THE EFFECTIVENESS OF PERI-OPERATIVE CARDIAC MONITORING AND PULSE OXIMETRY

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SUMMARY

Life-threatening systemic complications during ophthalmic surgery under local anaesthesia are rare. However, respiratory and cardiovascular complications can cause significant morbidity and mortality. In this study continuous peri-operative oxygen saturation and cardiac monitoring provided the surgeon with early warning of life-threatening complications, resulting in rapid intervention and full recovery of the patients. Pre-operative venous cannulation aided rapid treatment. Due to ease of handling and interpretation, the equipment can be used effectively for peri-operative monitoring without any specialist training. All patients should be carefully monitored during local anaesthesia with pulse oximetry and cardiac monitors.

Safe, effective administration of local anaesthesia prior to ocular surgery is a primary concern of ophthalmologists. Various techniques are available to provide excellent operative anaesthesia and akinesia.¹ Complications such as retrobulbar haemorrhage,² globe penetration/perforation,³ visual impairment⁴ and muscle injury⁵ are well documented in the literature for all local anaesthetic techniques.

Peri-operative complications are most commonly related to surgery, with problems due to anaesthesia occurring more frequently with general anaesthetics.⁶ However, life-threatening events such as grand mal seizures,² respiratory arrest⁷ and cardiac arrest² do occur with local blocks.

Pulse oximetry to monitor oxygen saturation during local anaesthetic procedures has revolutionised the early detection and treatment of the hypoxaemia⁸ which may occur due to concomitant systemic disease, surgical draping and medication.⁹ Cardiovascular problems during eye surgery usually consist of sinus bradycardia and hypotension pro-

voked by the oculocardiac reflex,¹⁰ with cardiac monitoring during local anaesthesia providing early warnings of cardiovascular complications.¹¹

This prospective study was designed to determine the effectiveness of continuous cardiac and oxygen saturation monitoring peri-operatively for early detection of life-threatening systemic complications in patients undergoing ocular surgery under local anaesthesia.

PATIENTS AND METHODS

Seven hundred and four consecutive patients undergoing intraocular surgery at Walkergate Hospital, Newcastle upon Tyne, under peribulbar or retrobulbar local anaesthesia from October 1993 to March 1994 were included in this prospective study. Patients underwent venous cannulation prior to the anaesthetic block. All venous cannulas were inserted and local anaesthetics administered by the ophthalmic surgeons. Identical pulse oximeters and cardiac monitors were used for peri-operative monitoring by ophthalmic senior house officers. No anaesthetists were present during these local anaesthetic procedures. Oxygen saturations of less than 90% or a pulse rate below 50 beats per minute resulted in an alarm sounding. Urgent action could then be initiated due to the early detection of life-threatening problems. The surgeon performing the operation made the clinical decision to stop the surgical procedure if necessary and resuscitation was instituted by a member of the ophthalmic medical staff in theatre.

All complications were recorded by the surgeon who performed the operation, using a numbering system in the theatre notes (0, no peri-operative complications; 1, surgical complication; 2, systemic complication (cardiac or respiratory problem) following local anaesthesia). For each patient with a systemic complication their age, pre-existing medical problems, type of surgery, type of anaesthetic block, alteration of vital signs peri-operatively (including

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oxygen saturation and heart rate), medical treatment and outcome were recorded.

To ensure that no patient with a life-threatening systemic complication under local anaesthesia was excluded from the study, clinical records of all patients transferred from the ophthalmic surgical department to general medical units during the study period were also reviewed.

RESULTS

This study was composed of 704 consecutive patients undergoing intraocular surgery under local anaesthesia. Of these, 5 patients (0.7%) suffered systemic complications under local anaesthesia (Table I). All patients made satisfactory recoveries and were discharged. The complications are outlined below.

Case 1

An 80-year-old woman with no previous relevant medical history had received 3.5 ml lignocaine 2% as a retrobulbar injection prior to cataract extraction. Two minutes after the injection the pulse oximeter reading registered an oxygen saturation of 80%, and the patient became unresponsive. The patient had suffered a respiratory arrest. Immediate medical treatment, intubation and transfer to intensive care were initiated. The patient made an uneventful recovery.

Case 2

A 68-year-old woman with a previous history of severe chronic obstructive airways disease had episodes of reduced oxygen saturation of between 85% and 90% peri-operatively following retrobulbar injection of lignocaine 2% and bupivacaine 0.75% for a cataract extraction. Nasal oxygen was administered and the surgery performed without any further incidents.

Case 3

A 62-year-old patient with no pre-existing cardiovascular problems had received a retrobulbar injection of lignocaine 2%, bupivacaine 0.75% and 100 IU hyaluronidase for cataract surgery. Peri-operatively the pulse rate reduced to 40 beats per minute and the patient was cold and clammy. Nasal

oxygen and intravenous atropine were administered. The operation was completed without any further complications.

Case 4

An episode of asymptomatic bradycardia was also recorded in a 62-year-old patient with no pre-existing cardiovascular problems undergoing cataract extraction after a retrobulbar injection of lignocaine 2%, bupivacaine 0.75% and 100 IU hyaluronidase. The surgery and recovery were uneventful.

Case 5

A 74-year-old hypertensive patient on beta-adrenergic receptor blocking medication had received a peribulbar injection of lignocaine 2%. The patient was noted to have a bradycardia of 40 beats per minute and an oxygen saturation of 85% peri-operatively. The operation was stopped and nasal oxygen administered. A few minutes later the oxygen saturation had improved, the operation was completed and the patient made an uneventful recovery.

DISCUSSION

The relative safety of local anaesthesia used for ophthalmic surgery is evident from medical literature.² However, life-threatening complications such as respiratory arrest, cardiac arrest and grand mal seizures do occur.² Disturbances of the cardiac rhythm during ophthalmic surgery are observed in patients of all ages.¹² Extrasystoles and sustained cardiac arrhythmias are particularly common in older patients.¹² Cardiovascular complications during eye surgery usually consist of sinus bradycardia,¹⁰ provoked by the oculocardiac reflex. Atropine when given intravenously appears to have a protective effect on the oculocardiac reflex.¹² In the present study, the incidence of sinus bradycardia was 0.42%.

The recorded incidence of respiratory arrest following retrobulbar injections varies from 0.09% to 0.79%,¹³ and was found to be 0.14% in this study. Optic nerve sheath injection of local anaesthetic during a retrobulbar block has been proposed as a possible mechanism for the respiratory arrest.¹⁴ The local anaesthetic may spread through the

Table I. Systemic complications registered by continuous peri-operative pulse oximetry and cardiac monitoring during ophthalmic surgery under local anaesthesia

Case	Operation/anaesthesia	Medical history	Complications/treatment
1	Cataract extraction/retrobulbar	None	Respiratory arrest
2	Cataract extraction/retrobulbar	Emphysema	Low oxygen saturation Medical treatment/discharged
3	Cataract extraction/peribulbar	None	Bradycardia Medical treatment/discharged
4	Cataract extraction/retrobulbar	None	Bradycardia No treatment/discharged
5	Cataract extraction/retrobulbar	Hypertension	Bradycardia/low oxygen saturation Medical treatment/discharged

subarachnoid space surrounding the optic nerve and subsequently spread posteriorly to the suprachiasmatic and parabrachial cisterns. Respiratory depression is probably the result of brainstem anaesthesia, which causes confusion, dizziness, unresponsiveness and hypoxaemia.¹⁴ Other possible (but less likely) mechanisms include idiosyncratic reactions to local anaesthetics or a direct toxic effect through either systemic absorption or intravascular injection.¹⁴ The maximum safe dose for bupivacaine is 250 mg and for lignocaine is approximately 500 mg. The total anaesthetics used in our cases were below these values.

The pulse oximeter remains the method of choice for monitoring oxygenation in spontaneously breathing patients because of its ease of handling.¹⁵ In this study a significant fall in arterial blood oxygenation as measured by pulse oximetry provided the surgeon with early warning of respiratory problems.

In the present study peri-operative cardiac monitoring, pulse oximetry and pre-operative venous cannulation aided in the rapid diagnosis and management of life-threatening systemic complications in patients undergoing ophthalmic surgery following local anaesthesia. Due to its ease of handling and interpretation, the equipment can be used effectively for peri-operative monitoring without any specialist training.

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Key words: Cardiac monitoring, Local anaesthesia, Pulse oximetry, Respiratory arrest.

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