ORIGINAL ARTICLE
The effect on outcome of peribulbar anaesthesia in conjunction with general anesthesia for vitreoretinal surgery

A. M. Ghali¹ and A. M. El Btarny²

¹ Consultant, Department of Anesthesiology, ² Consultant, Department of Ophthalmology, Magrabi Eye & Ear Hospital, Muscat, Oman

Summary
The purpose of this study was to evaluate peri-operative outcome after vitreoretinal surgery when peribulbar anaesthesia is combined with general anaesthesia. Sixty adult patients undergoing elective primary retinal detachment surgery with scleral buckling or an encircling procedure received either peribulbar anaesthesia in conjunction with general anaesthesia or general anaesthesia alone. For peribulbar anaesthesia a single percutaneous injection of 5–7 ml of local anaesthetic solution (0.75% ropivacaine with hyaluronidase 15 iu.ml⁻¹) was used. The incidence of intra-operative oculocardiac reflex and surgical bleeding interfering with the surgical field, postoperative pain and analgesia requirements, and postoperative nausea and vomiting were recorded. In the block group there was a lower incidence of oculocardiac reflex and surgical bleeding intra-operatively. Patients in the block group also had better postoperative analgesia and a lower incidence of postoperative nausea and vomiting compared with the group without a block. The use of peribulbar anaesthesia in conjunction with general anaesthesia was superior to general anaesthesia alone for vitreoretinal surgery with scleral buckling.

Correspondence to: Dr Ashraf M. Ghali
E-mail: ashrafghali@hotmail.com
Accepted: 3 November 2009

Vitreoretinal surgery with scleral buckling and intraocular expansible gas injection is frequently associated with the oculocardiac reflex intra-operatively, probably as a result of traction on the ocular muscles and sclera. A high incidence of postoperative pain and postoperative nausea and vomiting (PONV) are attributed to increased intra-ocular pressure due to expansion of the gas bubble or tight buckling or encirclement, particularly when performed under general anaesthesia [1–3]. The reluctance to use local anaesthesia alone for vitreoretinal surgery may stem from the longer, more unpredictable and uncomfortable nature of such surgery [4]. Surgical dissatisfaction because of insufficient akinesia resulting from partial blockade [5] and patient discomfort during prolonged surgery involving scleral buckling are further limitations to the use of local anaesthesia alone. The combination of general anaesthesia and peribulbar anaesthesia may reduce these drawbacks [6]. The aim of this study was to evaluate the effect of peribulbar anaesthesia when used in conjunction with general anaesthesia on peri-operative outcome after vitreoretinal surgery.

Methods
After obtaining approval from the Institutional Ethics Committee and written informed consent from all patients, 60 adult patients (ASA 1 or 2), scheduled for elective primary retinal detachment surgery, were enrolled in this prospective, double-blind, randomised study. All patients underwent scleral buckling or an encircling procedure. Twenty-five patients underwent additional pars plana vitrectomy with gas/silicone oil injection. Exclusion criteria included allergy to local anaesthetic solutions, clotting abnormalities, impaired mental status, drug abuse, and surgical procedures entailing vitrectomy without scleral buckling. The study was carried out in the Magrabi Eye & Ear Hospital in Oman between January 2008 and July 2009. All operations were performed by the same surgeon. Patients were randomly allocated (using the block randomisation method, with a block size of six) to one of two groups to receive either peribulbar anaesthesia in conjunction with general anaesthesia (PB-GA group, n = 30) or general anaesthesia alone (GA group, n = 30).
In the anaesthetic room, an intravenous cannula was placed and standard monitoring, including non-invasive arterial blood pressure, ECG, and peripheral oxygen saturation (SpO₂) were started. Propofol 0.5 mg.kg⁻¹ was used to provide a brief period of sedation during the peribulbar injection. All blocks were performed by a senior anaesthetist experienced in the technique who was not involved in the peri-operative management or evaluation of the patients. The study solutions were prepared by this physician at the bedside just before the injection. In the PB-GA group, a single percutaneous injection was performed using a 25-G 16-mm short-bevel needle. The injection site was in the inferior orbital edge and in the same line as the inferior lacrimal canaliculus. The needle was advanced in an antero-posterior direction for half of its length and then obliquely in the direction of the optical foramen as described by Rizzo et al. [7]. After negative aspiration, 5–7 ml of the local anaesthetic solution (0.75% ropivacaine with hyaluronidase 15 iu.ml⁻¹) was slowly injected until there was a complete drop and fullness of the upper eyelid. In the GA group, normal saline (2 ml) was injected subcutaneously (as placebo) at the same site on the inferior eyelid, using a 25-G 15-mm needle. Intermittent compression was applied for 10 min in both groups, using a Honan balloon set at 30 mmHg. Akinesia was evaluated in the four quadrants using a 3-point scoring system: 0 = akinesia; 1 = partial akinesia; and 2 = normal movement, giving a maximal score of eight for the four muscles. An akinesia score of three or less was defined as a successful block [8]. Sensory block was assessed according to abolition of the corneal reflex and the eye was dressed until induction of anaesthesia. Intra-ocular pressure was measured using a Perkins applanation tonometer at the following times: before block; and 1, 5, 10 and 15 min after injection of the local anaesthetic solution or placebo. Management of patients was then similar in the two groups.

General anaesthesia was induced with propofol 1–2 mg.kg⁻¹ and fentanyl 1–2 μg.kg⁻¹ and tracheal intubation was facilitated with cisatracurium 0.15 mg.kg⁻¹. Anaesthesia was maintained with a mixture of 50% oxygen and 50% air and sevoflurane (0.5–3%). The inspired concentration of sevoflurane was adjusted to maintain comparable depths of anaesthesia (BIS value 40–50). Ventilatory frequency was set to obtain an end-expiratory pCO₂ of 4–4.6 kPa. An increase of mean arterial pressure or heart rate more than 20% above the patient’s baseline despite a BIS value within the targeted range was treated with supplemental boluses of fentanyl 25–50 μg. The last supplemental bolus of fentanyl was given at least 30 min before the end of the operation. A drop of mean arterial pressure below 20% of the patient’s baseline was managed with intravenous fluid boluses of 200 ml or ephedrine 5–10 mg boluses. Postoperative analgesia was started 30 min before the end of surgery and maintained for 24 h by infusion of paracetamol 1 g 6-hourly.

Scleral buckling started with 360° conjunctival opening (peritomy). The sub-Tenon’s (episcleral) space and the sclera were entered engaging rectus muscle insertions with traction sutures. Retinal breaks were treated with cryopexy. Solid silicone rubber or silicone sponge (Mira, Waltham, MA, USA) were used for explant scleral buckling and to support retinal pathology. These were secured to the sclera with partial thickness non-absorbable scleral sutures. The placement of explant material was either segmental or encircling. Adjustment of a buckle height was done by tightening the encircling element or by adjusting the distance between the scleral sutures [3].

Assessments were performed by the anaesthetist responsible for providing general anaesthesia and the surgeon, both of whom were blinded to the use of peribulbar block. The oculocardiac reflex was considered to present if the heart rate decreased by 20% from the baseline value or if arrhythmias or sinoatrial arrest occurred during ocular manipulation [9]. Atropine 0.5 mg was then administered. Peri-operative bleeding was scored using a 3-point rating scale as follows: 0 = absent; 1 = does not interfere with surgery; 2 = interferes with surgery.

The degree of pain was assessed by using a 10-cm visual analogue scale where 0 = no pain and 10 = intolerable pain 1, 2, 4, 6, 8, 12, and 24 h after extubation. If the patient complained of pain postoperatively (VAS > 4), diclofenac 1 mg.kg⁻¹ was given intramuscularly. If the VAS for pain was > 7, in addition to the diclofenac, tramadol 100 mg was given as rescue medication. The maximum frequency of either analgesic was 6 hourly, with a maximum number of three doses per 24 h. The time from the end of anaesthesia to first use of rescue analgesia (tramadol infusion) and the number of patients who required tramadol were recorded. The incidence of PONV (defined as two episodes within 1 h, or persistent vomiting) during the first 24 h postoperatively was noted; PONV was treated with ondansetron 0.1 mg.kg⁻¹.

We chose diclofenac consumption as the primary endpoint to calculate the required sample size for this study. The number of patients was determined from a preliminary investigation during which we established that for similar retinal surgery performed under general anaesthesia, the mean (SD) consumption of diclofenac was 66 (6) mg during the first 6 h postoperatively. The required sample size was calculated to be 30 patients per group with α = 0.05 and a power of 90% to detect a difference of at least 25% in diclofenac consumption.
Statistical analysis was conducted using SPSS® statistical software (SPSS Inc., Chicago, IL, USA). Two-way, repeated-measures ANOVA was used to compare interval data, and Student’s t-test was used post-hoc to determine differences between and within groups. Fisher’s exact test was used to compare nominal data. A Bonferroni correction for repeated comparisons was applied where necessary. The number of fentanyl doses was compared using the Mann–Whitney U-test. We considered p < 0.05 to be significant.

Results

The two groups were comparable with respect to age, sex, weight, and duration of surgery (Table 1). In the PB-GA group, the mean (SD) volume of ropivacaine administered was 6.7 (0.1) ml. The number of patients requiring fentanyl and the total intra-operative dose of supplemental fentanyl were less in the PB-GA group compared with the GA group (Table 1). There was a higher incidence of bradycardia requiring atropine administration in the GA group, and surgical bleeding interfering with the surgical field was more common in the GA group compared with the PB-GA group (Table 1).

In the postoperative period, there was a higher incidence of PONV in the GA group compared with the PB-GA group (Table 1). The VAS for pain was greater in the GA group during the first 4 h postoperatively compared with the same values in the PB-GA group, while there was no difference between the two groups after that (Fig. 1). Diclofenac consumption and the number of patients who required tramadol rescue medication postoperatively were less in the PB-GA group compared with the GA group. In the GA group, the mean (SD) time to the first tramadol infusion received for nine patients was 42 (3) min; only two patients in the PB-GA Group required tramadol (at 211 and 220 min postoperatively).

<table>
<thead>
<tr>
<th><strong>Table 1</strong> Patients’ characteristics, anaesthetic and surgical management, and peri-operative events in patients undergoing vitreoretinal surgery with peribulbar block and general anaesthesia (PB-GA), or general anaesthesia alone (GA). Data are mean (SD), or median (range), number (%).</th>
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<tbody>
<tr>
<td><strong>Age; years</strong></td>
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<td><strong>Sex; M / F</strong></td>
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<td><strong>Weight; kg</strong></td>
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<td><strong>Total intra-operative fentanyl; μg</strong></td>
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<td><strong>Incidence of oculocardiac reflex</strong></td>
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<td><strong>Incidence of surgical bleeding (Grade 2)</strong></td>
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<td><strong>Incidence of PONV</strong></td>
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<td><strong>Total diclofenac consumption; mg</strong></td>
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<td><strong>Number of patients requiring tramadol</strong></td>
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The baseline intra-ocular pressure values were comparable in the two groups. Compared with baseline value there was a transient increase in intra-ocular pressure in the PB-GA group after 1 min after injection of local anaesthetic, and a reduction in intra-ocular pressure 10 and 15 min after injection. In the GA group there were no changes in intra-ocular pressure (Fig. 2).

![Figure 1](image1.png)  
**Figure 1** Mean visual analogue scores for pain for 24 h after vitreoretinal surgery with peribulbar block and general anaesthesia (——), or general anaesthesia alone ( - - - ). Error bars are SD. *p < 0.05 between groups.

![Figure 2](image2.png)  
**Figure 2** Mean intra-ocular pressure in patients undergoing vitreoretinal surgery with peribulbar block and general anaesthesia (——), or general anaesthesia alone ( - - - ). *p < 0.05 from baseline.
Discussion

Our study has demonstrated that the use of peribulbar anaesthesia in conjunction with general anaesthesia for vitreoretinal surgery was associated with a lower incidence of oculocardiac reflex, and provided more effective post-operative analgesia with lower diclofenac consumption and fewer patients requiring rescue analgesia medication. These findings can be attributed to blocking the afferent limb of the oculocardiac reflex [10] and reducing the afferent stimuli from muscle traction, thus preventing central hyperexcitability by noxious stimuli [11]. Similar results have been described in previous studies [1, 2, 6, 12, 13]. However, most of these studies included patients scheduled for surgery without scleral buckling [1, 2, 6]. Placement of a scleral buckle entails extensive dissection of the conjunctiva, Tenon’s capsule and sclera, requiring repeated traction on extra-ocular muscles, leading to an increased incidence of the oculocardiac reflex and more postoperative pain [4]. In the study by Shende et al. [1] the time to administration of first analgesic rescue medication was similar in the peribulbar and GA groups, which may have been due to the lower concentration of bupivacaine used (0.25%) and the use of long-acting opioid analgesia (morphine) in the GA group.

We observed there to be less bleeding in the PB-GA group. This may have been due to the decrease in intraocular pressure induced by the peribulbar block. Although there was a transient increase in the intraocular pressure in the PB-GA group after 1 min, there was a reduction in intra-ocular pressure at 10 and 15 min. Relaxation of the extra-ocular muscles and the resulting decreased muscle traction on the sclera have been proposed as a mechanism for the reduction in intraocular pressure after peribulbar block [14], and may account for the decreased bleeding in our PB-GA group.

We found that adding peribulbar anaesthesia to general anaesthesia reduced the incidence of PONV. This is in agreement with results reported in previous studies [1, 6, 12] and can be explained by the effect of the block on the oculoemetic reflex which shares its afferent limb of the reflex arc with the oculocardiac reflex [15]. Our findings are in accord with a study by Allen et al. [16], who reported an association between the intra-operative oculocardiac reflex and PONV. In contrast to our finding, Morel et al. [13] have reported that the incidence of PONV during the first postoperative 24 h was similar in patients receiving peribulbar or general anaesthesia (26% and 23% in the PB-GA and GA groups, respectively). They believed their low overall incidence of PONV was due to the omission of nitrous oxide and the use of propofol anaesthesia.

In conclusion, peribulbar anaesthesia in conjunction with general anaesthesia was superior to general anaesthesia alone for vitreoretinal surgery with scleral buckling, resulting in better intra-operative surgical conditions, improved early postoperative analgesia and less PONV.

Acknowledgements

We thank Dr Mahmoud M. Ibrahim, Assistant Professor of Educational Psychology (Statistical Education), Sultan Quaboos University, Oman for his assistance.

References


