our codes and labels which can be easily read are a necessity. In addition, perhaps it is time for a national body such as the Canadian Anaesthetists' Society to become involved in the problem of packaging-related drug errors in anaesthesia.

Finally, it is important to remember that drug labeling and packaging is only part of the complex patient safety issue of getting the right drug to the right patient at the right time by the right route in the right dose. There are many opportunities for human error in all stages of the action of giving a patient a drug^{3,4} and any changes made in labeling and packaging should be done in consultation with the end users.

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REFERENCES

- 1 Orser BA, Oxorn DC. An anaesthetic drug error: minimizing the risk. *Can J Anaesth* 1994; 41: 120-4.
- 2 Yemen TA. Drug errors (Letter). *Can J Anaesth* 1994; 41: 870.
- 3 Currie M, MacKay P, Morgan C, et al. The 'wrong drug' problem in anaesthesia: an analysis of 2000 incident reports. *Anaesth Intensive Care* 1993; 21: 596-601.
- 4 Williamson JA, Webb RK, Sellen A, Runciman WB, Van der Walt JH. Human failure: an analysis of 2000 incident reports. *Anaesth Intensive Care* 1993; 21: 678-83.

Fentanyl infusions for post-thoracotomy pain management

To the Editor:

We congratulate the efforts of Dr. Baxter *et al.*¹ in their attempt to shed further light on this important and challenging topic of post-thoracotomy pain management. However, we question the validity of comparing two pairs of variables (*iv*-PCA-morphine + *iv*-fentanyl infusion vs *iv*-PCA-morphine + epidural-fentanyl infusion). It is feasible that *iv*-PCA-morphine consumption reflects an inadequately managed infusion (epidural or intravenous fentanyl) rather than demonstrating the superiority of one technique over the other. An appropriately managed infusion requires frequent patient assessment and titration. Over- or underdosing a constant infusion will add bias, and favour the more appropriately dosed infusion. As noted in Dr. Grant's editorial, fentanyl has a five-fold MEC range, therefore dosing on a per kilogram basis for a non-titrated constant infusion, is probably inappropriate. Intravenous-PCA-fentanyl vs epidural-PCA-fentanyl may be a more valid method for comparing these two techniques, rather than *iv*-PCA morphine consumption.

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REFERENCE

- 1 Baxter AD, Laganière S, Samson B, Stewart J, Hull K, Goernert L. A comparison of lumbar epidural and intravenous fentanyl infusions for post-thoracotomy analgesia. *Can J Anaesth* 1994; 41: 184-91.

REPLY

We appreciate the interest of Drs. Kahn and Jackson in our study, and their comments about our study design.

We agree that a fixed-rate infusion regimen will not produce optimum analgesia for some patients because of variations in MEC. It is therefore important to allow the administration of additional analgesia by some means. We allowed patients to self-titrate patient-controlled morphine, as used in many other studies as an index of the efficacy of the regimen being investigated. It is possible that some patients with low MEC may have received more fentanyl than necessary with the fixed-rate infusion, and this may have produced respiratory depression. However, all patients used supplementary morphine during the study period, which we interpret as indicating inadequate analgesia at that time.

Titration of the infusion alone requires frequent assessment of the patients, may involve a latent period until changes in rate become effective, and introduces bias by involving the assessor in the "analgesic arc." "Over- or under-dosing a constant infusion" will only "add bias", as suggested by Drs. Kahn and Jackson, if the two infusion routes were treated differently (they were not in our study). Alternatively, this could have been a problem if the two routes should have been managed in different fashions and were not, but we are not aware of any evidence to suggest this.

Indeed the hypothesis to be tested by our study was that the effects of fentanyl were the same whether given by the epidural or intravenous route. We, therefore, used the same regimen by both routes: a variable dosage regimen would make interpretation of the results more difficult.

We agree that PCA administration may provide effective dose titration by both the epidural and intravenous routes. This has been used in three studies, two showing lower fentanyl requirements with epidural administration^{1,2} and the third indicating no advantage to the epidural route.³

It is noteworthy that studies using infusion titration,⁴ PCA,^{1,3} or constant infusion, as in ours, have all shown a similar pattern of poor pain control in the immediate postoperative period. Perhaps we should be looking more at other modalities, e.g., NSAIDs, intra- and/or postoperative local anaesthetics, or other opioids, rather than relying on a single agent technique for pain control in this situation.

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REFERENCES

- 1 Grant RP, Dolman JF, Harper JA, et al. Patient-controlled lumbar epidural fentanyl compared with patient-controlled intravenous fentanyl for post-thoracotomy pain. *Can J Anaesth* 1992; 39: 214-9.
- 2 Welch EA, Breen DP. Patient-controlled on-demand epidural fentanyl. *Anaesthesia* 1991; 46: 438-41.
- 3 Glass PSA, Estok P, Ginsberg B, Goldberg JS, Sladen RN. Use of patient-controlled analgesia to compare the efficacy of epidural to intravenous fentanyl administration. *Anesth Analg* 1992; 74: 345-51.
- 4 Sandler AN, Stringer D, Panos L, et al. A randomised, double-blind comparison of lumbar epidural and intravenous fentanyl infusions for post-thoracotomy pain relief. *Anesthesiology* 1992; 77: 626-34.

Mask lung ventilation by ambulance personnel

To the Editor:

I wish to raise a comment on "Mask lung ventilation by ambulance personnel: a performance assessment," by Devitt *et al.*¹ Although the ability of basic life support ambulance officers to perform tracheal intubation was not evaluated, the authors postulate that if ventilation volume is inadequate with bag valve mask (BVM) devices to meet current AHA standards, then tracheal intubation should be considered as a solution. Clearly, the cuffed tracheal tube achieves the best airway with minimal risk of aspiration during cardiopulmonary resuscitation in the hands of experienced people. However, the large numbers of ambulance men to be trained in a relatively difficult skill to acquire, relative to the number of patients requiring tracheal intubation, means that it is impossible to provide adequate experience for everyone. Therefore, I believe that at least for Europe with its tiered emergency medical systems it would be more appropriate to recommend the use of the laryngeal mask airway (LMA) above tracheal intubation as an alternative method for airway management by first tier personnel. A recent, albeit limited, study has shown that teaching and subsequent use of the LMA for manual ventilation is superior to that involving Guedel airway, bag and facemask.²

Ideally, a multicentre study that looks at outcome according to the Utstein Style should be initiated to prove the superiority of the LMA for the out-of-hospital cardiac arrest patients.

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REFERENCES

- 1 Devitt JH, Brooks DA, Oakley PA, Webster PM. Mask lung ventilation by ambulance personnel: a performance assessment. *Can J Anaesth* 1994; 41: 111-5.
- 2 Alexander R, Hodgson P, Lomax D, Bullen C. A comparison of the laryngeal mask airway and Guedel airway, bag and facemask for manual ventilation following formal training. *Anaesthesia* 1993; 48: 231-4.

REPLY

As pointed out by Dr. Martens, our study suggested ambulance personnel using bag valve mask devices may achieve inadequate expiratory volumes during mask lung ventilation. We also share in the expressed concerns regarding training and maintenance of proficiency in a technical procedure such as tracheal intubation.

However, we do not believe that the laryngeal mask airway (LMA) is an appropriate solution for airway management by ambulance personnel. In a follow-up study, using a similar experimental technique, we measured expiratory volume and the frequency of oesophago-gastric insufflation when the LMA was used to maintain the airway during positive-pressure ventilation.¹ The fraction of leak, when leak was calculated by subtracting the expiratory from the inspiratory volume and expressed as a fraction of the inspiratory volume, rose from 13% at 15 cm H₂O to 27% at 30 cm H₂O inflation pressure. Of greater concern, the frequency of oesophago-gastric insufflation rose from 2.1% at 15 cm H₂O to 35.4% at 30 cm H₂O inflation pressure. These measurements were taken in healthy, paralyzed and anaesthetized patients with normal lung compliance and airways resistance. Others have shown in lung models that increased airway resistance and decreased pulmonary compliance will decrease effective ventilation and increase the frequency of oesophago-gastric insufflation.²

Alexander *et al.* only studied healthy, paralyzed, anaesthetized patients.³ In the field, patients often have residual upper airway reflexes, there may be a risk of aspiration, and many of the conditions necessitating tracheal intubation and mechanical ventilation result in increased airway resistance and decreased pulmonary compliance. We agree with the guidelines elaborated by Fisher *et al.* recommending that the LMA is unsuitable as an emergency airway outside the operating room.⁴

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REFERENCES

- 1 Devitt JH, Wenstone R, Noel AG, O'Donnel MP. The laryngeal mask airway and positive-pressure ventilation. *Anesthesiology* 1994; 80: 550-5.
- 2 Johannigman JA, Branson RD, Davis K Jr., Hurst JM. Techniques of emergency ventilation: a method to evaluate tidal volume, airway pressure, and gastric insufflation. *J Trauma* 1991; 31: 93-8.
- 3 Alexander R, Hodgson P, Lomax D, Bullen C. A comparison of the laryngeal mask airway and Guedel airway, bag and facemask for manual ventilation following formal training. *Anaesthesia* 1993; 48: 231-4.