Recent Updates In Spinal Anaesthesia In Infants

Essay

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الحديث فى التخدير النصفى فى الرضع

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الملخص العربي

الهدف من هذا البحث هو تقييم فاعلية وآمان التخدير النصفي النصفي في الرضع لإجراء الجراحات المناسبة به. ويعتبر **بان بيردج** أول من أعطى التخدير النصفي في الأطفال بالولايات المتحدة عام ١٩٠١ عندما قام بإجراء ٤٠ عملية جراحية باستخدام هذا النوع من التخدير أحداهم لطفل عمره ٣ شهور.

لإعطاء التخدير النصفي للرضع لابد من معرفة بعض الاختلافات التشريحية بينهم وبين البالغين من حيث نهاية الحبل الشوكي والحقيبة الجافية والتشريح السطحي وحجم السائل المخي الشوكي. ينتهي الحبل الشوكي في الرضع بالمخروط النخاعي عند الفقرة القطنية الثانية او الثالثة بعكس البالغين عند الفقرة الأولى. لذا لتفادي إصابة الحبل الشوكي إثناء إعطاء التخدير النصفي للرضع لابد أن يكون ذلك أسفل الفقرة القطنية الثانية.

انه من الضروري فهم التدخلات الدوائية للمخدرات الموضعية لتوقع قوة وسرعة ومدة وآمان الدواء المستخدم في التخدير النصفي في الرضع. ادوية التخدير الموضعية تتداخل مع الخلية العصبية وإثارة الغشاء العصبي الخلوي وإمكانية التوصيل في الجهاز العصبي وكذلك القلب عن طريق غلق قنوات الصوديوم

يعتبر التسمم بالمخدرات الموضعية من أهم الأولويات عند استخدامهم في الرضع . فهذه الفئة العمرية معرضة للتسمم المباشر للحبل الشوكي عند إعطاء جرعات كبيرة من هذه المخدرات الموضعية. بعد زيادة استخدام التخدير الموضعي والمخدرات الموضعية أصبحت الحاجة ماسة لمعرفة كيفية حدوث التسمم منذ أكثر من ١٠٠ عام .

يستخدم مستحلب الدهون في علاج التسمم من المخدرات الموضعية وتظل الوقاية أفضل من العلاج عند إعطاء هذه العقاقير ويجب عدم دخول هذه الإبرة أو القسطرة للدم وتجزئة الجرعة وملاحظة المريض. عند حدوث التسمم يجب التحكم في التشنجات وإنعاش القلب ثم استخدام مستحلب الدهون الذي يعطي نتائج جيدة.

First and foremost thanks ALLAH, our mighty GOD to WHOM I owe any success in my life.

I would like to express my sincere gratitude to Prof. Dr. **Naglaa Mohammed Ali**, Professor of Anaesthesia and intensive care, Faculty of medicine, Ain Shams University, who supervised this work with great interest and who gave me unlimited support throughout the work.

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Ahmed Badawy

Aim of the work

This essay is to assess the safety and efficacy of spinal anaesthesia in infants undergoing surgery appropriate for this technique.

Chapter (1)

ANATOMICAL AND PHYSIOLOGICAL CONSIDERATIONS

It is imperative to have a good knowledge of the anatomical and physiological differences among the pediatric age groups (neonates, infants, children, teenagers) and adult patients for the conduct of successful and safe spinal anaesthesia. Infant's age ranges from 1 month to 12 months **(Breschan and Likar, 2006)**.

Anatomical considerations

The spinal cord in infants

The spinal cord extends from the foramen magnum, where it is continuous with the medulla oblongata, to the level of the third lumbar vertebra. Below that level, the vertebral canal is occupied by spinal nerve roots and meninges. A fibrous strand, the filum terminale, continues from the spinal cord down to the coccyx. The spinal cord at birth and in term babies ends at the level of the third lumbar vertebra and the dural sac ends at the fourth sacral foramen. Only after the first year of life do they reach their definitive anatomical position (Figure 1) **(Frawley and Ingelmo, 2010).**

The intercristal or truffier's line crosses the midline at the L5- S1 interspace in neonates, and at the L5 vertebra in young children and L3-4 interspace in adults. It is for this reason that the lumbar puncture be done at a level below which the cord ends, safest being at or below the inter cristal line. The bones of the sacrum are not fused posteriorly in children enabling an access to the subarachnoid space even at this level. Another feature which is unique in infants is that there is only one anterior concave curvature of the vertebral column at birth. The cervical lordosis begins in the first 3 months of life with the child's ability to hold the head upright. The lumbar lordosis starts as the child begins to walk at the age of 6-9 months. Therefore, the spread of isobaric local anaesthetic is different in infants particularly as compared to adults. The subarachnoid space is incompletely divided by the denticulate ligament laterally, and the subarachnoid septum medially **(Sahin et al., 2007).**

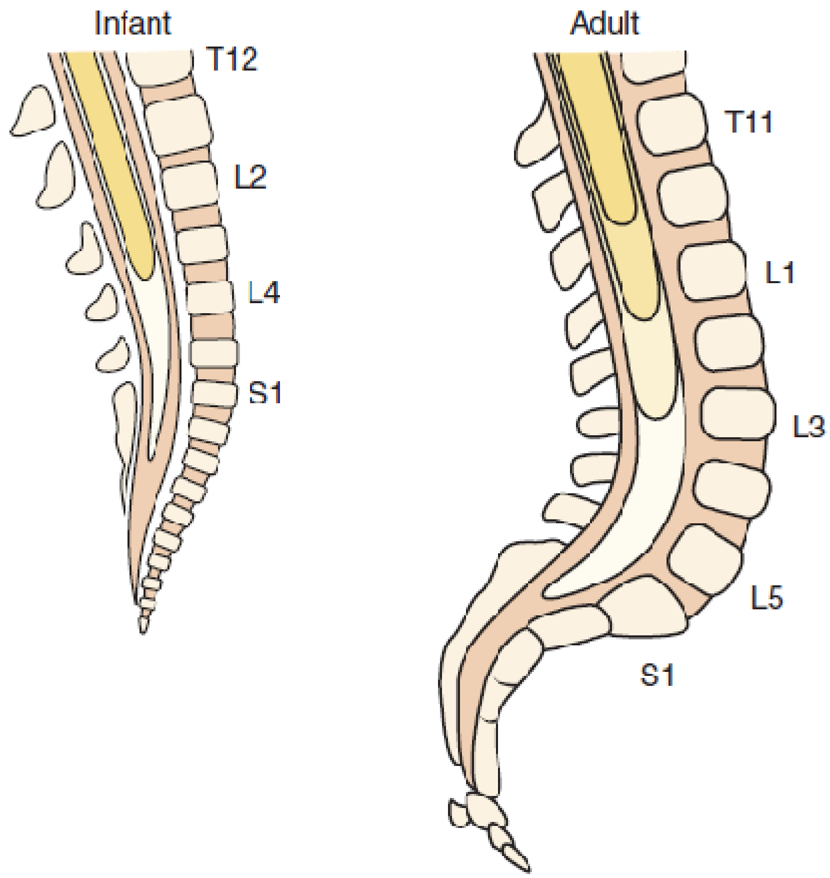

Figure 1: Anatomic differences between adults and children that affect the performance of spinal and epidural anesthesia; an infant's sacrum (*left*) is flatter and narrower than an adult's (*right*). Note that the tip of the spinal cord in a neonate ends at L3 and does not achieve the normal adult position (L1-2) until approximately 1 year of age **(Sahin et al., 2007).**

Internal structure of the cord (Figure 2)

In cross section, the spinal cord is seen to consist of gray matter, which is shaped like the letter "H" surrounded by white matter. Regional differences occur e.g., the contour of the gray matter varies, and the amount of white matter decreases as one descends the cord. There is a central canal running the length of the spinal cord, which extends from the fourth ventricle of the brain to the upper part of the filum terminale **(Saladin and Kenneth, 2007).**

Nerve roots:

Each dorsal root presents a swelling, the spinal (dorsal root) ganglion, which lies near or within the intervertebral foramen. Distal to the ganglion, each dorsal root combines with the corresponding ventral root to form a spinal nerve. There are 31 pairs of spinal nerves: 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 1 coccygeal. The first pair of spinal nerves emerges between the atlas and the skull; hence C1 to 7 nerve roots leave the vertebral canal above the correspondingly numbered vertebrae. C8 emerges below the C7 vertebra, and all the remaining spinal nerves leave inferior to the corresponding vertebrae. The nerve roots below L1, and those which occupy the vertebral canal inferior to the cord, resemble a horse's tail and hence are collectively called the "cauda equina" **(Saladin and Kenneth, 2007).**

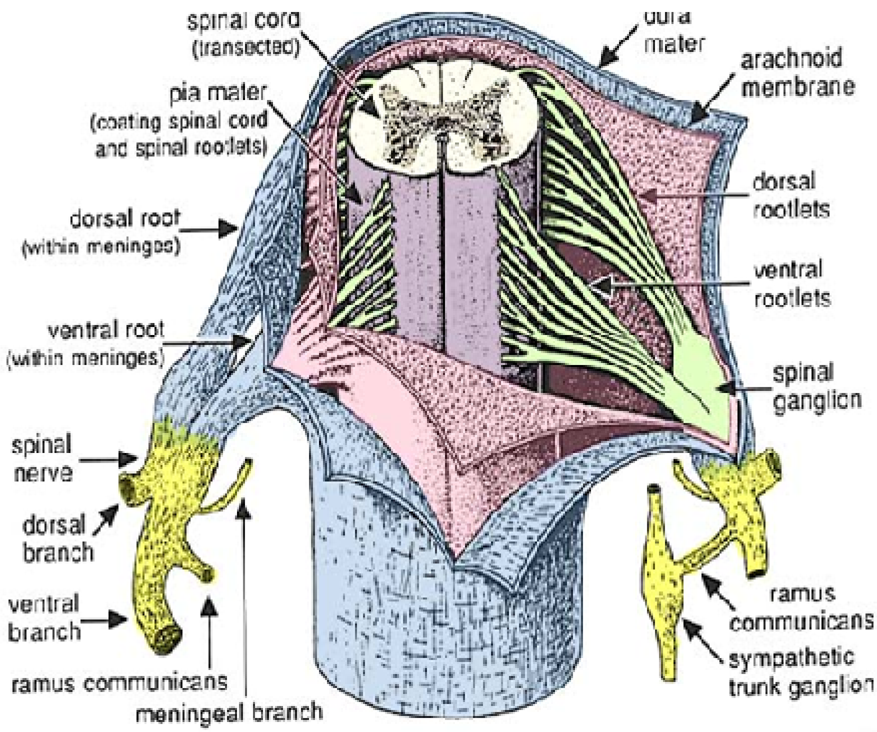

Figure 2: spinal cord and its meninges **(Boon et al.,2004).**

Meninges (Figure 3)

Dura mater.

The spinal cord, like the brain, is surrounded by the three meninges. The dura mater extends from the foramen magnum to the sacrum and coccyx. The dura is attached to the foramen magnum and the periosteium covering the uppermost cervical vertebrae and their ligaments. Through the remainder of the vertebral canal, the dura is not attached to the vertebrae, being separated by the epidural space, which contains fat and the internal vertebral venous plexus. In caudal analgesia, an anaesthetic solution injected into the sacral hiatus diffuses upward into the epidural space. This may be used in surgical procedures relating to pelvic and perineal regions. Extensions of dura (dural sheaths) surround the nerve roots and spinal ganglia, and continue into the connective tissue coverings of the spinal nerves **(Boon et al.,2004).**

Arachnoid mater

The arachnoid invests the spinal cord loosely. Continuous with the cerebral arachnoid above, it traverses the foramen magnum and descends to about the S2 vertebral level.

The subarachnoid space, which contains cerebrospinal fluid (C.S.F.), is a wide interval between the arachnoid and pia. Because the spinal cord ends at about the level of the L2 vertebra, whereas the subarachnoid space continues to S2, access can be gained to the C.S.F. by inserting a needle between the vertebral lamina below the end of the cord, a procedure termed lumbar puncture . By this means, the pressure of C.S.F. can be measured, the fluid can be analyzed, and a spinal anaesthetic can be introduced. The distance between the skin and the subarachnoid space is influenced by age – from 10 to 15mm in newborns. The distance between skin and subarachnoid space can be related to height or weight using the formulae:

Distance from skin to subarachnoid space (cm) = 0. 03 x height (cm)

Distance from skin to subarachnoid space (cm) = (2 x weight) + 7(mm)

The subarachnoid space in newborns is very narrow (6 to 8mm) and successful lumbar puncture in this population requires great precision and avoidance of lateral deviation **(Arthurs et al., 2008**).