gaps present in eight cadavers at both T4/5 and eight at T5/6. At the T2/3 level, just two of 47 acceptable cadaveric specimens showed a complete gap in the midline ligamentum flavum. In similar previous lumbar epidural cadaver dissections reported by Lirk³ using the same methodology, the incidences of midline lumbar ligamentum flavum defects were reported as L1/2 (22.2%), L2/3 (11.4%), L3/4 (11.1%) and L4/5 (9.3%). This study also concluded that the loss-of-resistance technique for midline epidural placement should be impaired, with attendant increased risk of dural puncture.

It is our belief that the possible risk of increased dural puncture derived from these cadaver studies is not substantiated by clinical experience in obstetric practice, where midline lumbar epidural approaches are routine. Nor is it substantiated in our cumulative nine-year experience of teaching residents and placing over 600 T4 thoracic epidural catheters (midline and paramedian) with only two dural punctures (unpublished data). Lirk acknowledged that "the clinical implications of our findings remain to be ascertained in studies identifying the frequency of entering the subarachnoid space without penetrating the ligamentum flavum in cervical epidural or high thoracic anesthesia."² We agree with this statement, and suggest that Morley-Forster *et al.*'s assertion that T4 epidural catheter placement, midline or paramedian is associated with a high risk of dural puncture, is not supported by sufficient clinical data.

Michael Beriault MD
Piotr Korzeniewski MD
Foothills Medical Centre, University of Calgary,
Calgary, Canada
E-mail: beriaul@telusplanet.net
Accepted for publication May 16, 2006.

References

- 1 Morley-Forster PK, Abotaiban A, Ganapathy S, Moulin DE, Leung A, Tsui B. Targeted thoracic epidural blood patch placed under electrical stimulation guidance (Tsui test). *Can J Anesth* 2006; 53: 375–9.
- 2 Lirk P, Kolbitsch C, Futz G, *et al.* Cervical and high thoracic ligamentum flavum frequently fails to fuse in the midline. *Anesthesiology* 2003; 99: 1387–90.
- 3 Lirk P, Moriggl B, Colvin J, *et al.* The incidence of lumbar ligamentum flavum midline gaps. *Anesth Analg* 2004; 98: 1178–80.

Reply:

*We appreciate the interest shown by Drs. Beriault and Korzeniewski in our recent case report¹ describing the use of the Tsui test to target placement of a thoracic epidural blood patch. These authors object to our expressed caution in entering the epidural space between T2 and T4, based on both their own extensive experience with high thoracic epidural placement, and their concern that the cited findings of failure of ligamentum flavum fusion in the midline reported by Lirk *et al.*,² may be an artifact of the embalming preparation. Our major objective in reporting this case was to demonstrate that it is possible to use the Tsui test to allow precise placement of a blood patch at a site distal from the entry point. Using this strategy, we were able to both circumvent the theoretical risks associated with high thoracic epidural entry, as well as confirm that the catheter placement is limited to the epidural space.*

Beyond the debatable ligamentum flavum fusion failure, there are other theoretical reasons to avoid high thoracic insertion. Foremost, this portion of the spinal cord has been associated with a higher risk of significant cord injury, according to a recent Anesthesia Patient Safety Foundation newsletter.^A At the cervical and high thoracic levels, the epidural space is at its narrowest due to emerging roots of the brachial plexus. Intuitively, the margin of safety for avoidance of needle trauma may be reduced.

Although we agree that, in experienced hands, epidural catheter placement at the T2–4 level is generally safe, not all anesthesiologists share this level of experience and confidence with the anatomy. Up to 53% of first clinical attempts using loss-of-resistance technique fail in the high thoracic or cervical region, if performed without fluoroscopic guidance.³

On occasion, there can be sufficient cerebrospinal fluid accumulated in the epidural space at the site of previous dural puncture to create the mistaken impression that one has again breached the dura in performing the epidural blood patch. Another advantage to using the Tsui test for an epidural blood patch is that a motor response elicited at a low current level (< 1 mA) can be used as a warning sign of catheter placement in the subdural or subarachnoid space. Thus, one can be assured with a negative test response at low current that catheter tip placement is not only at the correct level, but is confined to the epidural space.⁴

A Lofsky AS. Complications of cervical epidural blocks attract insurance company attention. *Anesthesia Patient Safety Foundation Newsletter*; Fall 2005.

Pat Morley-Forster MD FRCPC*
Ban Tsui MSc MD FRCPC†
Sugantha Ganapathy MD FRCPC*
Ahmad Abotaiban MD*
University of Western Ontario,* London, Canada
University of Alberta,† Edmonton, Canada
E-mail: pat.morley-forster@sjhc.london.on.ca

References

- 1 Morley-Forster PK, Abotaiban A, Ganapathy S, Moulin DE, Leung A, Tsui B. Targeted thoracic epidural blood patch placed under electrical stimulation guidance (Tsui test). *Can J Anesth* 2006; 53: 375–9.
- 2 Lirk P, Kolbitsch C, Putz G, et al. Cervical and high thoracic ligamentum flavum frequently fails to fuse in the midline. *Anesthesiology* 2003; 99: 1387–90.
- 3 Stojanovic MP, Vu TN, Caneris O, Slezak J, Cohen SP, Sang CN. The role of fluoroscopy in cervical epidural steroid injection: An analysis of contrast dispersal patterns. *Spine* 2002; 27: 509–14.
- 4 Tsui BC, Gupta S, Finucane B. Detection of subarachnoid and intravascular epidural catheter placement. *Can J Anesth* 1999; 46: 675–8.

Instructions for Letters to the Editor

We welcome submissions in consideration for publication in our *Correspondence* section. Letters to the Editor must contain original material that has not been published previously, nor is under consideration for publication elsewhere. Letters commenting on previously published articles in the *Journal* must not exceed 400 words (excluding references), and must be received within four weeks after publication of the original article. All other types of letters must not exceed a count of 600 words, with a maximum of five references and one figure or table. No more than three authors may sign a letter, and any financial associations or competing interests must be disclosed. Such disclosure will be published. Letters that do not adhere to these instructions will not be considered.

All Letters to the Editor are subject to editing and abridgement. Receipt of all letters will be acknowledged, but letters which are not accepted will not be returned. We are unable to provide prepublication proofs. Submission of a letter constitutes permission for the Canadian Anesthesiologists' Society to use it in the *Journal's* print and electronic publications. Letters should be submitted electronically as an e-mail attachment, formatted in MS Word for Windows (version 2003 or higher) to: cja_office@cas.ca.