Reports of Original Investigations

The antero-posterior diameter of the lumbar dural sac does not predict sensory levels of spinal anesthesia for Cesarean delivery

[Le diamètre antéro-postérieur du sac dural lombaire ne prédit pas l’étendue des niveaux sensitifs de la rachianesthésie pour la césarienne]

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Purpose: The lumbosacral cerebrospinal fluid (CSF) volume, as assessed by magnetic resonance imaging, is a major determinant of the intrathecal spread of local anesthetics. Ultrasound imaging of the lumbar spine allows measurement of dural sac dimensions, which we hypothesize can be used to estimate CSF volume. The purpose of this study was to investigate whether the dural sac antero-posterior diameter correlates with sensory levels of spinal anesthesia during elective Cesarean delivery (CD).

Methods: After Research Ethics Board approval and informed consent, a prospective observational study enrolled 41 patients scheduled for elective CD under spinal anesthesia. With ultrasound imaging (transverse approach, 2-5 MHz curved array probe), we measured the antero-posterior diameter of the lumbar dural sac (dural sac diameter, DSD). Spinal anesthesia was administered with 0.75% hyperbaric bupivacaine 1.6 mL, fentanyl 10 µg and morphine 100 µg, with the patient in the sitting position. Sensory block levels were assessed with ice and pinprick every five minutes until peak sensory levels (PSL) were attained. Spearman’s rank correlation was used to correlate DSD with PSL and time to attain PSL.

Results: There were no significant correlations between DSD and PSL assessed with ice (p = 0.474) or pinprick (p = 0.583). Similarly, there was no significant correlation between DSD and time to reach PSL, and between DSD and patient demographics.

Conclusion: The lumbar DSD, as determined by ultrasound, is not a predictor of spinal anesthesia spread. Further research is necessary to understand if ultrasound findings can be used to predict intrathecal spread of local anesthetics.

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Résultats : Il n'y a pas eu de corrélations significatives entre le DSD et les PSL évalués avec de la glace (P = 0.474) ou par piqûre d'épingle (P = 0.583). De même, il n'y a pas eu de corrélation significative entre le DSD et le temps jusqu'à l'obtention des PSL ou entre le DSD et le profil démographique des patientes.

Conclusion : Le DSD lombaire, tel que déterminé par ultrason, n'est pas un prédicteur de diffusion de la rachianesthésie. Des recherches plus poussées sont nécessaires afin de comprendre si les trouvailles de l'ultrason peuvent être utilisées pour prédire la diffusion intrathécale des anesthésiques locaux.

The prediction of the intrathecal spread of local anesthetics remains one of the major challenges in spinal anesthesia. At least 25 factors are thought to influence such spread, some with greater impact than others.1–3 The most important factors include the physical characteristics of the cerebrospinal fluid (CSF) and the injectate, positioning of the patient during injection, the injection technique, and several anthropometric variables.

The CSF occupies a narrow space surrounding the spinal cord and cauda equina, and is enclosed by the membranes of pia, arachnoid and dura mater.4 Carpenter et al.5 and Higuchi et al.6,7 using magnetic resonance imaging (MRI), reported significant correlations between lumbosacral CSF volume and peak sensory block levels during spinal anesthesia. Radiological investigations, such as MRI,8 computed tomography epidurography9 and myelography,10 have demonstrated that compression of the dural sac by epidural saline injection decreases the lumbosacral CSF volume. This change in CSF volume results in a corresponding increase in the rostral intrathecal spread of local anesthetics10–13 during a combined spinal-epidural technique. In general, the more compressed the dural sac and the smaller the CSF volume, the more extensive is the intrathecal spread.

Although ultrasound imaging of the lumbar spine does not determine CSF volume, it allows assessment of certain dimensions of the lumbar dural sac.14 We hypothesized that these dimensions could indicate variations of CSF volume, and therefore their measurement could provide a practical method to predict local anesthetic spread. The purpose of this study was to investigate whether the dural sac antero-posterior diameter, as assessed by ultrasound imaging of the spine, correlates with spinal anesthesia sensory block levels in patients undergoing elective Cesarean delivery (CD).

Methods

After approval of the Mount Sinai Hospital Research Ethics Board, this prospective observational study was undertaken during the period December 2005 - February 2006. Forty-three patients scheduled for elective CD under spinal anesthesia were screened for enrollment. Written informed consent was obtained from all participants. Included were patients with full-term pregnancies, > 18 yr of age, ASA physical status I or II, presenting with a singleton fetus. Excluded were patients with significant coexisting disease, marked spinal bony deformity (kyphosis, scoliosis), previous

FIGURE 1 Determination of the midline of the spine by ultrasound imaging (transverse approach). The spinous process is shown as a hyperechoic signal underneath the skin, continued as a vertical acoustic shadow.

FIGURE 2 Determination of the intervertebral space by ultrasound imaging (transverse approach). Image shows the vertebral body, dural sac, ligamentum flavum and dura mater.