Editorial Commentary

Is paravertebral block the new standard of care for postoperative analgesia after thoracoscopic surgery?

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Effective pain control is critical for quick recovery of patients undergoing video-assisted thoracoscopic surgery (VATS). Thoracoscopy has improved but not eliminated the need of sustained analgesia in patients undergoing surgery for both lung and esophageal disease. Yet, 25–45% of patients are estimated to experience at least moderate pain requiring escape medication in the form of intravenous opioids even beyond postoperative day 4 (1,2). Postoperative chest pain is multifactorial and associated with the intercostal, sympathetic, vagus, and phrenic nerve pathways. Inadequate analgesia delays patient recovery and prolongs hospital stay. When not appropriately prevented and treated, pain results in a higher risk of developing atelectasis and pneumonia (3). Nowadays, regional anesthesia techniques in combination with multimodal systemic analgesia are the preferred options for patients undergoing minimally invasive lung and esophageal surgical procedures. For a long time, thoracic epidural analgesia (TEA) has represented the gold standard of care in these patients. However, despite a more extended sensory block compared to the paravertebral block (PVB), TEA can fail for technical reasons in up to 15–30% of patients (4-6) and is associated with hypotension and risk of neurological complications (7). A Cochrane review showed moderate-quality evidence of comparable efficacy between TEA and PVB after thoracotomy, and fewer minor side-effects associated with PVB (8). PVB remains a reasonable alternative to TEA, but relatively few comparative studies have assessed its efficacy in the setting of VATS (9,10).

The authors of this randomized clinical trial (11) should be commended for their effort to improve the technique of surgeon-guided video-assisted PVB and to compare this method to TEA. In short, they showed that creation of an extra pleural pocket just lateral to the sympathetic chain under VATS guidance can facilitate the placement of a paravertebral catheter and can help to secure it to avoid early dislodgment. A total of 176 patients diagnosed with a solitary pulmonary nodule and eligible for a three-port thoracoscopy were included in the PVB group (n=88) and TEA group (n=88), respectively. The groups were well-matched. Six patients in the TEA group were excluded (4 for technical difficulties in catheterization, 2 declined study participation for pain). Overall, four patients in whom conversion to thoracotomy occurred were included in the

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final analysis. Two intercostal chest tubes were inserted at the end of the procedure. Patient-controlled postoperative analgesia with 0.2% ropivacaine was set to deliver 1 mL bolus with a lockout interval of 15 minutes and a background infusion rate of 5 mL/hour for up to 2 days with the goal to keep the visual analogue scale (VAS) score below 4. If pain control was poor, rescue opioid analgesia was provided with intramuscular 10 mg of morphine equivalent. Main findings were that both the median time to place the catheter (5 *vs.* 14 minutes, P<0.001) and the failure rate (0% *vs.* 6.8%, P=0.038) were significantly lower in the PVB group compared to the TEA group. Postoperative outcomes on postoperative day 0–2, which included conversions to thoracotomy, major morbidity, the VAS pain scores at rest and with coughing, the number and doses of rescue analgesic medication received, the overall satisfaction scores, and the rate of patients discharged with oral analgesics were comparable in the two groups. The mean length of hospital stay was 2 days in both groups.

In the study by Wu *et al.*, the trial category was not clarified (i.e., superiority, equivalence, or non-inferiority) whereas, even if the power analysis was performed, we do not know if an adequate number of patients were enrolled in the study. Further, we do not know whether the design of this randomized clinical trial may have overestimated the effects of PVB since patients who underwent conversion to thoracotomy were not excluded from the final intention-to-treat analysis (12). We also do not know whether an opioid-sparing protocol for rescue analgesia could have produced similar results. The study was not double blinded and the very short follow-up does not allow to speculate about the possible persistence or recurrence of pain beyond postoperative day 2. Last but not least, the results of this single-center study may not be generalizable to other hospital settings. Despite these limitations, the Authors have indeed shown that the technique of implanting a catheter for postoperative continuous PVB analgesia after VATS is safe and effective, and provides similar short-term pain control compared to TEA. The study results also suggest that intraoperative surgeon-guided PVB can avoid discomfort/pain and potential adverse events during epidural catheter placement in the awake state. For the above reasons, surgeon-guided PVB may represent the preferred option for postoperative analgesia management after VATS.

Similar to the transversus abdominis plane block in laparoscopic procedures (13), the ultrasound (US)-guided technique with pre-emptive local anesthetic infiltration of the port sites to avoid sensitization and amplification of the nociceptive signals before entry in the thoracic cavity could prove useful and safe for PVB. However, pain control may fail due to poor sonographic visualization, and the catheter for continuous analgesia is often misplaced with the US-guided technique (14,15). Interestingly, a recent randomized clinical trial including 196 patients undergoing diverse types of lung resections has demonstrated the noninferiority of PVB performed by surgeons under video thoracoscopic view compared with PVB performed by anesthesiologists using the US-guided technique in terms of opioid consumption during the first 48 hours (16). A procedural failure occurred in 6% of PVB-VATS group and in 10% of PVB-US group. The mean opioid consumption was not inferior in the per-protocol and in the modified intention-to-treat analysis and after adjustment for the type of surgery. Duration of anesthesia was shorter in the PVB-VATS group (P=0.04). Pain VAS scores at rest and while coughing, mean hospital opioid consumption, postoperative overall complications, length of hospital stay, rate of 30-day readmission, rate of analgesic consumption at 30 days, and global satisfaction for pain management were similar in both groups.

In the study by Wu *et al.*, postoperative pain relief by surgeon-guided PVB with catheter placement was similar to that of TEA in patients undergoing thoracoscopic resection of lung nodules. We believe that this method may also apply to major thoracoscopic/robotic lung resections and esophagectomies, and should be considered a suitable option in the context of multimodal analgesic regimens after video-assisted thoracic surgery. Compared to TEA, PVB is associated with a better side-effect profile (17). Although serious complications of TEA are rare if contraindications are respected, we believe that TEA is not a panacea as the overall incidence of failure may be high even in high-volume centers and hypotension can cause reduction in splanchnic blood flow and ischemia of the gastric substitute after esophagectomy (18). TEA may still be considered an option when the chance to convert to an open surgical approach is high. However, with the widespread diffusion of enhanced recovery after surgery pathways, locoregional anesthesia including PVB has gained popularity in the perioperative management for minimally invasive thoracic surgery. The recent PROSPECT guidelines for pain management after VATS consider PVB as the first-line analgesic approach in combination with paracetamol and non-steroidal anti-inflammatory drugs or dexmedetomidine, and opioids as a rescue therapy. Use of TEA for postoperative analgesia is not recommended due to the risk of hypotension, urinary

retention, and potential lower limb weakness which can delay early rehabilitation (19).

A one-size-does-not-fit-all approach is appropriate in the context of postoperative multimodal analgesia considering that between 30% and up to 80% of patients report that moderate to severe pain is not adequately treated in the days after surgery (20). Importantly, poorly controlled intra- and postoperative pain is associated with complications, such as delirium and infections, and represents a potential risk factor for developing disabling postsurgical pain (17,21-23). Unfortunately, there is a lack of high-quality studies comparing TEA and PVB in combination with standardized adjuvant therapies. Therefore, it seems logical that a patient-centered analgesic titration should be the main research goal. Further randomized and multicenter trials are needed to validate this hypothesis, to define the optimal use of systemic analgesia and rescue opioids (24-26), and to fill the existing gap in long-term chronic pain assessment and outcomes after VATS.

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