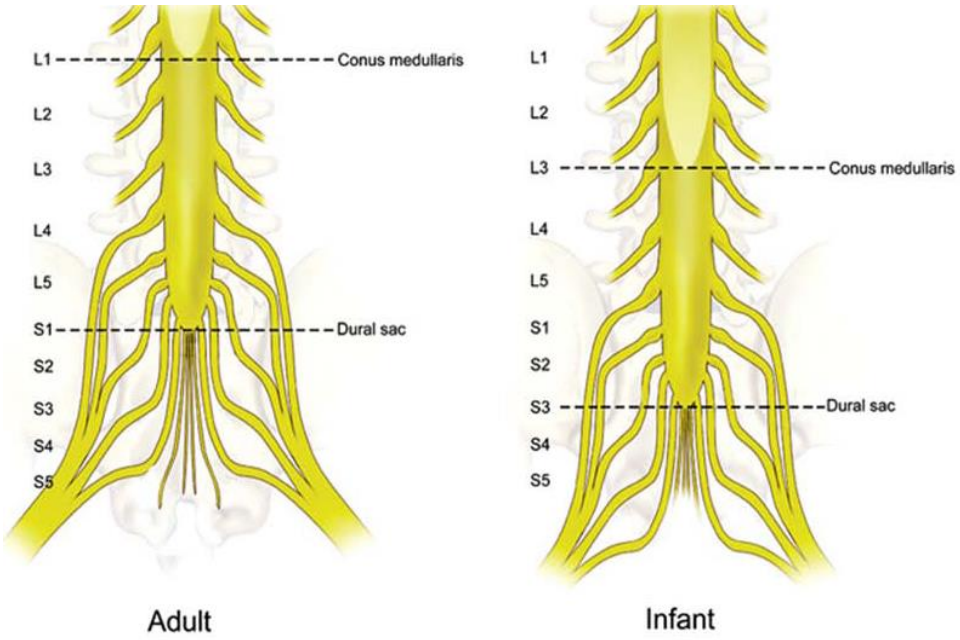

Fig. (1): Comparisons between levels of the conusmedullaris and thedural sac in the infant versus the older child or adult. *(Tames and Burstal, 2003)*