Block for uniportal video-assisted thoracoscopic surgery: an ultrasound-guided, single-penetration, double-injection approach

Y.-J. Lee¹, C.-C. Chung², H.-C. Chou² and J.-A. Lin²,*

¹Hsin-chu, Taiwan, and ²Taipei, Taiwan

Editor—For selected surgical procedures, the use of peripheral regional anaesthetic blocks may avoid general anaesthesia and increase the efficiency of the surgical pathway. However, evidence on peripheral truncal anaesthetic blocks is scarce.¹ Even though non-intubated video-assisted thoracoscopic surgery (VATS) has been reported under local anaesthesia showing safety, feasibility and favourable results,²⁻⁵ suboptimal anaesthetic status still occurs with moderate pain during surgery.⁴ For uniportal VATS,⁵ we would like to report two cases based on approval from the institutional review board, where we introduced an ultrasound-guided peripheral truncal anaesthetic block combining serratus plane block⁶ and intercostal nerve block.

Two ASA II (hypertension history) male patients (57 years old, 65 kg and 74 years old, 81 kg respectively) underwent wedge resection of the pulmonary nodule(s) through uniportal VATS. They refused tracheal intubation and neuraxial techniques, so loco-regional anaesthesia with sedation was proposed. Under standard monitoring, they were positioned in a full lateral decubitus position with the operative side up (Fig. 1a). Intravenous (iv) fentanyl (2 μg kg⁻¹) and midazolam (0.02 mg kg⁻¹) were given for sedation. By targeting the neurovascular bundle in the cross-sectional view obtained by a linear transducer (Fig. 1a and e), 20 ml of local anaesthetic (LA; 0.5% ropivacaine with 1:400 000 epinephrine) was used for the first injection (serratus plane block⁶) (Fig. 1c) and another 10 ml for the second injection (intercostal nerve block) (Fig. 1d) from the same penetration point after confirmation by nerve stimulation. Ipsilateral vagal and phrenic blocks were done at neck level to prevent coughs and reduce diaphragmatic movement. Opening pressures were tested before every injection to prevent intrafascicular spread.⁷ Sedation was maintained intra-operatively by target-controlled infusion with propofol (Schnider Ce, 2–3.5 μg ml⁻¹). After skin incision, but before entering the pleura, the surgeon was asked to inject 5 ml LA into the parietal pleura, after which open pneumothorax was created. Oxygen saturation was >92%, with spontaneous breathing through a face mask throughout the procedure. The surgical procedures were uneventful, without patient movement or top-up anaesthetic, and were completed within 2 h.

At the end of the operation, the collapsed lung was re-inflated by a face mask.

The reasons for choosing injection below (in between the serratus and rib) the serratus anterior to accomplish serratus plane block⁶ are 3-fold. First, considering lateral cutaneous branches of the intercostal nerves, either from the indicated or adjacent level, run in an outward direction in the mid-axillary line, below-the-serratus injection covers all the soft tissues superficial to the ribs (Fig. 1c and e). Second, below-the-serratus injection distributes more anteriorly, better fitting the anterolateral incision site. Third, finding the ribs is easier⁶ and more consistent than using the serratus as a landmark. The round hyperechoic structure (Fig. 1a and e) is likely the neurovascular bundle, because usually it has left the subcostal groove in the mid-axillary line and can travel to the middle of the intercostal space,⁹ verified by randomly dissecting two cadavers in our work (Fig. 1f).

Vagal blockade was achieved at the neck level because the left-sided vagus nerve is sometimes difficult to visualize within the thorax,¹⁰ and the act of exploring the vagus nerve may induce coughs before intrathoracic vagal blockade is accomplished.¹¹ In combination with phrenic nerve blockade achieved via injection over the surface of the scalenus anterior at the interscalene level, the two blocks can be easily done as another single-penetration double-injection technique in the neck.

In conclusion, we propose an easy ultrasound-guided peripheral truncal anaesthetic block for uniportal VATS. A prospective trial (TMU-JIRB 201504056) is going to be conducted to clarify the details of VATS block.

Acknowledgements

The authors thank the Department of Anatomy and Cell Biology at Taipei Medical University for providing the human cadavers.

© The Author 2015. Published by Oxford University Press on behalf of the British Journal of Anaesthesia. All rights reserved. For Permissions, please email: journals.permissions@oup.com
Fig 1 Patient posture, injection method, ultrasound images and cadaver findings regarding VATS block. Two lines were drawn with the model lying in the lateral decubitus position. One line was drawn along the anterior axillary line (purple line), from which the other was drawn along the intercostal space at the nipple level (red line). The planned incision site was at the intersection point of the two lines. The ultrasound transducer was placed at the intersection point and the needle inserted in a caudad-to-cephalad direction with the long axis of the transducer oriented along the visual axis (A). The cross-sectional view reveals the hyperechoic neurovascular bundle (B). The first injection is made after touching the surface of the caudad rib (white dotted arrow) to expand the interfascial space (blue shaded area) between the serratus anterior muscle and the external intercostal muscle (C). The second injection follows the same needle direction as the first one and targets the neurovascular bundle (white dotted arrow in the intercostal space). After confirmation by twitches of the intercostal muscle, local anaesthetic was administered in the intercostal plane, which achieved circumferential spread (blue shaded area) and further enhanced the contrast with local anaesthetic as the background. The yellow dotted line depicted within the acoustic shadow of the cephalad rib outlined the margin of the subcostal groove (D). To further illustrate ultrasound anatomy of the intercostal space in the anterolateral chest, a smiling-face cartoon figure is made. The nose represents the neurovascular bundle as the target of needle trajectory and the line between the eyes represents the fascia separating the serratus anterior muscle and the external intercostal muscle. The red arrow region above the rib was anesthetized by the first injection and the green arrow region, including the intercostal muscles, was anesthetized by the second injection (E). Dissection from the human cadaver showed that in the lateral chest, the nerve could be found near the middle of the intercostal space instead of being tucked away in the subcostal groove (F).
Declaration of interest
None declared.

References
doi:10.1093/bja/aev327

Change in endothelial vascular reactivity and acute brain dysfunction during critical illness


Nashville, Tennessee, USA

*E-mail: christopher.hughes@vanderbilt.edu

Editor—Impaired endothelial vascular reactivity, a measure of systemic endothelial function, is independently associated with prolonged brain dysfunction (delirium and coma) in the intensive care unit (ICU). It is unknown if improvement in endothelial function over time is associated with a shorter duration of acute brain dysfunction. Early physical therapy has been shown to reduce delirium in the ICU and also to improve endothelial function among non-critically ill patients. We performed a prospective pilot study to examine whether improvements in endothelial vascular reactivity over time are associated with a reduced duration of acute brain dysfunction and whether early physical therapy improves endothelial vascular reactivity in critically ill patients.

In adult medical and surgical ICU patients with respiratory failure and/or shock, we assessed endothelial vascular reactivity at enrolment and again at 7 days or hospital discharge via peripheral artery tonometry with the reactive hyperemia index (RHI). We assessed coma and delirium twice daily using the Richmond Agitation-Sedation Scale (RASS) and the Confusion Assessment Method for the ICU (CAM-ICU). We defined coma as a RASS of −4 (responsive to physical stimulus only) or −5 (completely unresponsive). Non-comatose patients were considered delirious if the CAM-ICU assessment was positive. We assessed patients for 14 days following study enrolment or until they died or were discharged from the hospital, whichever occurred first. During the study timeframe, a number of patients received an early physical therapy protocol during their ICU stay in which they received progressive, graded physical rehabilitation guided by the patient’s level of consciousness. Briefly, comatose patients received passive range of motion exercises while patients who were more alert were progressed through passive range of motion exercises, sitting in the bed, active range of motion exercises, standing, walking, and activities of daily living training. We used multivariable linear regression to study the association of change in RHI with days alive and free of brain dysfunction (delirium/coma-free days), adjusting for severe sepsis at ICU admission, participation in the early physical therapy protocol, enrolment RHI and an interaction term between enrolment RHI and the change in RHI. We additionally performed an analysis of covariance model to study the association between early physical therapy and improvement in RHI, adjusting for enrolment RHI and severe sepsis.

We enrolled 42 patients in this pilot study, 29 of whom participated in the early physical therapy protocol, with a median age of 61 yr [interquartile range (IQR) 56–69], APACHE II score of 24 [IQR 20–29], mechanical ventilation duration of 2.9 days (IQR 1.6–9.2) and an ICU length of stay of 3.8 days (IQR 2.8–10.9). Improved (increased) RHI from enrolment to follow-up was associated with more days alive and free of brain dysfunction (P=0.02; Fig. 1). For example, the 75th percentile of our cohort had a 0.46 increase in RHI over time, whereas the 25th percentile had a 0.26 decrease in RHI. This greater increase in RHI was associated with 1.9 more delirium/coma-free days over the 14-day study period, other covariates being equal (95% confidence interval (CI) 0.44, 3.34; P=0.02). This association was modified by the enrolment vascular reactivity (P for interaction=0.10; Fig. 1). Participation in the early physical therapy protocol was marginally associated with improved vascular reactivity (P=0.09).

In this prospective pilot study of severely ill medical and surgical ICU patients, we found that improved endothelial vascular