

arterial oxygenation can be affected by changes in either shunt, V/Q scatter, or both. Increased shunt fraction results in a downward shift of this relationship, and an increase in scatter of V/Q ratios moves the relationship to the right. One or both of these mechanisms, rather than simple hypoventilation, can reduce arterial oxygen saturation, even when overall alveolar ventilation is little affected.

We suggest that one convincing primary mechanism of impaired oxygenation is airway closure, caused by a decrease in lung volume⁶ since the time course resembles that of the change in lung volume seen in very similar conditions.³ This is supported by the tendency for the effect to occur more often during laparoscopy, where lung volume will be already reduced. Both increased shunting and increased V/Q scatter could result. As lung volume decreases, narrowing of airways in dependent lung regions will generate additional low V/Q units. In addition, transient decreases in ventilation at low lung volume can also result in hypoxaemia,⁷ although the mechanism is likely to be similar, because a decrease in overall ventilation would have a greater proportionate effect in those lung units that already have a low V/Q ratio. It is also possible that if complete airway closure occurs, ventilation may cease in part of the lung, and if perfusion continues, then a shunt-like effect would result.

The clinical importance of reduced lung volume and impaired oxygenation of this minor degree is not clear. One could argue that airway closure followed by possible alveolar collapse is potentially harmful. However, when alveolar nitrogen concentrations are maintained above 30%, alveolar collapse is unlikely, and short-term airway closure may not be harmful in day-surgery patients. Only if there were a clear clinical concern that these effects were harmful, would further research be justified, for example, by a randomized comparison. In addition, formal randomized studies of such patients are almost impossible given the current degree of regulation of research in the UK. Nevertheless, we have been able to confirm the previous observations of Smith and colleagues,¹ and offer an explanation for their findings.

Conflict of interest

None declared.

G. B. Drummond*

B. Lafferty

Edinburgh, UK

*E-mail: g.b.drummond@ed.ac.uk

- 1 Smith I, Walley G, Bridgman S. Omitting fentanyl reduces nausea and vomiting, without increasing pain, after sevoflurane for day surgery. *Eur J Anaesthesiol* 2008; **25**: 790–9
- 2 Drummond GB, Duncan MK. Abdominal pressure during laparoscopy: effects of fentanyl. *Br J Anaesth* 2002; **88**: 384–8
- 3 Chawla G, Drummond GB. Fentanyl decreases end-expiratory lung volume in patients anaesthetized with sevoflurane. *Br J Anaesth* 2008; **100**: 411–4

- 4 Nunn JF. Factors influencing the arterial oxygen tension during halothane anaesthesia with spontaneous respiration. *Br J Anaesth* 1964; **36**: 327–41
- 5 Jones JG, Jones SE. Discriminating between the effect of shunt and reduced V_A/Q on arterial oxygen saturation is particularly useful in clinical practice. *J Clin Monit* 2000; **16**: 337–50
- 6 Bergman NA, Tien YK. Contribution of the closure of pulmonary units to impaired oxygenation during anesthesia. *Anesthesiology* 1983; **59**: 395–401
- 7 Findley LJ, Ries AL, Tisi GM, Wagner PD. Hypoxemia during apnea in normal subjects: mechanisms and impact of lung volume. *J Appl Physiol* 1983; **55**: 1777–83

doi:10.1093/bja/aeq076

Transversus abdominis plane block for renal transplant recipients

Editor—Renal transplant recipients are challenging to anaesthetists due to the altered pharmacokinetics of many drugs, including opioids. The use of morphine to control postoperative pain after renal transplantation must be monitored closely as the clearance of its active metabolite morphine-6-glucuronide (M6G) is reduced by renal impairment resulting in its accumulation.¹

We conducted a pilot study to investigate whether transversus abdominis plane (TAP) block reduced the morphine requirements in the first 24 h after renal transplantation. Of the 20 patients in the study, 10 received a TAP block as part of their anaesthetic (TAP group) and 10, matched for age and sex, were included in the control group from our transplant database.

A standard general anaesthetic was administered to all patients. In the control group, patients received intraoperative acetaminophen 1 g i.v. and morphine up to 10 mg as required. They also received bupivacaine 0.5% (20 ml) in the wound edges before the end of anaesthesia. The treatment group received a TAP block using bupivacaine 0.5% (20 ml) after induction of anaesthesia and similar intraoperative pain relief. All patients were prescribed regular acetaminophen 1 g i.v. every 6 h for postoperative pain relief and a patient-controlled analgesia (PCA) pump delivering 0.5 mg on demand with a lockout period of 10 min after every dose delivered.

We compared pain, nausea and vomiting, and sedation scores measures at 3, 6, 12, and 24 h after surgery between the groups.

There was a statistically significant reduction in intraoperative morphine requirements in the TAP group 0.4 (1.2) mg compared with 9.3 (1.4) mg in the control group ($P<0.0001$) and also in the first 24 h after operation in the TAP group: 10.4 (4.5) mg compared with 28.9 (7.1) mg in the control group ($P<0.0001$). Pain scores were significantly lower in the TAP group at 3, 6, and 12 h ($P<0.001$),

but there was no difference at 24 h. Nausea and vomiting and sedation scores were significantly lower at 3 and 6 h in the TAP group compared with the control group.

Postoperative pain after renal transplantation may be severe and the administration of systemic analgesia may be limited due to impaired renal function and respiratory complications from opioids.^{2,3} The use of regional anaesthesia for renal transplantation remains controversial.⁴ I.V. opioid administration provides the mainstay of analgesia after renal transplantation in the majority of transplant centres in the UK,⁵ although significant accumulation of M6G, to levels associated with respiratory depression, has been observed in transplant patients despite sufficient primary graft function negating the need for dialysis after transplantation.⁶

TAP blocks have been shown to be effective after a variety of abdominal procedures^{7–11} as they provide opioid-sparing effects and improve patient satisfaction.¹¹ Abdominal wall incisions may contribute significantly to the postoperative pain experienced after surgery,¹⁰ and TAP blocks are most suitable for operations where parietal pain is a major factor.¹² Renal transplant recipients are ideally suited to gain maximum benefit from TAP blocks as their classical incisions extend from the symphysis pubis to just above and medial to the anterior superior iliac crest (T10–L1 dermatomes, which are usually covered by the block)¹³ without any intraperitoneal extension, eliminating the visceral pain component.

We recommend the use of TAP blocks as part of a balanced analgesia regimen for renal transplant recipients. The significant pain relief provided in the first 24 h after operation coupled with the ease of performing the block and the good safety profile makes it an appealing choice for this group of patients.

Conflict of interest

None declared.

K. Mukhtar*

I. Khattak

Liverpool, UK

*E-mail: karimmukhtar@gmail.com

- 1 Stein C, Schafer M, Machelska H. Why is morphine not the ultimate analgesic and what can we do to improve it? *J Pain* 2000; **1**: 51–6
- 2 Ghods AJ. Organ transplantation in Iran. *Saudi J Kidney Dis Transpl* 2007; **18**: 648–55
- 3 Dean M. Opioids in renal failure and dialysis patients. *J Pain Symptom Manage* 2004; **28**: 497–504
- 4 Akpek E, Kayhan Z, Kaya H, et al. Epidural anesthesia for renal transplantation: a preliminary report. *Transplant Proc* 1999; **31**: 3149
- 5 Williams M, Milner QJW. Postoperative analgesia following renal transplantation—current practice in the UK. *Anaesthesia* 2003; **58**: 712–3
- 6 Carr AC, Stone PA, Serpell MG, et al. Patient-controlled morphine analgesia (PCA morphine) in cadaveric renal transplant recipients:

does morphine-6-glucuronide accumulate? *Br J Anaesth* 1998; **81**: 630P

- 7 McDonnell JG, O'Donnell BD, Curley G, et al. Analgesic efficacy of transversus abdominis plane (TAP) block after abdominal surgery: a prospective randomized controlled trial. *Anesth Analg* 2007; **104**: 193–7
- 8 McDonnell JG, Curley G, Carney J, et al. The analgesic efficacy of transversus abdominis plane block after cesarean delivery: a randomized controlled trial. *Anesth Analg* 2008; **106**: 186–91
- 9 El-Dawlaty AA, Turkistani A, Kettner SC, et al. Ultrasound-guided transversus abdominis plane block: description of a new technique and comparison with conventional systemic analgesia during laparoscopic cholecystectomy. *Br J Anaesth* 2009; **102**: 763–7
- 10 Niraj G, Searle A, Mathews M, et al. Analgesic efficacy of ultrasound-guided transversus abdominis plane block in patients undergoing open appendectomy. *Br J Anaesth* 2009; **103**: 601–5
- 11 Belvay D, Cowlshaw PJ, Howes M, et al. Ultrasound-guided transversus abdominis plane block for analgesia after Caesarean delivery. *Br J Anaesth* 2009; **103**: 726–30
- 12 Bonnet F, Berger J, Aveline C. Transversus abdominis plane block: what is its role in postoperative analgesia. *Br J Anaesth* 2009; **103**: 468–70
- 13 Tran TMN, Ivasunic JJ, Hebbard P, Barrington MJ. Determination of spread of injectate after ultrasound-guided transversus abdominis plane block: a cadaveric study. *Br J Anaesth* 2009; **102**: 123–7

doi:10.1093/bja/aeq077

Influence of an extracorporeal lung assist system on transpulmonary thermodilution-derived variables

Editor—The reliability of extended haemodynamic monitoring by the transpulmonary thermodilution technique has been questioned during extracorporeal circulation. Previously, it was shown that running renal replacement therapy has no clinically relevant impact.¹ Recently, we presented data on the influence of different blood flows through a pumpless extracorporeal lung assist (PECLA) system on the reliability of transpulmonary thermodilution-derived haemodynamic variables.² Here, we provide data on the influence of PECLA on these variables since we sampled data during a period of interrupted therapy before planned withdrawal of the system.

A 70-yr-old woman (162 cm, 60 kg) underwent uneventful elective upper lung sleeve resection for cancer. Unfortunately, she developed acute respiratory distress syndrome (ARDS) 5 days after surgery. She was re-admitted to the ICU and underwent intubation of the trachea for mechanical ventilation.² The patient received a left femoral 5 F thermistor catheter (PV20L15, Pulsion Medical Systems, Munich, Germany) which was connected to a PiCCOplus monitor (Pulsion Medical Systems AG, Munich, Germany). Owing to severe respiratory acidosis, she required a PECLA system (iLA Membrane