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Retrospective analysis of postoperative pain after general anesthesia for vitreoretinal surgery with or without a retrobulbar block

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Abstract: *Objective*: In ophthalmic surgery, postoperative pain is mostly ignored, or its importance is undervalued. This retrospective study aims to evaluate the effect of the intra-operative administration of a retrobulbar block on postoperative pain in patients undergoing eye surgery under general anesthesia. Postoperative pain scores were assessed at different time intervals (0, 4, 8, and 12 hours respectively), dose, and the number of administered analgesics postoperatively. The number of intra-operative antiemetics and the need for postoperative antiemetic administration was also evaluated.

Methods: A retrospective observational study was performed in adult patients undergoing vitreoretinal surgery under general anesthesia between July 1st, 2019, and January 1st, 2020. We identified 77 patients receiving only general anesthesia (RB- group) and 176 patients who received a retrobulbar block in addition to their general anesthesia (RB+ group). Our primary outcome was the postoperative numeric pain rating scale (NPRS) assessed at different time points (0, 4, 8, and 12 hours respectively). As secondary outcomes, the dose and number of postoperative administered analgesics, the number of intraoperative antiemetics and the need for postoperative antiemetic rescue medication, and the incidence of technique-related complications were evaluated.

Results: Mean NPRS scores of the RB- group were slightly higher compared to the RB+ group. However, none of these differences were statistically significant at the different time intervals (p values at each time point: T0= 0.13, T4= 0.89, T8= 0.17, T12= 0.63). Groups did not differ with respect to overall analgesic consumption, need for antiemetics, or complications.

Conclusion: The results of this retrospective study revealed no significant benefit of supplementing a retrobulbar block on top of general anesthesia in vitreoretinal surgery. Therefore, the application of this technique remains a joint decision of the surgeon, anesthesiologist, and patient in which postoperative analgesia is not a determinant factor.

Keywords: Vitreoretinal surgery; retrobulbar block, analgesics; postoperative analgesia.

Introduction

Perioperative pain therapy is an important goal in perioperative medicine. As the International Association for the Study of Pain (IASP) declared, pain management is a fundamental human right (1). Good postoperative pain management can improve clinical outcomes and patients' satisfaction and constitute an essential criterion for hospital discharge after ambulatory surgery (2, 3).

In ophthalmic surgery, postoperative pain is mostly ignored, or its importance is undervalued, resulting in poor pain management (4). When pain scores are assessed, they are mostly measured only during the first 6 hours postoperatively when the pain is more likely to occur (5). It has been revealed that less than 50% of patients undergoing major ophthalmic surgery receive postoperative analgesic drugs, and in most of these operations, analgesics are administered only once (6).

Vitreoretinal surgery is the indicated therapy for posterior segment diseases such as retinal detachment, diabetic proliferative retinopathy, macular holes, epiretinal membrane, and vitreous hemorrhage (7). The incidence of postoperative pain in vitreoretinal surgery is low but, however, should not be neglected. It mostly occurs within the first two to six hours after surgery, correlates with surgery duration, and is influenced by the choice of anesthesia (2). An ideal anesthetic or analgesic

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protocol should allow for pain-free surgery without systemic or local perioperative complications (8). Vitreoretinal surgery is traditionally performed under general anesthesia with the use of opioids. Opioids provide efficient analgesia but increase the incidence of respiratory depression and postoperative nausea and vomiting (PONV) (9, 10). In many other surgical interventions, the complementation of regional anesthesia to general anesthesia has proven to improve postoperative pain management and decrease the use of opioids without increasing complications or side effects (11). Therefore, also in eye surgery, the popularity of local anesthesia has increased (8). For many years, the retrobulbar block was considered the "gold standard" technique for ocular regional anesthesia. Despite the increasing use of newer techniques, it still maintains its popularity due to the potential usefulness of the retrobulbar block and its advantages. It generates faster pain relief and akinesia compared with other newer techniques (12). On the other hand, complications of retrobulbar blocks should also be taken into consideration. Although complications related to this technique appear rare, they can range from mild to life-threatening and include retrobulbar hemorrhage, the central spread of the local anesthetic and brain stem anesthesia, retinal vascular occlusions, optic nerve injury, ocular perforation, seizures, and cardiorespiratory distress (13, 14, 15).

In this retrospective study, we aimed to evaluate the effect of the intraoperative application of a retrobulbar block on postoperative pain scores and analgesic therapy in patients undergoing eye surgery under general anesthesia. We assessed patients' pain scores at different time points (0, 4, 8, and 12 hours respectively), the dose, and the number of analgesics administered perioperatively. We also evaluated the number of perioperative administered antiemetics and the incidence of retrobulbar block-related complications.

We hypothesized that the intraoperative application of a retrobulbar block reduces postoperative pain scores and the need for opioids or other analgesic medication in patients undergoing vitreoretinal surgery under general anesthesia.

Materials and Methods

After approval of the local ethics committee was obtained (S65134, approval date March 18th, 2021, Ethics Committee of the University Hospitals Leuven, Herestraat 49, 3000 Leuven), a monocentric, retrospective observational trial of all vitrectomy patients from July 1st, 2019, to January 1st, 2020, was performed.

Including criteria were patients older than 18 years of age who underwent vitrectomy surgery under general anesthesia with and without a retrobulbar block. Exclusion criteria were being under the age of 18, receiving only local blocks without general anesthesia, receiving only sedation for placement of the block, receiving total intravenous anesthesia instead of sevoflurane, or administering opioids other than sufentanil during anesthesia. The preoperative evaluation and information, the perioperative report, and the postoperative records until 12 hours were obtained from patients' medical files recorded in the hospital database.

All patients had standard anesthesia monitoring using an electrocardiogram, heart rate (HR), non-invasive blood pressure (NIBP), pulse oxygen saturation level (SpO_2), and end-tidal carbon dioxide ($EtCO_2$). Preoperatively no premedication was given, and a peripheral vein was cannulated. General anesthesia was induced with propofol 2-3 mg/kg, sufentanil 1-2 mcg/kg. After induction of anesthesia, a laryngeal mask was inserted, and anesthesia was maintained with sevoflurane at 2-2.5% in a 40% O_2/air mixture. According to the hospital standard multimodal analgesic pain protocol (if no patient dependent contra-indications), each patient received an intravenous bolus of paracetamol 1000 mg and ketorolac 0.5 mg/kg (with maximum doses of 30mg) intraoperatively. Administration of a supplemental bolus of clonidine 1mcg/kg or tramadol 2-3 mg/kg to prevent postoperative pain was left at the discretion of the attending anesthesiologist. Dexamethasone 5mg and ondansetron 4 mg were administered as part of our institutional guidelines for preventing PONV. If indicated, dehydrobenzoperidole 0.6mg (DHBP) was supplemented as a third prophylactic drug, except in case of contraindications.

In the retrobulbar block group, general anesthesia was combined with a retrobulbar block administered by ophthalmologists before the start of surgery. 2.5ml of lidocaine 2%, 2.5ml of bupivacaine 0,5% with adrenaline 1:200 000 and 150, IE, hyaluronidase was injected except in case of diabetes. In diabetic patients, adrenaline was omitted to reduce the risk of secondary vascular occlusion. For all RB+ patients, a 22G x 1.25" hypodermic needle was used for injection.

Postoperatively, according to our institutional standard protocol, if pain scores were > 3 on the numeric pain rating scale (NPRS), patients received supplemental analgesics. In the recovery, rescue analgesics consisted of piritramide (0.03 mg/kg),

morphine (0.03 mg/kg) or clonidine (1mcg/kg) At the ward, paracetamol 1000mg maximum every 6 hours, ketorolac 30mg maximum every 8 hours, tramadol maximum 3mg/kg every 8hours was administered to treat pain if necessary (NPRS>3). If PONV occurred, patients were treated with ondansetron 4mg, dehydrobenzoperidole 0.6mg, or alizapride 50mg intravenously, depending on the prophylactic scheme administered intraoperatively.

According to the accumulated data, patients were classified into two groups as "with a retrobulbar block (RB+)" and "no retrobulbar block (RB-)."

Outcome parameters

Our primary outcome parameter was the intensity of the pain, measured at four time points: on arrival at the recovery unit (T0), 4 hours (T4), 8 hours (T8), and 12 hours (T12) after surgery. Pain scores were assessed with a numerical rating scale from 0 to 10 (NPRS), where 0 is no pain, and 10 is the worst imaginable pain.

Secondary outcomes were the dose and number of postoperative use of analgesics and antiemetic medication. Differences between both groups in intraoperative opioid and prophylactic antiemetic administration were also evaluated. The occurrence of adverse events caused by the retrobulbar block was also noted.

Statistics

This is a purely retrospective investigation; therefore, no formal sample size estimation has been done.

Statistical analyses were performed using GraphPad Prism version 9 (GraphPad Software, Inc., La Jolla, CA).

Patients' characteristics were tabulated as absolute numbers, percentages, median and interquartile range (IQR). After checking the data for normality with the Shapiro-Wilk test, groups were compared using a Fisher's Exact test (two-sided with alpha = 5%) for the variables where the proportion of patients was compared (number of patients receiving analgesics, antiemetics). A Mann-Whitney U test (two-sided with alpha = 5%) was used for the variables on the ordinal or ratio level (e.g., medication dose, pain scores).

The retrobulbar block is by default used in vitro-retinal surgery in our institution. Only in surgical exceptions: patients under anticoagulant therapy in case of urgent surgery, preoperative proptosis, or extremely high myopia, a retrobulbar block is not performed. Nevertheless, these differences in population groups will not influence the investigated anesthetic outcome parameters. Therefore, no correction for possible confounders was needed.

Results

We identified 253 patients whose vitrectomy was performed under general anesthesia during the six months from 01/07/2019 to 01/01/2020. Seventy-seven patients (RB-group) under general anesthesia were compared with 176 patients who received a retrobulbar block on top of their general anesthesia (RB+ group).

Demographic characteristics of the patients (age, gender, and weight) are summarized in Table 1.

Table 1

Demographic characteristics of the patients

		RB+ group N= 176	RB- group N= 77
Age	Years	61 [52-68]	63 [55-70]
Gender Male Female	N (%)	 109 (61.9%) 67(38.1%)	 51(66.2%) 26(33.8%)
Weight	Kg	77 [67-90]	78 [68-95]

Data are presented as median [IQR] or absolute numbers (percentage of the whole).

Primary outcome parameter

Mean postoperative NPRS pain scores were low in both study groups, although slightly higher in the RB- group, at every time point. However, these results were at no time point statistically significantly different (Table 2, Fig. 1).

Secondary outcome parameters

There was no difference in sufentanil administration during anesthesia between both groups.

Table 2

NPRS (Numeric pain rating scale) pain scores at different time points

Timepoint **Group**		**T0**	**T4**	**T8**	**T12**
RB+ group	Mean NPRS (±SD)	0.47 (±1.33)	0.39 (±1.06)	0.49 (±1.41)	0.51 (±1.41)
RB- group	Mean NPRS (±SD)	0.77 (±1.67)	0.54 (±1.46)	0.66 (±1.51)	0.58 (±1.38)
	P-value	0.13	0.89	0.17	0.63

Data are presented as mean and standard deviation of the mean.

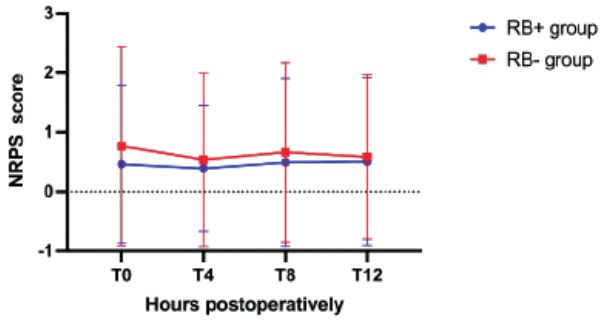

Fig. 1. — Evolution of pain scores over time in both groups. Numeric pain rating scale (NPRS) scores presented as mean with SD at four different time points.

Table 3

Intraoperative administered analgesics (dose and number of patients)

		RB+ group N= 176	**RB- group** N= 77	**P-Value**
Sufentanil	mg	10 (7.5-10)	10 (7.5-12.25)	0.32
Clonidine	N (%) mg	25 (14.2%) 75 [60-77.5]	15 (19.5%) 75 [60-75]	0.32 0.58
Tramadol	N (%) mg	11 (6.3%) 150 [100-200]	18 (23.4%) 175 [150-200]	**0.0002** 0.77
Paracetamol	N (%)	176 (100%)	77 (100%)	>0.99
Ketorolac	N (%)	132 (75%)	46 (59.7%)	**0.017**

Data are presented as median [IQR] or absolute numbers (percentage of the whole).

Table 4

Administered analgesics during the first 12 hours postoperatively

		RB+ group N= 176	**RB- group** N= 77	**P-Value**
Supplemental analgesics	N (%)	53 (30.1%)	33 (42.9%)	0.06
Paracetamol	N (%)	43 (24.4%)	24 (31.2%)	0.28
Ketorolac	N (%)	0 (0%)	1 (1.3%)	0.30
Opioids	N (%)	12 (6.8%)	10 (13%)	0.14

Data are presented as absolute numbers (percentage of the whole).

(Table 3) Also, the number and dose of clonidine administered intraoperatively did not differ between groups (Table 3).

According to the institutional multimodal analgesic protocol, all patients received paracetamol. However, more patients in the RB-group had contraindications for nonsteroidal anti-inflammatory agents, resulting in a significant difference in ketorolac administration between both groups (RB+ group: 75% vs. RB-group: 60%, P<0.05) (Table 3).

Table 5

Antiemetics administered intraoperatively and during the first 12 hours postoperatively

		RB+ group N= 176	**RB- group** N= 77	**P-Value**
Dexamethasone	N (%)	170 (96.6%)	74 (96.1%)	0.99
Ondansetron	N (%)	174 (98.3%)	77 (100%)	0.56
Dehydrobenzo-peridol	N (%)	33 (18.6%)	10 (13%)	0.36
Alizapride	N (%)	3 (1.7%)	1 (1.3%)	0.99

Data are presented as absolute numbers (percentage of the whole).

In terms of intraoperative tramadol use, significantly fewer patients in the RB+ group received tramadol during anesthesia (RB+ group: 6.3% vs. RB- group: 23.4%, p<0.001) (Table 3).

The total number of patients in need of postoperative analgesics regardless of the type of medication did not differ significantly between both groups. In addition, the subgroup analysis of the specific drugs (paracetamol, ketorolac, opioids) did not reveal any differences between the groups during the first 12 hours postoperatively (Table 4).

The prophylactic antiemetic medication protocol (2 or 3 was applied to all patients (except in patients with contraindications) with no differences between the study groups (Table 5).

The number of patients that received postoperative alizapride to treat PONV was very low, and no significant difference was demonstrated between the two groups. (Table 5).

The retrobulbar block technique was complicated with a retrobulbar hemorrhage in one patient. No other block-related adverse advents were noted.

Discussion

In our study, we evaluated 253 patients after vitreoretinal surgery retrospectively. Approximately 70% of these patients received retrobulbar block.

We had to refute our hypothesis that the intraoperative application of a retrobulbar block reduces postoperative pain scores and the need for opioids or other analgesic medication in patients undergoing vitreoretinal surgery under general anesthesia.

Similar to our study, Bayerl et al. did not show any advantage of additional retrobulbar anesthesia regarding postoperative analgesia compared to an adequate treatment with peripheral acting analgesics during surgery and the early postoperative period (16).

They also investigated the effectiveness of the retrobulbar block under general anesthesia. Although the total number of patients was about half of our study (130 total (88 RB+, 42 RB-)), the results of pain scores of their study were also in line with our research. However, their results showed that patients in the RB+ group had the tendency to experience delayed and higher postoperative pain scores, which was also reflected in the postoperative use of pain medications. Although there was no statistically significant difference between the two groups in our study, the use of postoperative pain medication was slightly higher in patients who did not receive a retrobulbar block.

Remarkably, the prospective study by Fekrat et al. has shown that 56% of patients undergoing vitreoretinal surgery under general anesthesia combined with a retrobulbar block request pain medication within 5 hours after surgery. And one-half of these patients needed narcotic analgesia for pain control after the operation (17). In our study, the percentage of patients that needed postoperative analgesics (30.1%) appeared lower than their study. This observation might result from our institutional routine multimodal analgesic regimen (paracetamol and ketorolac), whereas Fekrat et al. used extra pain medications only when needed in the postoperative period.

In contrast, the results of Henzler et al. have demonstrated that the combination of a retrobulbar block as pre-emptive analgesia with general anesthesia reduces the development of pain in ophthalmic operations (18).

In cases where regional anesthesia is not applied, opioids may also be preferred to provide effective and sufficient analgesia. In terms of strength of effectiveness, opioids have been used to treat a moderate-to-severe range of pain for a long time. Some other studies have also highlighted the effect of opioids on pain treatment after eye surgeries (19).

On the other hand, intravenous opioid use may also result in complications. The potential risk of complications limits the use of opioids in routine practice, especially in ambulatory surgery. While the most common side effects are nausea or vomiting, more severe side effects such as respiratory depression, bowel obstruction, bradycardia, hypotension, and addiction with prolonged use should also be considered (19).

Our database (within the study period) did not encounter any serious complications related to opioid administration. Also, no significant difference was determined between the two groups regarding postoperative nausea or vomiting. Furthermore, due to our intraoperative routine antiemetic use according to our protocol, it was noteworthy that the need for extra postoperative antiemetics was very low in terms of the total number. Thus, it demonstrates that this complication rate can be reduced with an effective pre-emptive treatment.

Generally, eye surgery operations carry a high risk of nausea. (With a rate of up to 60-70% in strabismus surgery) (20). In our study incidence of nausea in the postoperative period was remarkably low (only three patients (1.7%) in the RB+group and one patient (1.3%) in RB-group).

In a strabismus surgery study, which usually has a higher expected incidence of nausea, Huang et al. also showed a relatively reduced incidence of nausea compared to similar previous studies on strabismus surgery under general anesthesia (21). This lower rate was due to the administration of effective pre-emptive treatment, which is similar to our study.

On the other hand, a recent study by Fekrat et al. revealed that nausea was observed in 16% of the patients following vitreoretinal surgery with retrobulbar anesthesia. They declared a statistically significant relationship between the use of postoperative narcotic pain medication and nausea (17).

Another issue that should be considered in the selection of anesthesia is possible complications.

In general, ophthalmic surgical procedures, excluding exceptions, are considered low-risk operations because of the low percentage of significant volume blood loss (20). Although ophthalmic surgeons rarely encounter life-threatening problems, the following possible complications might appear associated with a retrobulbar block: retrobulbar hemorrhage, globe penetration, and perforation, brain stem anesthesia, globe ischemia, chemosis, optic nerve damage, optic nerve atrophy (1, 22).

In our current study, in evaluating the complications related to retrobulbar block, retrobulbar hemorrhage was encountered in 1 patient out of 176 total patients (0.57%) in the RB+ group. No other block-related adverse reactions were reported. This complication ratio appears to be in line with the results of some other previous studies.

According to the study of Zhuang et al., the incidence of complications associated with the retrobulbar block is about 1%, including global perforation, retrobulbar hemorrhage, brain stem injection of local anesthetics, and oculocardiac reflex (20).

An older study by Edge and Nicoll revealed that the overall prevalence of retrobulbar hemorrhage was 1:227 (0.44%) (23).

In contrast, Eke and Thompson demonstrated that the calculated incidence of reported 'Severe' retrobulbar hemorrhage (RBH) after retrobulbar injection was much lower (0.07%) (24).

Although there is only limited significant information about the complications of the retrobulbar block in the recent period studies, Bayerl et al. highlighted that they did not observe any serious side effects and complications, such as retrobulbar hematoma bradycardia, asystole, or apnea in their study (16).

With the new techniques developed, choosing the most appropriate anesthesia method for patients who will undergo eye surgery maintains its importance. The anesthesia technique to be applied is determined by the surgeon or by a joint decision with the anesthesiologist, depending on the current condition of the patient and the preferences of the patient, surgeon, or anesthesiologist. Retrobulbar block (with general anesthesia or alone) is still an effective analgesic method, especially for eye surgeries such as vitrectomy.

Like other surgical interventions, selected techniques, timely and adequate intervention against the pain, possible complications, etc., are the issues that need to be balanced in eye surgery.

We acknowledge, as this research is a retrospective investigation, it has some limitations. First, the administration of pain medication was not generally standardized, and it was subject to the preference of the responsible anesthetist. Because of this reason, some of the patients had to be excluded from the study. Second, the number of patients in the RB+ and RB- groups were not identical due to the selected period in which patients were observed. In our study, during the chosen period of 6 months, the RB-group sample size was smaller than the RB+ group (77 to 176 patients) which might have influenced our results. Third, postoperative pain score follow-up was limited to 12 hours since most patients were discharged within 24 hours. Last, given the retrospective nature of our study, our observations were limited to the collected data during daily clinical documentation.

Conclusion

The results of this retrospective study revealed no significant benefit of supplementing a retrobulbar block on top of general anesthesia in vitreoretinal surgery. We could not demonstrate a difference in pain scores or analgesic consumption nor a difference in side effects or adverse events. Therefore, the application of this technique remains a joint decision of the surgeon, anesthesiologist, and patient in which postoperative analgesia is not a determinant factor.

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