At present approximately 300 000 patients undergo general anaesthesia for minor dental procedures in the UK each year. Of these 300 000, approximately 2 die.1 Anaesthesia most commonly consists of a mixture of oxygen, nitrous oxide and halothane and is administered in general dental practices, community dental surgeries and hospitals. Of the 26 patients who died in the course of a dental anaesthetic between 1984–1993 (information from the British Dental Association) more than 50% were children less than 16 yr of age. A previous mortality report2 suggested that the precipitating causes were distributed equally between respiratory difficulty and sudden cardiovascular collapse. Recent data obtained from the coroners’ reports of two patients in the latter group suggest that the typical course of events is that they suffer an unexpected cardiac arrest with no obvious precipitating factor. The cardiac arrest in both cases proved resistant to resuscitative measures and the post mortems did not provide evidence as to the cause of the cardiac arrest and the deaths went unexplained.

It has long been known that patients undergoing general anaesthesia for dental procedures suffer changes in heart rhythm.3–6 Stimulation of the sympatoadrenal system via the fifth cranial nerve in the presence of halothane is considered to be a major factor in the production of these arrhythmias. Halothane is also known to slow conduction between the atria and bundles of His and slow conduction in the ventricles. It has been postulated that this mechanism may allow re-entrant activity6 and hence produce arrhythmias. The incidence of arrhythmias in dental surgical patients anaesthetized with halothane varies between 18% and 75%. Ryder and Wright7 compared the use of halothane and enflurane in dental anaesthesia and showed that the incidence of arrhythmias with halothane was 32%, whereas it was only 9.8% with enflurane. Cattermole and colleagues5 compared isoflurane with halothane and found that the incidence of arrhythmias with isoflurane was only 14%, which was 38% lower than with halothane.

The nature of the arrhythmias differed depending on the volatile agent used; with enflurane and isoflurane there was a total absence of ventricular ectopic beats whereas with halothane they occurred frequently. Ventricular arrhythmias are generally thought to carry a higher risk than those that are supraventricular in origin as the former are more likely to progress to ventricular fibrillation.7 However, halothane has remained the agent of choice for inhalation induction and maintenance of anaesthesia in dental patients as both enflurane and isoflurane are irritant and can cause excessive coughing, salivation and laryngospasm.

Several large scale studies8–11 revealed that the commonest causes of cardiac arrest during anaesthesia are hypoxia as a result of ventilatory problems and “overdose” of anaesthetic agent, particularly when combined with hypovolaemia, post-induction hypotension and post-succinylcholine asystole. In most cases of cardiovascular collapse, patients had pre-existing disease and were undergoing major surgery. This contrasts sharply with dental out-patients who are healthy individuals undergoing relatively minor surgery where cardiac arrests have occurred without any obvious precipitating factor. The nature of the arrests in the children who died was also unusual. Paediatric cardiac arrests are characteristically asystolic,12 whereas children having dental treatment who are anaesthetized using halothane are prone to ventricular arrhythmias,13 some of which have proceeded to ventricular tachycardia. In one case described in the coroner’s court, ventricular fibrillation occurred without any preceding change in normal rhythm. Unfortunately data on the incidence of cardiac arrest during anaesthesia for dental surgery are limited as only deaths are recorded.

The number of deaths associated with dental anaesthesia is decreasing. The first Coplans and Curson report2 examined deaths in dentistry over the decade 1970–1979, and during this period more than 15 million anaesthetics were given with a total of 100 deaths. In the period 1980–1989, the number of deaths had decreased to 42.13 However, it is suggested that the reduction in mortality was attributable largely to the decrease in the number of general anaesthetics administered rather than improved standards, although no information is available on the numbers of general anaesthetics given during this latter period.

Nevertheless, because of the ongoing mortality (another two highly publicized deaths), a working party led by Professor Poswillo14 was set up in 1989 to examine the need for general anaesthesia and sedation in dentistry outside hospital, and to develop guidelines for their safe use. In addition, part of their assessment was to comment on the provision for resuscitation, and undergraduate and postgraduate training in general anaesthesia, sedation and resuscitation. The working party concluded that: where
general anaesthetics are given, full monitoring equipment in the form of an ECG, pulse oximeter, non-invasive arterial pressure and a capnograph together with a defibrillator should be available; there should be both a dental and an anaesthetic assistant present; there should be a fully equipped recovery facility with adequately trained staff; everyone who administers anaesthetics for dental surgery should be able to formally manage an airway, establish i.v. access, correctly give drugs used in resuscitation and be able to use a defibrillator; and that there should be an increase in postgraduate training in anaesthesia, sedation and resuscitation. The Clinical Standards Advisory Group’s report on dental general anaesthesia in 1995 confirmed that the majority of dental practices had carried out the recommendations in the Poswillo Report, particularly with reference to basic monitoring. Unfortunately, the improved standards of care do not seem to have had any effect on mortality. Patients are continuing to die (still approximately two per year).

This leaves the basic question unanswered of why healthy people have unexplained cardiac arrests and die? One possible answer is the high propensity to arrhythmias in dental patients when halothane is used. The popularity of halothane for general anaesthesia in dental outpatients has continued because of the absence of a suitable alternative. However, with the advent of the new volatile anaesthetic agent, sevoflurane, the use of halothane needs to be re-assessed.

Sevoflurane is a halogenated ether which is non-irritant, has a pleasant odour and a low blood-gas solubility; such properties make it ideally suited to inhalation induction and maintenance of general anaesthesia for minor dental surgery in both adults and children. More importantly, Paris and colleagues found that the incidence of arrhythmias with sevoflurane was 26% whereas with halothane it was 62%. Interestingly they found that only 6% of patients suffered arrhythmias during the recovery period; this may be relevant for outcome as Coplans and Curson in 1982 found that more than 50% of dental deaths occurred during the recovery period. The type of arrhythmias also differed, with sevoflurane the associated arrhythmias were predominantly supraventricular whereas with halothane a far greater number of the more sinister ventricular arrhythmias were seen.

Deaths associated with general anaesthesia are always difficult to accept, particularly when they occur in children and young people with no pre-existing disease. Despite the time and money spent in recent years to improve the quality of care, patients undergoing general anaesthesia for dental procedures continue to have seemingly unprovoked cardiac arrests. Halothane, with its high incidence of ventricular arrhythmias, may no longer be the volatile agent of choice in these circumstances. Sevoflurane is now widely available and has been shown to produce rapid and smooth loss of consciousness during inhalation induction, is easy to use during maintenance of anaesthesia and has good recovery characteristics for day-care procedures. In addition, sevoflurane is associated with fewer cardiac arrhythmias. It may be that by using sevoflurane in place of halothane, further unexplained cardiac arrests in patients undergoing minor dental surgery can be prevented.

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References