ejection fraction was calculated at 30%. Cardiac index (CI) was $1.6 \text{ L}\cdot\text{min}^{-1}\cdot\text{m}^2$, and pulmonary capillary wedge pressure 15 mmHg. Coronary angiography revealed a solitary ostium in the right aortic sinus, but the entire coronary system was free of any obstructive atherosclerotic lesions (Figure). The patient first received dobutamine $5 \mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ and thereafter milrinone $0.5 \mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, with a slight improvement in CI, but tachycardia developed. Infusion of glucose-insulin-potassium (GIK) was given over 72 hr. CI improved progressively. Extubation was possible 62 hr after the acute episode.

A single coronary ostium is found in 0.2–1.4% of adult patients undergoing coronary arteriography.^{1,2} The mechanism leading to myocardial infarction in the present setting remains open to discussion: 1) myocardial ischemia has been described in patients with this anomaly in the absence of additional atherosclerotic disease. The pathophysiology is not completely understood.^{2–4} Impairment of coronary reserve (functional obstruction) is one among other hypotheses. Although a mild degree of hypotension was tolerated, there was no evidence of myocardial ischemia during surgery; 2) coronary vasospasm may have occurred in the postoperative phase; 3) paradoxical air embolism causing an acute occlusion of the single coronary system should be considered after ENT surgery. The origin of the single coronary artery from the right aortic cusp together with the position of the patient during the procedure may have favoured air embolism.

In conclusion, this patient with a single coronary ostium but without heart disease, previously asymptomatic in daily life, suffered a myocardial infarction in the immediate postoperative period.⁵ Several explanations are likely. Whatever the exact mechanism, such individuals may be more prone to perioperative cardiac events.

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References

- 1 Tricquet JY, Gurné O, Chenu P, Schroeder E, Marchandise B. Application of intracoronary flow velocity analysis in isolated congenital coronary artery. *J Vasc Invest* 1996; 2: 99–102.
- 2 Sharbaugh AH, White RS. Single coronary artery. Analysis of the anatomic variation, clinical importance, and report of five cases. *JAMA* 1974; 230: 243–6.

FIGURE

- 3 Schwarz ER, Hager PK, Uebis R, Hanrath P, Klues HG. Myocardial ischaemia in a case of a solitary coronary ostium in the right aortic sinus with retroaortic course of the left coronary artery: documentation of the underlying pathophysiological mechanisms of ischaemia by intracoronary Doppler and pressure measurements. *Heart* 1998; 80: 307–11.
- 4 Brandt B III, Martins JB, Marcus ML. Anomalous origin of the right coronary artery from the left sinus of Valsalva. *N Engl J Med* 1983; 309: 596–8.
- 5 Multz A, Scharf S. Pharmacology and ventilatory support of the circulation in critically ill patients. In: Dantzker D, Scharf S (Eds.) *Cardiopulmonary Critical Care*, 3rd ed. Philadelphia: WB Saunders Company; 1998: 329–47.

Identification of the epidural space: air or saline?

To the Editor:

It is clear that mischief (injection of air in a blood vessel, pneumocephalus, patchy and inadequate analgesia) can occur if air is injected when using a loss of resistance (LOR) technique to identify the epidural space.^{1,2} However, the injection of air is not necessary to detect a LOR and was never intended. When the tip of the epidural needle enters the epidural space, this increases

the volume into which air is compressed by the syringe plunger and produces the characteristic LOR. In adults, the injection of air with a LOR technique should be considered a technical failure.³ Nevertheless, air may not be a suitable medium for a LOR technique in infants and small children as their size and physiology may uniquely predispose them to risk.²

I have no immediate plan to abandon the use of air to identify the epidural space in adults. Perhaps the mischief that continues to occur is due to poor technique and poor judgement rather than an inherent danger associated with the use of air to identify the epidural space.⁴ The volume of air injected is probably underestimated by case reports.⁴ Any interpretation of the literature on this subject should consider the influence of technique and judgement. If a clinician's technique involves the injection of air, he/she should reevaluate the wisdom of using that medium. If, in the absence of corrective actions, serious adverse events continue to occur with the use of air for LOR, a perfectly good technique may be relegated to history. Eventually, all current LOR techniques used to identify the epidural space may soon be relegated to history anyway (B. Tsui, personal communication).⁵

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References

- 1 Kuczkowski M, Benumof JL. Images in Anesthesia: Headache caused by pneumocephalus following inadvertent dural puncture during epidural space identification: is it time to abandon the loss of resistance to air technique? *Can J Anesth* 2003; 50: 159–60.
- 2 Shenouda PE, Cunningham BJ. Assessing the superiority of saline versus air for use in the epidural loss of resistance technique: a literature review. *Reg Anesth Pain Med* 2003; 28: 48–53.
- 3 Lang SA. The use of air for the identification of the epidural space (Letter). *Reg Anesth Pain Med* 2001; 26: 383.
- 4 Scott DB. Identification of the epidural space: loss of resistance to air or saline? (Editorial) *Reg Anesth Pain Med* 1997; 22: 1–2.
- 5 Tsui BCH, Uwiera R, Emery D, Finucane B. Epidural needle insertion using electrical guidance in a porcine model. *Anesthesiology* 2002; 96: A723.

To the Editor:

I agree with Kuczkowski and Benumof,¹ and with others who reviewed the topic,^{2–4} that saline is the fluid of choice to detect the epidural space (ES) using the loss of resistance (LOR) technique. However, other

aspects should be considered. Some of them have been previously discussed,^{1–4} but others have sparsely been considered. Due to the patient's position (sitting) during the attempted epidural, in the event of a dural puncture air will migrate into the central nervous system (CNS), producing the symptoms described. Theoretically, lumbar puncture in the lateral decubitus cannot produce a pneumocephalus. On the other hand, although controversial, there is a trend to change from air to saline to determine LOR amongst obstetric anesthesiologists.⁴ However, if the operator is experienced in the LOR to air, the incidence of pneumocephalus should be low. The volume of air or saline used to detect the ES is, in my opinion, of capital importance with respect to both interference with the effects of local anesthetics,² and with the adverse CNS effects in the case of a subarachnoid injection. Most of the clinical notes published reported amounts greater than 3 to 4 mL of air injected, both as a single bolus, or as repeated boluses in difficult epidurals. Usually a small volume of 1 to 2 mL of air is sufficient to detect the ES. In some patients, changing from air to saline can be an option for repeated attempts. If a pneumocephalus occurs, nitrous oxide should be avoided when an epidural is combined with a general anesthetic.

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References

- 1 Kuczkowski KM, Benumof JL. Images in Anesthesia: Headache caused by pneumocephalus following inadvertent dural puncture during epidural space identification: is time to abandon the loss of resistance to air technique? *Can J Anesth* 2003; 50: 159–60.
- 2 Saberski LR, Kondamuri S, Osinubi OY. Identification of the epidural space: is loss of resistance to air a safe technique? A review of the complications related to the use of air. *Reg Anesth* 1997; 22: 3–15.
- 3 Shenouda PE, Cunningham BJ. Assessing the superiority of saline versus air for use in the epidural loss of resistance technique: a literature review. *Reg Anesth Pain Med* 2003; 28: 48–53.
- 4 Howell TK, Prosser DP, Harmer M. A change in resistance? A survey of epidural practice amongst obstetric anaesthetists. *Anaesthesia* 1998; 53: 238–43.

REPLY:

We wish to thank Drs. Lang and Errando for their valuable input. The endpoint for identifying the epidural