Inadvertent inhalation anaesthesia during surgery under retrobulbar eye block

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Summary
I describe a case of inadvertent inhalation anaesthesia during surgery under retrobulbar anaesthesia and its management. Some of the hazards of supplementary oxygen delivery during monitored anaesthetic care and the actions taken to prevent this mishap recurring are discussed. (Br. J. Anaesth. 1998; 81: 793–794).

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Surgery under local anaesthesia is performed in many surgical disciplines and is common in ophthalmology. Despite the recent trend towards greater anaesthetic presence during this type of surgery, it still takes place in the absence of an anaesthetist. In these instances, it is recommended that an appropriately trained person, often the operating department assistant (ODA) or a theatre nurse, be present to monitor physiological variables such as arterial pressure, heart rate and oxygen saturation. I describe a case which underlines the constant dangers in an operating theatre environment when non-anaesthetic personnel are responsible for monitoring patients undergoing surgery under local anaesthesia in the absence of an anaesthetist.

Case report
An 83-yr-old woman presented for vitreoretinal surgery. The patient weighed 90 kg and was being treated for hypertension with slow release nifedipine 10 mg twice daily but had no history of cardiac failure or a cerebrovascular incident. Preoperative arterial pressure was 130/90 mm Hg, and heart rate was 10 mg twice daily but had no history of cardiac failure. An electrocardiogram showed atrial flutter with variable atrioventricular block, a ventricular rate of 40–50 beat min⁻¹ with left ventricular hypertrophy, and a normal axis. Haemoglobin and electrolyte concentrations, and a chest radiograph were within normal limits.

Having established i.v. access, a retrobulbar anaesthetic was administered by the consultant ophthalmologist using 0.75% bupivacaine 5 ml. After 15 min the patient’s neck and face were covered with surgical drapes and surgery commenced. A theatre nurse sat beside the patient holding her hand and maintaining verbal contact. Monitoring included a three-lead ECG and pulse oximeter probe. Supplementary oxygen 4 litre min⁻¹ was delivered via a Bain’s breathing system attached to the anaesthetic machine and placed underneath the drapes near the patient’s face. After a few minutes, verbal contact with the patient was lost and it was noticed that she had stopped breathing. The alarm was sounded and a consultant anaesthetist summoned from an adjacent theatre. The surgical drapes were removed and the airway supported.

On arrival, the anaesthetist found an unresponsive apnoeic patient, not cyanosed, with a heart rate of 40 beat min⁻¹ and a weak pulse pressure. Oxygen was delivered by face mask via the same Bain’s breathing system with airway support and manual inflation of the lungs. Atropine 600 μg was administered i.v. which increased heart rate to 80 beat min⁻¹. A non-invasive arterial pressure reading of 180/90 mm Hg was obtained. Oxygen saturation remained greater than 96% throughout. The patient began to breathe spontaneously but remained unresponsive with bilateral dilated pupils. A strong smell of isoflurane was noticed by the anaesthetist who found that the isoflurane vaporizer on the anaesthetic machine was switched to 5%. On discontinuing isoflurane, the patient awoke quickly and responded appropriately. There were no abnormal cranial nerve signs, except for the operated eye whose pupil had been dilated before operation with mydriatics.

Surgery was abandoned and the patient recovered normally. Subsequent follow-up revealed no abnormalities and she was discharged uneventfully to return for successful surgery a week later under retrobulbar anaesthesia.

Discussion
Apnoea after retrobulbar anaesthesia has been reported; it usually occurs within 8 min of injection, although onset has been delayed for up to 40 min.¹² Much is written about the contribution of technique, needle length and local anaesthetic concentration in producing brainstem anaesthesia as a cause of apnoea.³⁵

On the initial assessment, it seemed very likely that the patient had suffered inadvertent subarachnoid injection with central spread of local anaesthetic. This is described as having an incidence of approximately 1 in 375.⁶ However, the rapid and total recovery of the patient on removal of isoflurane, which is a potent cause of excessive sedation and possible apnoea, casts significant doubt on subarachnoid injection as the cause of this patient’s misadventure.
During administration of local anaesthetic blocks, patients may receive sedation and supplementary i.v. analgesia which can cause apnoea. Monitoring oxygen saturation as a detector of respiratory inadequacy is widely accepted and advocated during surgery under local anaesthesia. In addition, the benefit of a dedicated nurse beside the patient maintaining verbal contact can result in very early detection of a problem, as demonstrated in this case.

The potential hazards of supplementing the patient’s inspired oxygen concentration may not always be appreciated, especially when trained anaesthetic staff are not present. An editorial on the dangers of supplementary oxygen highlighted the hazards of inadvertent barotrauma when delivering oxygen from hyperbaric sources inappropriately. This modification would not be reasonable to expect routine use of gas analysers by untrained personnel, which will detect oxygen delivery from the anaesthetic machine. It is the responsibility of the anaesthetist, if present, to ensure that hypoxic or unsafe mixtures of gas are not inadvertently delivered to the patient. Older anaesthetic machines are often devoid of modifications which prevent the delivery of hypoxic gas mixtures. Such modifications include oxygen–nitrous oxide rotameter chain linkages and pneumatic mixing valves which guarantee a minimum of 25–30% inspired oxygen concentration. Hypoxic guards deliver a constant minimum oxygen flow rate of 200 ml min⁻¹ which is almost equivalent to adult basal oxygen consumption.

The anaesthetic machines in this eye hospital have cage mounted vaporizers which eliminates simple vaporizer removal from the bar, as with Selectatec mounted vaporizers, as a solution to inadvertent administration of volatile agent. On removal from the vaporizers, careful connection of appropriate tube ends is required with cage mounted vaporizer systems to ensure gas flow from the common gas outlet. Many anaesthetic machines still have carbon dioxide cylinders attached, creating the potential for inadvertent delivery of dangerous concentrations of carbon dioxide to a patient.

Clearly, human error resulted in failure to detect a vaporizer in the “on” position during supplementary oxygen delivery from the anaesthetic machine. It would not be reasonable to expect routine use of gas analysers by untrained personnel, which will detect the presence of volatile agent in inspired gas and hypoxic gas mixtures.

The importance of monitored anaesthetic care during local anaesthetic procedures, even in the absence of patient sedation or supplementary analgesia administration, is understated. It has been agreed by the Royal College of Anaesthetists and the College of Ophthalmologists that an anaesthetist is best suited for both administration of retrobulbar and peribulbar anaesthetics and intraoperative monitoring of the patient. This standard for intraoperative monitoring is supported by the Association of Anaesthetists and must be the ideal to strive towards in all hospitals. However, some patients are operated on under local anaesthesia in the absence of an anaesthetist. Recognizing that this practice, albeit undesirable, is endorsed for minor surgery in ophthalmology, an alternative measure has been devised to allow safe delivery of supplementary oxygen in this eye hospital.

Bypassing the anaesthetic machine with an oxygen flowmeter directly connected to piped oxygen allows supplementary oxygen delivery to the patient via bubble tubing through either a conventional clear face mask or nasal cannulae. This has the advantage for non-anaesthetic personnel of avoiding the pitfalls in managing a rotameter system which delivers three or more gases, and has in-line vaporizers. In addition, there is no need for the use of an anaesthetic breathing system which may be incorrectly connected or faulty. By attaching the oxygen flowmeter to a bar on the side of the anaesthetic machine (fig. 1) it is not necessary to remove the anaesthetic machine permitting the use of integrated or attached anaesthetic monitors. It is simple and quick to modify the anaesthetic machine safely after general anaesthesia for use during local anaesthesia.

Surgery under local anaesthesia should ideally always be undertaken in the presence of an anaesthetist. Use of an anaesthetic machine by personnel unfamiliar with it is potentially hazardous.

References