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CORRESPONDENCE

A method for improving access to the paramedian epidural space in the lumbar region

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To the Editor,

We wish to share a method for improving access to the paramedian epidural space in the lumbar region. Visualization of the posterior longitudinal ligament (PLL) during paramedian sonography of the spinal column has been shown to be predictive of the number of needle passes required for neuraxial anesthesia.[1] Flexion plus shoulder rotation increases the dimension of the acoustic window for paramedian thoracic epidural access in the sitting position as well as the lateral decubitus position.[2,3] The effect of body position on the size of the paramedian acoustic window in the lumbar region, however, has not been reported to date. In a volunteer study, we measured the dimensions of the paramedian acoustic window in various body positions.

After obtaining approval from the Research Review Board of the University of British Columbia (UBC RISE H12-02141), we recruited 30 healthy adult volunteers for the study. Inclusion criteria were age >18 yr and American Society of Anesthesiologists physical status I-II. Previous spinal surgery or trauma, significant spinal anatomical abnormalities, or an allergy to ultrasound gel precluded participation. The PLL length at the L3-L4 interspace was measured in a standardized sequential manner in four seated positions as previously described[2]: P1, sitting with lumbar flexion; P2, P1 with right shoulder rotation; P3, P1 with dorsal table-tilt; P4, P1 with dorsal table-tilt combined with right shoulder rotation (see Figure). Detailed scanning methodology was identical to that in a previous study of the thoracic spine.[2] For each position, scanners (readers) adjusted the transducer to maximize the PLL length and had a single optimal image captured but were blinded to the measurement value. A third anesthesiologist independently measured the PLL on each captured image. After scanning all four positions, the first scanner exited the room. The process was then repeated with the second scanner to test inter-operator reproducibility. The PLL was independently measured again on all saved images, from which all identifying data had been removed, by two other anesthesiologists not involved with the data collection to remove any bias by the scanners and to test the reproducibility of the measurements.

Repeated measures analysis of variance in pair-wise comparisons were conducted on mean lengths of the PLL in each position (Bonferroni adjustment to maintain $P < 0.05$). The Kolmogorov–Smirnov (Lilliefors significance correction) check was used to analyze the data distribution for normality (therefore allowing the use of the analysis of variance). It was calculated that a sample size of 30 subjects was required to detect a clinically important change (defined as 1 mm) in mean PLL length, in any of the positions (alpha = 0.05, power = 90%), based on a mean (standard deviation [SD]) change of 1 (1) mm, as reported in previous studies.[2,4]

Thus, 30 subjects (20 men, 10 women) participated with a mean (SD) age, height, weight, and body mass index of 44.1 (11.4) yr, 167 (11) cm, 69.5 (17.3) kg, and 24.7 (4.3) $kg \cdot m^{-2}$, respectively. The mean (95% confidence interval) PLL length increased from 14.3 (13.3 to 15.2) mm in P1 to 15.7 (14.7 to 16.7) mm in P2, to 15.7 (14.8 to 16.6) in P3, and to 17.5 (16.5 to 18.4) mm in P4 (see Figure). Positions P2, P3, and P4 showed significantly increased PLL length

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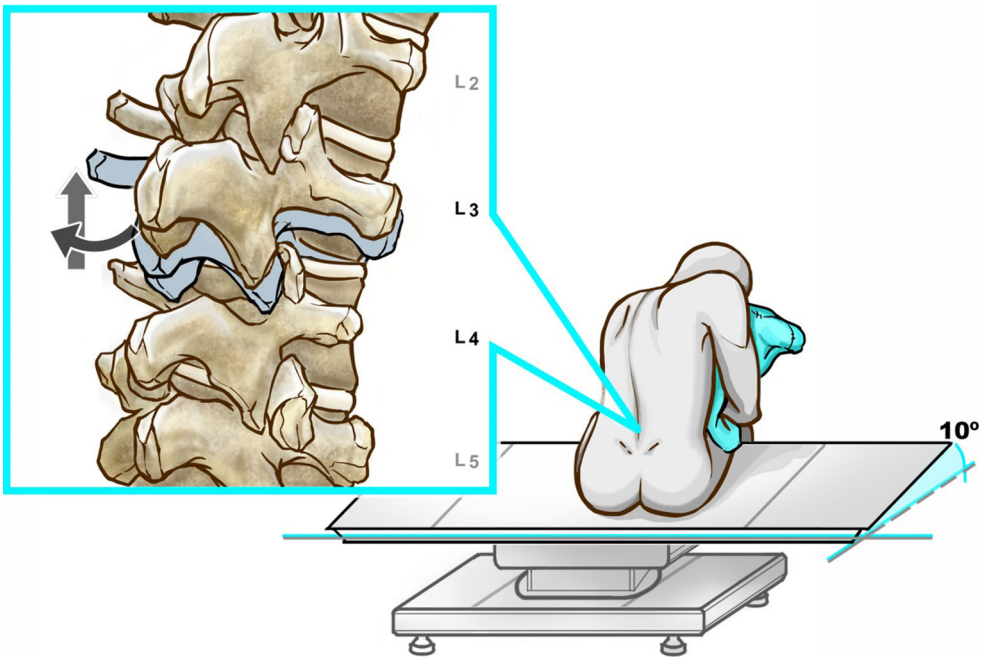

Figure Position 4 is illustrated with a subject positioned in lumbar flexion, with dorsal table-tilt and shoulders rotated to the right. The inset shows the effects on the L3/L4 vertebrae with the grey shadow depicting the original position of the vertebrae in the neutral position. Lumbar spinal flexion moves the spinous processes apart, and right shoulder rotation enlarges the interlaminar space by moving the L3 spinous process away from the L4 lamina. Thus, lumbar spinal flexion and right shoulder rotation theoretically increase the target area for needle placement during epidural or spinal anesthesia

compared with that of P1 ($P < 0.001$). The PLL lengths were not significantly different between P2 and P3.

Our findings suggest that lumbar flexion accompanied by dorsal table tilt and right shoulder rotation may result in improved access to the lumbar paramedian epidural space in the sitting position. Further clinical studies on the effects of lumbar flexion and shoulder rotation on lumbar epidural access are warranted.

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Conflicts of interest None declared.

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