Death in the dental chair - an avoidable catastrophe?

Editor,—I agree with Worthington, Flynn and Strunin that death in the dental chair is catastrophic, and I sincerely hope that it is avoidable. In their editorial the authors make the case for these views most elegantly, but I am a little concerned by their final, and isolated, conclusion that substitution of halothane by sevoflurane is the definitive requirement. All inhalation anaesthetics lower the threshold for arrhythmias. I would accept that the problem is somewhat greater with halothane than with sevoflurane, but I feel they are a little hard on a drug that has served us well for many years. Changing to sevoflurane will have significant cost implications — something that I would be happy to endorse if halothane really is the key cause of death in the dental chair. Arrhythmias with halothane are, in my view, nearly always associated with poorly conducted anaesthesia resulting in either carbon dioxide retention or hypoxaemia. In the dental chair, other factors (notably fear and intense surgical stimulation) are also relevant, but we must recognize that the proper conduct of the anaesthetic remains paramount. Many of the deaths referred to by Worthington, Flynn and Strunin have involved factors of much greater significance than the simple choice of inhalation agent. Sevoflurane will certainly reduce the incidence of arrhythmias, but will it reduce the incidence of avoidable catastrophes?  

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Editor,—We thank Professor Wildsmith for his interest in our article, and agree with his point that all inhalation anaesthetics lower the threshold for arrhythmias. He is correct to state that the problem is greater with halothane than with sevoflurane; the study carried out by Paris and colleagues found that the incidence of arrhythmias during dental anaesthesia for dental surgery is much greater with halothane (62%) than with sevoflurane (26%). We would, however, dispute the point that halothane arrhythmias are nearly always associated with poorly conducted anaesthesia. Again referring to the study by Paris and colleagues, only one of the 50 patients who received halothane suffered a reduction in oxygen saturation to below 90%, only five patients coughed and only four had any degree of breath-holding. It is therefore unlikely that a 62% incidence of arrhythmias can be attributed solely to poorly conducted anaesthesia resulting in carbon dioxide retention or hypoxaemia. In a study by Casson and Jones, which found that the incidence of arrhythmias during dental surgery was greater with halothane than with isoflurane or enflurane, it was noted that there were no significant differences in the end-tidal carbon dioxide concentration between the three groups and that the levels did not exceed 6.6 kPa in any patient. This is further evidence against the argument that the arrhythmias seen with halothane are caused by hypercarbia. Unfortunately, we cannot say if changing to sevoflurane will reduce the number of deaths in dental anaesthesia, but as Professor Wildsmith points out, using sevoflurane will certainly reduce the number of arrhythmias. In particular, ventricular arrhythmias — which are more likely to progress to ventricular fibrillation — will be reduced. Coplans and Curson found that 40% of deaths that occurred in dental practice were associated with a sudden cardiovascular collapse and 60% were principally attributable to respiratory problems. If use of a less arrhythmogenic drug can reduce the number of cardiac-related deaths, then surely a relatively small increase in cost per procedure is worthwhile.

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Optimum technique for delivery of extradural analgesia during labour

Editor,—I was interested in the study by Duncan and colleagues, who found that extradural analgesia was better when given by regular automated bolus injection rather than by continuous infusion. This finding has implications for extradural analgesia during labour, for which there has been a perception that continuous infusion is probably the preferred method. However, rather than moving towards automated bolus injections in this setting, the best choice may be to return to top-ups given by midwives, but on a regular basis rather than on demand. This should confer all the benefits found by Duncan and colleagues, but with the following additional advantages: it is arguably at least as safe as automated bolus dosing; it is simple, of low technology and cheap; and it is an adaption of a tried and tested method that is in place in many units.

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Editor,—We read the editorial on death in the dental chair with great interest, and note and agree with all the points made by the authors. A argument against the introduction of sevoflurane into high street anaesthesia for dentistry is cost. However, there is more to the issue than the difference in cost per unit volume and different MACs. The varying induction characteristics of the two anaesthetic agents make such comparison unrealistic. We work as a team in the practice of dental-chair general anaesthesia in hospital and in general dental practice. In the former venue, sevoflurane is used exclusively; in the latter, halothane. We are ideally placed to compare the cost of these agents. Our small study was very simple. We measured the mass of volatile agent used for a list of simple exodontias, calculated the volume of agent used and thereby the cost, and divided this by the number of children anaesthetized. The fresh gas flow rate was held constant. We found that, in our hands, the cost of the agent for this form of anaesthesia is 30p per patient using halothane, and £2.86 per patient using sevoflurane. We would add that nitrous oxide is not used, just the volatile agent in oxygen. Although the cost of sevoflurane is higher, as expected, it is also true that it is not prohibitively so, and is covered even by the low remunerative rates provided by the Dental Practice Board. In private practice, there is probably no need to adjust one’s scales either. Before reading this editorial and carrying out our investigation, we had been attempting to persuade our local Director of Dental Public Health to subsidize the introduction of sevoflurane into high-street practice. If this subsidy is not rapidly forthcoming, we shall ourselves make arrangements to introduce sevoflurane for our patients.

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Editor,—We thank Dr Mills for his interest and comments on our article. As mentioned in our paper, attempts have been made to provide postoperative extradural analgesia using regular, nurse-administered bolus injections of local anaesthetic. However, because of the many other demands on nursing time, injections were not given often enough to maintain analgesia and this method ultimately failed. We therefore designed our study to take advantage of recent technological advances in infusion pump design, and thus avoid putting further pressure on nursing staff. The provision of extradural analgesia in labour differs in many ways from its use for the relief of postoperative pain, but we believe many of the problems with nurse-administered injections exist in the obstetric setting. Further, we believe many nurses are reluctant to give analgesic drugs when patients are not in pain. Therefore, in our view, the use of appropriate infusion pumps to deliver regular bolus doses of local anaesthetic extradurally may be worthy of study in the obstetric population.

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Inhalation anaesthetics and the Medtronic Maxima Plus membrane oxygenator

Editor,—Most membrane oxygenators used in clinical practice contain microporous membranes, which are made from either polyethylene or propylene. Different types of oxygenator vary because of differences in the manufacturing process or in the size of the pores in the membrane. The Medtronic Maxima Plus PRF hollow-fibre oxygenator is used routinely for blood gas exchange during cardiopulmonary bypass. Total oxygen transfer is enhanced with this oxygenator, compared with the original Maxima model, because the outside diameter of the hollow, microporous polypropylene fibres within the oxygenator is reduced, thus providing a larger membrane surface area for transfer of oxygen. We conducted a study to determine if contact with inhalation anaesthetic agents has deleterious effects on these fibres, and can report that it appears not to do so. The polycarbonate outer shell of the oxygenator was removed to reveal the polypropylene fibres. Some of these fibres were placed in liquid sevoflurane, some for 3 h and others for 1 week. Fibres were also exposed to enfuvlurane, isoflurane and the solvent, acetone, for the same periods. After exposure, the fibres were examined under a high-resolution light microscope. Light-microscopic examination revealed no change in the structure or integrity of the fibres after short-term or long-term exposure to the three anaesthetic agents and acetone. We know of no evidence that inhalation anaesthetics damage oxygenator fibres, and in our short study, we found that exposing polypropylene, an inert substance, to saturating concentrations (concentrations in excess of those achieved in clinical practice) of three anaesthetic agents caused no visible structural damage. We have not carried out functional studies on fibres subjected to anaesthetic exposure. However, it appears that inhalation anaesthetics do not cause structural damage to the oxygenator fibres and we conclude, therefore, that oxygen transfer is unlikely to be impaired when they are used during cardiopulmonary bypass.

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A leak of concern

Editor,—Concerning the matter of potentially important, but not uncommon, leaks from anaesthetic machines, I should like to bring to your attention the possibility of leaks from soda-lime canisters of the type made by Demeca, which are widely used on the Blease 8200s circle scavenged anaesthetic machine.

A leak occurred after reassembly of such a canister following routine cleaning. The canister, of 1-kg size, is serviced by Blease under contract but is cleaned in the workplace by theatre staff. The leak was discovered at the start of a neurosurgical list; the anaesthetist checked the machine and declared the presence of an obvious leak without determining the source. An operating department assistant was informed but no repair was made. A second anaesthetist then used the machine without incident to anaesthetize an adult of 75 kg for a 2-h procedure.

The next procedure was upon a 15-kg child aged 2 yr. It was immediately apparent, because of significant difficulty in maintaining an adequate tidal volume, that a major leak was present. On careful search, it was found to arise from the soda-lime canister. The canister was replaced and the procedure continued without further incident.

Examination revealed the canister to be leaking from the rubber “O”-ring at the junction of the plastic top section with the metal lower section. On initial inspection, the canister appeared sound (fig. 1) but pressure with forceps on “O”-ring revealed a gap where the ring had been incorrectly seated (fig. 2).

With the “O”-ring properly fitted, there was no leak. The manufacturers confirmed that this complication had not been reported before. I therefore offer a warning that the reassembly of soda-lime canisters requires close attention to avoid the problem that I have described, which could be compensated for in an adult but represented a great risk in a small child. These canisters must be reasssembled carefully after cleaning and this complication borne in mind as the possible source of a major leak.

Figure 1 Apparent correct seating of the rubber “O” ring.
Equipment that is disassembled should have screw-on male and female parts in seals, rather than slip-together parts. If canisters were made so that the parts fitted together like those of a “Chinese puzzle”, such that an incorrectly assembled canister could not be used on an anaesthetic machine, this would prevent leaks of this sort. If rubber seals are unavoidable, these should be checked regularly for wear and porous changes. The need to check the anaesthetic machine at the start of every case needs great emphasis in a busy operating suite, where several different anaesthetists are using the same machine. A preoperative test to detect this possibility needs to be developed, and then recommended widely to help avoid the problem. Fresh gas flow observation to provide a given pressure limit while checking the breathing system before use is one possible method but, unfortunately, there are no fail-safe methods for detecting leaks. The presence of a leak should be unacceptable to any anaesthetist and preclude the use of any anaesthetic machine until the cause is detected and corrected.

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Figure 2  Demonstration of incorrect seating of rubber “O” ring.