ORIGINAL RESEARCH

A randomized clinical trial comparing the effectiveness of peribulbar versus parabulbar (subtenon) anesthesia in primary vitreoretinal surgery

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Acknowledgment
Supported by the Vision Research Foundation, 18 College Road, Chennai-600006, India.

Abstract

Aim: To compare the efficacy of peribulbar versus parabulbar anesthesia in primary vitreoretinal surgery.

Materials and methods: 142 consecutive patients were randomly assigned to either peribulbar (n=73) or parabulbar (n=69) anesthesia. The efficacy was graded 0-5 according to anesthesia or akinesia and the need for local supplementation.

Results: A larger volume of anesthetic mixture ($P<0.001$) and a longer interval between the administration of anesthesia and the start of surgery were required in peribulbar than parabulbar block ($P=0.008$). No differences were observed in their efficacy. The need for intraoperative supplementation was higher in eyes that required vitrectomy and scleral buckling or encircling than vitrectomy alone in peribulbar than parabulbar anesthesia ($P=0.01$).

Conclusion: Results suggest that parabulbar anesthesia is an effective alternative to peribulbar anesthesia, particularly for those eyes that undergo combined vitrectomy and buckling or encircling.

Key words: *Peribulbar anesthesia, Parabulbar anesthesia*

Introduction

In the recent past, several techniques of local anesthesia for vitreoretinal surgery have been reported. These include peribulbar, parabulbar (subtenon) and combined peribulbar and parabulbar anesthesia.[1-8] The aim of using these techniques was to reduce various ocular and systemic complications (such as globe perforation, grand mal seizures and cardiopulmonary arrest) associated with retrobulbar block.[9-14] However, no study that compares peribulbar and parabulbar techniques, particularly for vitreoretinal procedures, has yet been reported. Therefore, this prospective study was designed to compare these two techniques with respect to their efficacy, need for intraoperative supplementation, block complications, patients' comfort and the need for postoperative analgesic agents in those patients who underwent primary vitreoretinal procedures.

Materials and methods

One hundred and forty-two consecutive patients, while undergoing primary vitreoretinal procedures, were randomly assigned to either peribulbar (n=73) or parabulbar (n=69) anesthesia. The exclusion criteria included age under 20 years, revision retinal surgery, active ocular infection, known allergy to xylocaine or bupivacaine, mental retardation, or patient's preference for general anesthesia. No preoperative sedation was administered.

In the operating room, all standard monitoring devices were applied by the anesthesiologist. The anesthetic mixture consisted of a 50:50 mixture of 2.0% lignocaine and 0.5% bupivacaine with hyaluronidase (25 U/ml). The techniques of peribulbar and parabulbar anesthesia were similar to those we reported earlier.[4,8] To summarize, the peribulbar block was first given by injecting 0.5 ml of anesthetic solution subcutaneously just above the inferior orbital rim, 1 cm medial to the lateral canthus, to raise a small skin wheal. The needle was then advanced more deeply, and 0.5 to 1.0 ml of anesthetic solution was infiltrated in the plane of the orbicularis muscle. The procedure was repeated in the upper lid, just below the supraorbital notch. Then the needle was advanced further along the floor or the roof of the orbit, and another 1 ml of anesthetic solution was injected at the equatorial region. A further 1 to 2 ml was injected in the postequatorial region after the needle had been advanced to its hub.

The parabulbar anesthesia was administered in three stages: (1) orbicularis oculi injection; (2) subconjunctival injection; and (3) subtenon irrigation. The orbicularis oculi injection was similar to superficial injection of peribulbar anesthesia, as described above. Subconjunctival injection was given after routine sterile preparation and draping. With the patient looking down, the superior bulbar conjunctiva was tented up with toothed forceps. A 30-gauge needle was used to inject about 1.0 to 1.5 ml of anesthetic mixture beneath the conjunctiva to form a bleb around the circumference of the limbus. The anesthetized conjunctiva was incised to bare sclera with curved tenotomy scissors. A standard peritomy was performed. If pars plana vitrectomy without scleral buckling was contemplated, a blunt dissection was done posterior to the muscle ring, as performed routinely in scleral buckling surgery, to make tunnels along the inferior border of the lateral rectus and superior border of the medial rectus. Thereafter, subtenon irrigation was done using a blunt-tipped, 19-gauge irrigating cannula, by keeping the tip either at or just posterior to the equator of the eyeball. About 1.5 to 2 ml of anesthetic mixture per quadrant (lower temporal and upper nasal) was then placed in the tunnels between the Tenon's capsule and the globe.

Adequate anesthesia and its onset were determined by holding the bulbar conjunctiva and the lateral rectus muscle insertion. Motor akinesia was ascertained by observing intraoperative ocular movements in all directions. Patients were encouraged to inform the surgeon about pain during the surgery. Whenever required, the supplement anesthetic mixture was irrigated into the subtenon space. The efficacy of anesthesia was graded by the surgeon as follows: grade 0, inadequate anesthesia or akinesia or any other complication necessitating termination of the operative procedure, despite supplementation; grade 1, inadequate akinesia and anesthesia, supplementation required; grade 2, inadequate akinesia, adequate anesthesia, supplementation required; grade 3, inadequate anesthesia, adequate akinesia, supplementation required; grade 4, adequate anesthesia, inadequate akinesia, no supplementation required; and grade 5, adequate anesthesia and akinesia throughout surgery without any supplementation.

Other variables noted were preoperative diagnosis, type of surgery, onset of anesthetic effect, volume of anesthetic mixture, onset of pain during surgery, type of supplementation, duration of surgery and patients' comfort during surgery. Postoperative pain, vomiting and the need for analgesics and/or antiemetics were also recorded. The chi-square test and a Fisher's exact test were used, and differences were considered significant at P=0.05.

Results

Baseline characteristics of patients with respect to age, sex, weight, systemic disease and the American Society of Anesthesiologists' physical status classification were similar in both the groups (**Table 1**).

Table 1. Baseline characteristics of patients undergoing primary vitreoretinal surgery.

ASA = American Society of Anesthesiologists, NS = not significant

Characteristic	Peribulbar (n=73)	Parabulbar (n=69)	P
Mean age (years)	51.89±14.54	50.00±11.66	NS
Sex (%)			
Male	55 (75.3)	46 (66.7)	NS
Female	18 (24.7)	23 (33.3)	
Weight (Kg)	57.68±12.13	58.7±10.17	NS
Systemic diseases (%)			
Hypertension	30 (41.1)	33 (47.8)	NS
Diabetes mellitus	40 (54.8)	43 (62.3)	
Ischemic heart disease	6 (8.2)	3 (4.4)	
Others	4 (5.4)	0	
ASA status (%)			
I	13 (17.8)	11 (15.9)	NS
II	50 (68.5)	56 (81.2)	
III	10 (13.7)	2 (2.9)	

Table 2 shows the preoperative diagnoses of 142 patients enrolled in the study. Most of these patients underwent vitreous surgery to treat complications of vascular retinopathy. The surgical procedures were categorized as pars plana vitrectomy with or without lensectomy and no scleral buckling or encircling, pars plana vitrectomy with or without lensectomy and scleral buckling or encircling and scleral buckling alone (**Table 3**). Associated procedures included membrane peeling, fluid-gas exchange and endolaser, and were performed if necessary.

Table 2. Preoperative diagnoses of patients undergoing primary vitreoretinal surgery.

Diagnosis	Peribulbar (n=73) n(%)	Parabulbar (n=69) n(%)
Retinal detachment	13 (17.8)	5 (7.3)
Vascular retinopathy	55 (85.5)	59 (85.5)
Others (dislocated nucleus, traumatic cataract, macular pucker)	5 (6.8)	5 (7.4)

Table 3. Surgical procedures for patients undergoing primary vitreoretinal surgery.

Procedures	Peribulbar (n=73) n(%)	Parabulbar (n=69) n(%)
Lensectomy, vitrectomy and associated procedures (no scleral buckling)	50 (68.5)	55 (79.7)
Lensectomy, vitrectomy and associated procedures (scleral buckling)	22 (30.1)	14 (20.3)
Scleral buckling alone	1 (1.4)	0

The mean ± SD duration of the surgical procedure was 108.68 ± 51.95 and 95.49 ± 37.16 minutes for peribulbar and parabulbar block, respectively (**Table 4**). Operative pain started at a mean of 100.97 ± 29.2 minutes for peribulbar and 94.97 ± 21.35 minutes for parabulbar anesthesia. The need for local supplementation was 26% and 33% in peribulbar and parabulbar block, respectively. However, no significant difference was observed.

Table 4. Operative characteristics for patients undergoing primary vitreoretinal surgery.

Characteristic	Peribulbar (n=73)	Parabulbar (n=69)	*P*
Interval between the administration of anesthesia and the start of surgery (minutes)	23.88±8.99	20.13±7.51	0.008
Volume of anesthetic mixture(ml)	14.3±1.96	10.23±1.98	<0.001
Operative pain occurred (%)	23 (31.5)	27 (39.1)	NS
Onset of pain after the administration of anesthesia (minutes)	100.97±29.2	94.97±21.35	NS
Local supplementation (%)	19 (26.0)	23 (33.3)	NS
Duration of surgery (minutes)	108.68±51.95	95.49±37.16	NS

The mean ± SD volume of anesthetic mixture that was used for peribulbar and parabulbar block was 14.3±1.96 and 10.23±1.98 ml, respectively ($P<0.001$). Similarly, the interval between the administration of anesthesia and the start of surgery was 23.88 ± 8.99 and 20.13 ± 7.51 minutes for peribulbar and parabulbar anesthesia ($P=0.008$).

We found no difference in the efficacy of anesthesia, postoperative pain, analgesic requirements and the patients' comfort during surgery between the two groups (**Tables 5** and **6**). When various preoperative and intraoperative characteristics of patients who required supplemental block were compared with those who did not, the patients who needed supplemental block had a significantly longer duration of surgery, both for peribulbar and parabulbar anesthesia (**Table 7**). The need for supplemental block was significantly higher in those eyes that needed scleral buckling or encircling in the peribulbar group; however, no difference was observed in the parabulbar group. No other ocular or systemic complication occurred.

Table 5. Efficacy of anesthesia for patients undergoing primary vitreoretinal surgery.

Grades	Peribulbar (n=73) n (%)	Parabulbar (n=69) n (%)	*P*
0. Inadequate anesthesia or akinesia or any other complication necessitating termination of operative procedure despite supplementation	1 (1.4)	0	NS
1. Inadequate akinesia and anesthesia, supplementation required	5 (6.8)	8 (11.6)	NS
2. Inadequate akinesia, adequate anesthesia, supplementation required	4 (5.5)	2 (2.9)	NS
3. Inadequate anesthesia, adequate akinesia, supplementation required	9 (12.3)	13 (18.8)	NS
4. Adequate anesthesia, inadequate akinesia, no supplementation required	16 (21.3)	21 (30.4)	NS
5. Adequate anesthesia and adequate akinesia throughout surgery, no supplementation required	38 (52.1)	25 (36.2)	NS

Table 6. Postoperative characteristics of patients undergoing primary vitreoretinal surgery.

Characteristic	Peribulbar (n=73) n (%)	Parabulbar (n=69) n (%)	P
Eye pain (within 24 hours)	59 (80.8)	56 (81.2)	NS
Analgesic required	42 (57.5)	40 (58.0)	NS
Vomiting	14 (19.2)	13 (18.8)	NS
Patient's comfort during surgery			
Restless	4 (5.5)	0	NS
Least comfortable	8 (11.0)	12 (17.4)	
Comfortable	36 (49.3)	28 (40.6)	
Most comfortable	25 (34.3)	29 (42.0)	

Table 7. Comparison of patients with and without supplemental anesthesia for primary vitreoretinal surgery.

Characteristic	Peribulbar (n=73)			Parabulbar (n=69)		
	Supplementation (n=19)	No supplementation (n=54)	*P*	Supplementation (n=23)	No supplementation (n=46)	*P*
Age (years)	55.21±17.78	50.72±13.21	NS	51.61±12.54	49.19±11.25	NS
Duration of surgery (minutes)	132.95±53.15	100.95±49.21	0.01	119.43±36.58	83.52±31.51	<0.001
Volume of anesthetic mixture (ml)	14.39±1.32	13.91±2.41	NS	9.96±1.87	10.37±2.04	NS
Preoperative diagnosis(%)						
Retinal detachment	6 (31.6)	7 (13.0)	NS	2 (8.7)	3 (66.5)	NS
Vascular retinopathy	13 (68.4)	42 (77.8)		19 (82.6)	40 (87.0)	
Others	0	5 (9.3)		2 (8.8)	3 (6.6)	
Procedures						
Vitrectomy and no buckling/#240 band	8 (42.1)	42 (42.1)	0.01	15 (65.2)	40 (87.0)	NS
Vitrectomy and buckling/#240 band	10 (52.6)	12 (22.2)		8 (34.8)	6 (13.0)	
Buckling only	1 (5.3)	0		0	35 (76.1)	

Discussion

The result of this prospective study showed that parabulbar anesthesia was as effective as peribulbar anesthesia in eyes undergoing primary vitreoretinal surgery. However, a larger volume of anesthetic mixture was required in peribulbar than parabulbar block. This is not surprising, as the volume of the retrobulbar space is smaller than that of the peribulbar space. Moreover, a longer interval between the administration of the anesthetic mixture and the start of surgery was noticed after peribulbar anesthesia. This was possibly due to the time necessary for ocular compression to reduce orbital pressure and to obtain adequate anesthetic effect in peribulbar block.

Nearly one-fourth of the patients in the peribulbar group and one-third patients in the parabulbar group did require a local supplemental block in this study. This compared well with our previous reports, wherein the rate of supplementation block was 37% in peribulbar anesthesia[4] and 31% in parabulbar[8] anesthesia. However, further studies involving alkalinization[9] and/or medial periconal block[10] are needed to find out whether the rate of block failure can be decreased. In both groups, intraoperative pain started after a mean of around 90 minutes. Therefore, it is prudent to supplement the block at this stage should the surgery last longer. The need for intraoperative supplementation was significantly higher in those patients who needed buckling or encircling under peribulbar compared with parabulbar anesthesia.

Although effective, peribulbar anesthesia is a blind procedure and involves a sharp needle for its administration. Several ocular complications, such as globe perforation and rupture, have been reported with peribulbar block.[11,12] In contrast, parabulbar anesthesia (subtenon) is not only equally effective but is also a safe technique. It has the advantage of being performed under direct visualization[8] and hence helps avoid the risk of globe perforation. This is especially useful for eyes with a long axial length, scleral thinning, or staphyloma, which are often the very eyes that undergo vitreoretinal surgery.

The limitations of the study include subtenon supplementation of the anesthetic agent for both the peribulbar and parabulbar groups. As well, the surgeons were not masked to the techniques of administering the regional anesthetic agent. However, it is quite difficult to achieve the latter, as even if the anesthetic is given by other medical personnel, the surgeon may still manage to guess the injection technique from the appearance of the eyes.

In conclusion, the authors believe that parabulbar anesthesia is a reasonable option for regional anesthesia in suitable posterior segment procedures.

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