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Peribulbar and retrobulbar combined anesthesia for vitreoretinal surgery using ropivacaine

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PURPOSE. *To evaluate the efficacy and clinical effects of local retrobulbar anesthesia using ropivacaine in vitreoretinal surgery.*

METHODS. *Prospective study. A total of 919 vitreoretinal operations were followed. The operations were divided into three groups, depending on the degree of anesthesia needed. Group A: Vitrectomies with episcleral procedures (208 vitrectomies for detached retina or perforating trauma). Group B: Episcleral procedures only (410 operations for detached retina without vitrectomy). Group C: Vitrectomies without episcleral surgery (301 operations for macular pucker or hole, proliferative diabetic retinopathy, or silicone oil removal). Anesthesia was administered using a 23-gauge Atkinson-type retrobulbar needle, after topical anesthesia. Six mL of the solution containing 7.5 mg ropivacaine/mL were injected into the peribulbar space, and the other 4 mL deeper, into the retrobulbar space. The degree of infiltration of the palpebral region, the motor block in the extrinsic ocular muscles, and pain felt were checked and rated.*

RESULTS. *Swelling of lids was seen in 885 patients (96%); in 21 (2%) swelling was partial. In 13 patients (1%) there were no signs of infiltration. The motor block was total in 801 (87%) eyes, while 118 (12%) had reduced ocular movements. The degree of anesthesia was as follows, considering the three groups together: no pain = 855 (93%) patients; moderate pain = 44 (4%) patients; very strong pain = 20 (2%) patients. No adverse events or side effects were observed.*

CONCLUSIONS. *Ropivacaine used for retrobulbar-peribulbar combined anesthesia in vitreoretinal surgery showed excellent clinical efficacy as regards analgesia and muscle akinesia. (Eur J Ophthalmol 2006; 16: 295-9)*

KEY WORDS. *Peribulbar anesthesia, Retrobulbar anesthesia, Ropivacaine, Vitreoretinal surgery*

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INTRODUCTION

In vitreoretinal surgery, general anesthesia has always played a major role compared to loco-regional techniques. This seems to be changing, however, and local anesthetic block is often preferred by surgeons and anesthetists. This is partly because today's anesthetics are safer and easier to handle, but there are also indisputable organizational and economic advantages for the hospital where the operation is done.

Anesthesiologic requisites for endo-ocular surgery are perfect analgesia of the superficial and deep tissues of the eye, including the adnexa, and complete akinesia of the extraocular muscles, eyelids, and surrounding areas of the face (1, 2).

This study was designed to assess the efficacy and safety of ropivacaine for retrobulbar-peribulbar combined anesthesia in vitreoretinal surgery.

Ropivacaine is an amino amide local anesthetic, one of the xylidide derivatives, like mepivacaine and bupivacaine,

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from which it differs, however, in certain features (3). Bupivacaine and mepivacaine are used in medicine as racemic mixtures, meaning they contain equal parts of the dextro- and levo-rotatory enantiomers; ropivacaine, however, is synthesized as the pure levo-enantiomer, which makes it less toxic, with longer-lasting action, owing to differences in the three-dimensional structure of the molecule, which change its activity toward the complex receptor environment that is the anesthetic's target.

PATIENTS AND METHODS

In order to evaluate the efficacy and clinical effects of local retrobulbar anesthesia using ropivacaine, we followed and analyzed 919 vitreoretinal operations done in 2001 and 2002 at the II Ophthalmological Department of the Fatebenefratelli-Oftalmico Hospital in Milan, Italy. It was a prospective study. The operations were for posterior segment pathologies such as rhegmatogenous and tractional retinal detachment, vitreoretinal proliferation, macular epiretinal membrane, macular retinal holes, and perforating trauma. The eyes were operated either by vitrectomy or by an episcleral technique (cryopexy, segmental buckling, cerclage).

We divided the operations into three groups depending on the degree of anesthesia needed.

Group A: Vitrectomy with episcleral procedures (208 vitrectomies for detached retina or perforating trauma, all with segmental buckling, cerclage, and cryopexy); duration of operations was 168 (± 24) minutes.

Group B: Episcleral surgery (410 operations using cryopexy, segmental buckling, and in some cases cerclage without vitrectomy); 83 (± 16) minutes was average time.

Group C: Vitrectomy without episcleral surgery (301 vitrectomies for macular pucker or hole, proliferative diabetic retinopathy, or silicone oil removal); average duration was 52 (± 9) minutes.

Although it is difficult to classify vitreoretinal surgery, which is often complex, the often intense manipulations of the globe during prolonged vitrectomies (typical of Group A) are extremely painful, while Group C surgery is less aggressive to muscles and scleral tissue, so is usually tolerated better. Group B comprises the operations involving an intermediate degree of traction and manipulation of the ocular structures.

There were 465 men and 454 women, mean age 59 years (range 35–89). We excluded 93 patients from the analysis because we could not be certain they had had retrobulbar anesthesia. Exclusion criteria were allergies to local anesthetics, severe coagulation disorders, anatomo-constitutional anomalies of the orbit, and patients who specifically wanted general anesthesia.

Before the operation all patients (ASA status I and II) were seen by an anesthesiologist, and had chest X-rays and routine blood chemistry tests. When considered necessary, further instrumental or diagnostic investigations were done.

Patients were pre-anesthetized 45 minutes before surgery with a single intramuscular dose of a 4-mL solution containing 100 mg of pethidine, 2 mg of haloperidol, and 0.5 mg of atropine. Patients weighing 60 kg or less received half dose. Only one of the authors (P.S.) administered the anesthesia, using a 23-gauge Atkinson-type retrobulbar needle, 1.5 in. long (3.81 cm), after topical anesthesia with one drop 4% lidocaine.

Syringes were prepared with 10 mL of anesthetic solution containing 7.5 mg ropivacaine/mL and patients were asked to hold their gaze in the primary position, so the needle could enter the peribulbar space through the inferotemporal palpebral quadrant. Six mL of the solution were injected into the peribulbar space, and the other 4 mL deeper, into the retrobulbar space.

The degree of infiltration of the palpebral region achieved during anesthesia can be assessed from the slight swelling of the upper and lower lids caused by the anesthesia, and we rated it as follows: + for complete swelling of the whole lid; ± for only part; – for none. We did not analyze the relation between degree of infiltration and type of surgery in the three groups.

A small weight was positioned as an ocular pressor, and 15 minutes after the anesthesia – the time needed to prepare the sterile operating field – we checked the motor block in the extrinsic ocular muscles, using the following scoring system: 0 = akinesia, 1 = movement reduced (ocular movements more than 1 mm but less than 4 mm), 2 = movement present (>4 mm). Again, we did not analyze the relation between motor block and type of surgery.

At the beginning of the operation and during surgical procedure we asked patients if they felt any pain, rating the verbal responses as follows: 0 = no pain; 1 = moderate or medium; 2 = very strong. For further precision we asked the same question again at the end of the operation.

Patients were given a second dose of anesthetic only if they complained of pain during the operation.

Throughout surgery we monitored heart rate, blood pressure, ECG activity, and peripheral oxygen saturation, and recorded details of any intra- or postoperative adverse reactions.

RESULTS

As regards the level of palpebral infiltration, complete swelling of the upper and lower lids was seen in 885 patients (96.30%); in 21 (2.28%) there was swelling only in part of the eyelids. In 13 patients (1.41%) there were no signs of infiltration (Fig. 1).

The motor block, assessed 15 min after the injection, was total in 801 (87.15%) eyes, while 118 (12.84%) had reduced ocular movements. None of the patients had ocular motility reaching 2 on our rating scale, or at any rate such as to cause the surgeon problems handling the globe (Fig. 2).

Pain was none in 90%, 92%, and 96% in Groups A, B, and C, respectively. Very strong pain was felt by 3%, 2%, and nearly 0% of the patients (Fig. 3).

In the 20 patients who complained of very strong pain, we gave an additional injection of 5 mL into the retrobulbar cone of the superonasal sector, achieving good analgesia, permitting us to complete the operation without any need for intravenous anesthesia. Five of them needed intravenous sedation because additional local anesthesia was unsuccessful.

We observed no adverse events, allergic reactions, or side effects involving the central nervous or cardiovascular systems.

Table I summarizes the degree of anesthesia achieved.

DISCUSSION

L–ropivacaine was synthesized and marketed for general and ophthalmologic clinical-surgical use in 1997. It offers certain specific molecular properties different from other routinely used anesthetics that can be usefully exploited. A pure levo-rotatory enantiomer has longer-lasting action as regards the motor block and sensory effect than either the dextro-rotatory enantiomer or the racemic mixture, which is what most other anesthetic substances are, because the whole dose appears to be bioavailable and effective (4).

Studies to date confirm its excellent safety profile, with low cardiac and central nervous system toxicity in experimental and clinical settings (5-7). Thousands of patients have now been treated, with no significant adverse reactions. Comparative studies have confirmed the lower prevalence – even at high doses – of reactions such as headache, nausea, fever, or hyper- or hypotension with ropivacaine compared with other anesthetics such as bupivacaine, lidocaine, and mepivacaine (8).

Some studies (9) have compared the efficacy of parabul-

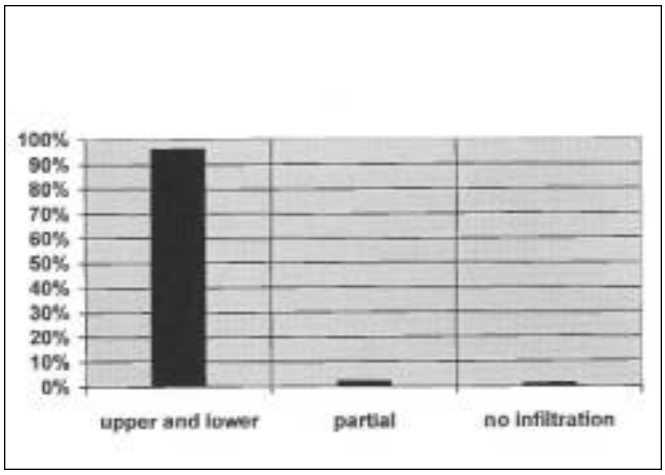

Fig. 1 - *Palpebral infiltration.*

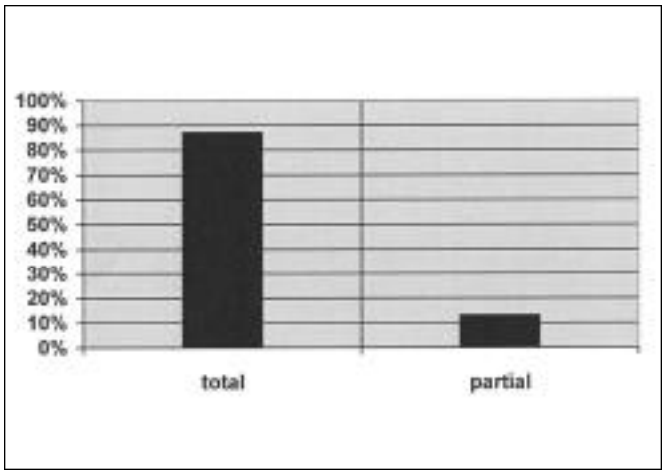

Fig. 2 - *Motor block.*

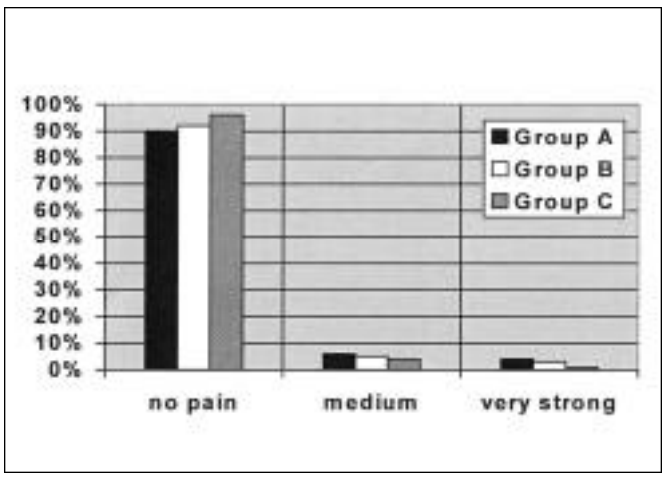

Fig. 3 - *Degree of pain.*

TABLE I - DEGREE OF ANESTHESIA RECEIVED

Pain	Group A (vitrectomy with episcleral surgery)	Group B (episcleral surgery)	Group C (vitrectomy without episcleral surgery)	Total
None	188 (90.38)	378 (92.19)	289 (96.01)	855 (93.03)
Moderate	12 (5.76)	21 (5.12)	11 (3.65)	44 (4.78)
Very strong	8 (3.84)	11 (2.68)	1 (0.33)	20 (2.17)
Total operations				
Values are n (%)	208 (22.63)	410 (44.61)	301 (32.75)	919 (100)

bar and retrobulbar anesthesia in rapid and lengthy vitreoretinal surgery, using a mixture of 4 to 7 mL of lidocaine and mepivacaine. The two techniques were similarly effective but more than 30% of patients required supplementary anesthesia, the proportion reaching 60% for more complex, lengthier operations such as vitrectomies and episcleral surgery, regardless of the technique. Often intraoperative analgesic sedation was required with drugs such as fentanyl citrate or propofol.

Gioia et al (10) compared the efficacy of peribulbar anesthesia using a mixture of lidocaine and bupivacaine (total 8 mL) or ropivacaine alone (8 mL); the results were comparable except that postoperative anesthesia was more effective in the group given ropivacaine. However, this study focused mainly on macular pathologies, where the operation is short and manipulation of the globe is limited.

With a view to eliminating the risks of retrobulbar anesthesia, many investigators have suggested sub-Tenon anesthesia using a blunt cannula to inject bupivacaine and mepivacaine (11) or lignocaine with bupivacaine (12) in one or all four quadrants of the bulb, after lifting Tenon's capsule. But in these studies too scleral buckling procedures were limited (Friedberg et al [11], 29%) and the seventh cranial nerve (11) and the orbicular muscle (12) was always blocked.

Mein and Woodcock (13) also demonstrated the efficacy and safety of the direct sub-Tenon approach for local anesthesia, taking the cannula into the retrobulbar space but without conventional retrobulbar block. Of their 58 cases at least 49 underwent scleral buckling procedures, but always after blocking the seventh cranial nerve using the standard Nadbath technique. After limbal peritomy 1.5 mL of the anesthetic mixture (lidocaine, bupivacaine, and hyaluronidase) was injected into the four quadrants.

In their study, Yepez et al (14) assessed the efficacy of topical anesthesia with ropivacaine in 134 lengthy, complex vitreoretinal operations, but they report that preoperative and intraoperative sedation of varying degrees was necessary. Intravenous midazolam hydrochloride (0.15 mg/kg) and fentanyl citrate (0.7 µg/kg) was always used, repeating the doses as necessary.

Brucker et al (15) sedated 15 patients with drugs that are very active on the central nervous system (midazolam hydrochloride, propofol, and fentanyl citrate) and then only used perilimbally injected anesthesia. However, their series was restricted to selected cases of macular surgery.

As we found no reports on the efficacy of peribulbar anesthesia with ropivacaine in lengthy vitreoretinal surgery requiring intense manipulation of the globe, we decided to test the new molecule in this type of surgery to assess its efficacy in terms of akinesia and analgesia during and after the operation. However, as we feared there might be a high rate of failures and we did not want to sedate patients too heavily, we decided to use the more standard technique of retrobulbar anesthesia, but with a new drug, ropivacaine, which has already been tested in cataract surgery and minor vitreoretinal operations.

CONCLUSIONS

We found that ropivacaine (7.5 mg/mL), used for peri-retrobulbar combined anesthesia in vitreoretinal surgery, showed excellent clinical efficacy as regards analgesia and muscle akinesia in all the types of vitreoretinal surgery investigated. Hardly anyone complained of pain during the operation and the surgeons found the motor block was altogether satisfactory.

The drug appears to have a longer duration of action – as shown in pharmacokinetic studies – than most of the anesthetics routinely used in clinical practice. This enables the surgeon to complete the operation serenely even if the globe has to be manipulated extensively, or intraoperative complications arise that prolong the procedure more than planned.

Although we did not specifically investigate the duration of postoperative analgesic effect, empirical observation suggests that it is particularly lasting, diminishing only 7 or 8 hours after injection. This is undoubtedly an advantage for the patient who can rest well after the operation, without extra analgesics.

The absence of noteworthy adverse reactions during and after surgery confirms the pharmacokinetic profile: at the recommended doses ropivacaine offers an excellent safety profile.

Therefore, although numerous studies confirm the efficacy and safety of other widely used and well-tried local anesthetics such as mepivacaine, bupivacaine, and lidocaine in anterior and posterior segment surgery of the eye, ropivacaine offers a valid and easy-to-handle alternative. The high doses that can be used and its molecular characteristics mean it can be proposed in vitreoretinal surgery as first-choice drug for the retro-peribulbar combined anesthesia described, ensuring deep and lasting analgesia and muscular akinesia.

The authors have no commercial or proprietary interest in this study.

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