Comparison of Subconjunctival and Peribulbar Anaesthesia in Cataract Surgery

Dalia Divakar[1], Arun Sahadevan Rajamma[2]

[1]Department of Anaesthesiology, Regional Institute of Ophthalmology Medical College, Thiruvananthapuram, Kerala, India. [2]Department of Cardiology, Government General Hospital, Thiruvananthapuram, Kerala, India.

ABSTRACT

BACKGROUND

Peribulbar anaesthesia for cataract surgery was the most popular technique in the past,[1] but it is not completely free from complications.[2] Less invasive Subconjunctival anaesthesia methods were tried as an alternative to peribulbar and subtenon anaesthesia. Even though subconjunctival anaesthesia is less invasive and more safe it was not popular as expected because of the fear of less than adequate anaesthesia and akinesia. The aim of the study was to test the safety and efficacy of subconjunctival anaesthesia for cataract surgery against the established peribulbar anaesthesia.

METHODS

After approval from the ethics committee, 220 patients who were admitted for small incision cataract surgery undergoing either peribulbar or subconjunctival anaesthesia under monitored anaesthesia care in Regional Institute of Ophthalmology were studied from June 2019 to March 2020. These patients were divided into two groups - Group A and Group B by closed envelope technique. Group A patients received subconjunctival anaesthesia and Group B patients received peribulbar anaesthesia.

RESULTS

There was no statistical difference between the two groups regarding haemodynamics, intraoperative pain and postoperative complications. Time of onset of blockage was significantly rapid in subconjunctival anaesthesia.

CONCLUSIONS

Subconjunctival anaesthesia is a better alternative to peribulbar anaesthesia for cataract surgery.

KEYWORDS

Subconjunctival, Peribulbar, Cataract Surgery

Corresponding Author:
Dr. Dalia Divakar,
ERA - 118, Deepam,
Thottam, Manacaud,
Trivandrum – 695009, Kerala, India.
E-mail: daliadivakaran@gmail.com

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BACKGROUND

Cataract is a leading cause of preventable blindness in the world whereas cataract extraction with intraocular lens implantation is perhaps the most effective surgical procedure in all of medicine.[3] Cataract surgery constitutes by far the most common surgical procedure performed under local anaesthesia. Hence there is a need to make the anaesthesia technique safe, effective, and economically feasible, especially in India. Even though cataract surgery is considered as one of the safest surgeries in the world, it can also cause serious cardiovascular complications. The reason for the same being geriatric age group and multiple comorbidities. Hypertension, tachycardia, hypotension are the major causes for perioperative acute cardiac events leading to mortality and morbidity in patients undergoing noncardiac surgeries.[4,5] Of these tachycardia and hypertension, common in the perioperative period, may exert shear stress and high circumferential tensile stress leading to plaque rupture.[6] Majority of then patients who develop perioperative myocardial infarction were not having obstructive coronary artery disease previously, which suggests that demand ischemia due to haemodynamic alteration plays a major role in complications.[7] Tachycardia is considered as the most common cause of postoperative oxygen supply-demand imbalance.[8,9,10] Adrenaline containing local anaesthetic can have systemic absorption and undesirable life-threatening complications because of it. It is a potential risk for patients with heart disease, both previously diagnosed and undiagnosed.

Retrobulbar anaesthesia was a commonly used form of local anaesthesia for cataract extraction almost for a decade. It was gradually replaced by peribulbar anaesthesia because of the serious needle - related complications associated with the former such as retrobulbar haemorrhage, optic nerve damage, brain stem anaesthesia and globe perforation.[11] Subconjunctival anaesthesia (SCA) was reported in 1990 to be effective for cataract surgery.[12,13] It is very simple procedure and provides fast - acting anaesthesia of the anterior segment and conjunctiva. No special needle is required and it does not cause intra - orbital or intraocular pressure to rise.[14] Cardiovascular complications remain a major cause of morbidity and mortality after non - cardiac surgery Cardiovascular complications remain a major cause of morbidity and mortality after non - cardiac surgery

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Objectives

Primary aim is to compare the changes in haemodynamic parameters like heart rate, blood pressure and oxygen saturation in patients receiving peribulbar and subconjunctival anaesthesia for cataract surgery. Secondary aim is to compare the Time of onset of blockade, Intraoperative pain sensation and complications of these two anaesthesia techniques.

METHODS

This is a prospective observational study conducted from June 2019 to March 2020 at Regional Institute of Ophthalmology, Trivandrum, among patients admitted for Small Incision Cataract Surgery planned for peribulbar or subconjunctival anaesthesia as part of the surgery.

Inclusion Criteria

- Patients admitted in Regional Institute of Ophthalmology, for manual small incision cataract surgery.
- Those who are willing to give written informed consent for the study.
- Age between 40-80 years.

Exclusion Criteria

- Patients refusing local anaesthesia, those with clotting abnormalities, impaired mental status.
- Patients with systemic Hypertension and coronary artery disease.
- Patients with obstructive pulmonary diseases.
- Patients on betablockers.
- Sensitivity to xylocaine.
- Previous intraocular surgeries, injuries and inflammations of eye.

After approval from the ethics committee, Patients who are admitted for small incision cataract surgery undergoing either peribulbar or subconjunctival anaesthesia under monitored anaesthesia care were considered for this study. Before surgery, full informed consent was taken. Vision, Anterior segment examination by Slit lamp will be done. Patient will be clearly informed about the procedure. A detailed pre anaesthetic check-up was done about the pre-existing systemic illness. Tab. Alprazolam 0.25 mg at 8 pm in the previous day and 6 am on the day of surgery was given to all patients. One hour before surgery, pupil mydriasis was induced by topical 10 % phenylephrine and 1 % cyclopentolate that were instilled in the eye to be operated. Baseline vital signs were taken for all patients. Patients will be randomly allotted into two groups using the sealed envelope method, Group A for (subconjunctival block) and Group B for (peribulbar block)

Peribulbar Anaesthesia

The eyelid and periocular areas were cleaned with 5 % povidone iodine. The injection was given at the inferotemporal site using 23 - gauge sharp needle attached to 5 ml syringe containing the anaesthetic agent with the eye in neutral position of gaze. After negative aspiration for blood, 5 ml of lignocaine 2 % mixed with 1 : 200000 adrenaline, and hyaluronidase 150 IU / ml was injected into the peribulbar space.

Sub Conjunctival Anaesthesia

Patients in this group received subconjunctival anaesthesia with 0.5 to 1ml lignocaine 2 % injected just beneath bulbar conjunctiva posterior to the limbus depending on the site of incision (superior or temporal).

Systolic, diastolic and mean blood pressures, heart rate, and oxygen saturation were recorded 5 minutes before anaesthetic injection and 5, 10, 15 minutes after injection. Comparison was done on the average of recorded parameters to find out which type of anaesthesia is haemodynamically better for the patient. Assessment of pain was done every 5 min after local anaesthesia injection by numerical pain reporting scale.[15] Patients were asked to grade the pain they felt on a linear scale of 0 – 4 (no pain = grade 0, mild pain = grade 1, moderate pain = grade 2, severe pain = grade 3, and maximum pain imaginable = grade 4). Time of onset of blockade was assessed as the starting time of the surgery. Complications if any were also documented.

RESULTS

Patient characteristics shows there were no significant differences between the two groups in terms of age and sex. The average value of HR of patients at pre induction stage in Subconjunctival block group was 79.82, where as its value in Peribulbar block group was 79.67. The student t test ($p>0.05$) shows that there was no significant difference in heart rate between two groups at pre induction stage. Repeated measures ANOVA was done to determine whether groups differ in heart rate at different stages such as 5 minutes, 10 minutes and 15 minutes after local anaesthesia, showed no significant difference across the groups with a f value of 0.427, p value of 0.514 (Table 1). The average value of Systolic blood pressure diastolic pressure and Mean arterial pressure of patients at pre induction stage in Subconjunctival block group was 130.12, 77.92 and 95.33. Whereas its value in Peribulbar block group was 131.97, 79.77 and 97.17 respectively. The student t test ($p>0.05$) showed that there was no significant difference in Systolic, Diastolic and Mean arterial pressure between two groups at pre induction stage. Repeated measures ANOVA was done to determine whether groups differ in Systolic and Diastolic blood pressure at different stages such as 5 minute, 10 minute and 15 minute after local anaesthesia is given, showed no significant difference across the groups with a f value of 0.398 and 1.52, p value of 0.529 and 0.214 respectively. Mean arterial pressure at different stages such as 5 minute, 10 minute and 15 minute is also showed no significant difference across the groups with f value of 1.035 a p value of 0.310 (Table 2,3,4). The average value of SPO2 of patients at pre induction stage in Subconjunctival block group was 97.78, where as its value in Peribulbar block group was 97.42. The student t test ($p<0.05$) shows that there is significant difference in SPO2 between two groups at pre induction stage. Repeated measures ANOVA was done to determine whether groups differ in SPO2 at different stages such as 5 minute, 10 minute and 15 minute after drug is given, showed no significant difference across the groups with an f value of 0.477, p value of 0.491. The average time of onset of block in subconjunctival group was 4.5 minutes whereas in Peribulbar group was 8.4 minutes. The student t test (< 0.0001) shows that there is significant early onset of block in subconjunctival group. (Table 5). With regard to intraoperative pain sensation assessed by NRS, 99 (82.5 %)patients in subconjunctival block group versus 107 (89.1 %) peribulbar block group reported grade 0 (no pain), with P value of 0.14.19 (15.8 %)patients in Subconjunctival block group and 12 (10 %) in Peribulbar block reported grade 1 (mild pain), with P value of 0.181. Two (1 %) patients in Subconjunctival block group and 1 (0.8 %) patients in in Peribulbar block reported grade 2 (moderate pain), with P value of 0.87. No patients complained Grade 3 (severe pain) and Grade 4 (maximum imaginable pain); (Table 6). Post - operative complications like brain stem anaesthesia, optic nerve damage, globe perforation and unplanned hospital admissions were nil in both groups (Table 7).

Stages	Subconjunctival Block		Peribulbar Group		t	P
	Mean	S.D.	Mean	S.D.	Value	Value
5 minute	80.72	9.74	80.27	9.67	0.359	0.720
10 minute	80.30	8.94	79.73	8.81	0.495	0.621
15 minute	80.87	9.58	79.72	9.53	0.926	0.356

Table 1. Comparison of Heart Rate in Different Stages

Stages	Subconjunctival Block		Peribulbar Group		t value	P Value
	Mean	S.D.	Mean	S.D.		
5 minute	130.72	12.79	132.33	12.72	-0.98	0.33
10 minute	129.6	14.35	130.92	14.58	-0.620	0.536
15 minute	129.87	13.68	130.38	14.49	-0.279	0.780

Table 2. Comparison of Systolic Blood Pressure in Different Stages

Stages	Subconjunctival Block		Peribulbar Group		t	P
	Mean	S.D.	Mean	S.D.	Value	Value
5 minute	79.54	6.44	80.78	8.07	-1.317	0.189
10 minute	78.82	6.08	80.18	7.81	-1.494	0.136
15 minute	79.94	6.97	80.68	8.61	-0.725	0.469

Table 3. Comparison of Diastolic Blood Pressure in Different Stages

Stages	Subconjunctival Block		Peribulbar Group		t	P
	Mean	S.D.	Mean	S.D.	Value	Value
5 minute	96.6	8.15	97.97	8.75	-1.249	0.213
10 minute	95.8	8.01	97.09	9.04	-1.166	0.245
15 minute	96.58	8.512	97.24	9.661	-0.560	0.576

Table 4. Comparison of Mean Arterial Pressure in Different Stages

Variable	Time of Onset of Block (Minutes)	S.D.	N	P Value
Subconjunctival block	4.5	1.62	120	< 0.0001
Peribulbar block	8.4	1.42	120	

Table 5. Time of Onset of Blockade

	Grade 0 (No Pain)	Grade 1 (Mild Pain)	Grade 2 (Moderate Pain)	Grade 3 (Severe Pain)	Grade 4 (Maximum Imaginable Pain)
Subconjunctival block (N-120)	99 (82.5 %)	19 (15.8 %)	2 (1 %)	0	0
Peribulbar block (N-120)	107 (89.1 %)	12 (10 %)	1 (0.8 %)	0	0
p value	0.14	0.181	0.87		

Table 6. Intraoperative Pain Assessment by Numerical Rating Pain Scale

Variable	Subconjunctival Block (N-120)	Peribulbar Block (N-120)	P Value
Brain stem anaesthesia	0	0	
Optic nerve damage	0	0	
Globe perforation	0	0	
Unplanned hospital admissions	0	0	

Table 7. Postoperative Complication

DISCUSSION

For cataract surgery, subconjunctival and peribulbar are the most commonly used techniques in our Institute. In this study, subconjunctival block and Peribulbar block was compared in terms of haemodynamic variables, onset of action, and pain perception during surgery and postoperative complications. We have randomized 240 patients undergoing cataract in to peribulbar and sub conjunctival groups with 120 patients in each group. The haemodynamic parameters in baseline, 5 minutes, 10 minutes and 15 minutes did not show any significant difference between two groups. Even though the amount of adrenaline containing local anaesthetic used in peribulbar anaesthesia is greater than that sub conjunctival group it was not reflected in the haemodynamics. This indicates that the systemic absorption of the adrenaline is negligible. This may be also due to the lower concentration of adrenaline (1 : 200000) in the local anaesthetic solutions used for cataract surgery. These observations were in agreement with the study by R. Sanders et al.[16] Where a prospective randomised study of plasma adrenaline and noradrenaline, heart rate, blood pressure, pain and anxiety before and after local anaesthesia and during surgery were studied.

They have shown that the larger volume of extraconal orbital anaesthetic solution used in the peribulbar technique produces no greater risk of systemic pressor effects. Regarding intraoperative pain sensation, it was found to be lower in sub conjunctival group than peribulbar, but was statistically insignificant. This was in total agreement with the previous study by Smith et al. Owing to the preliminary conjunctival surface anaesthetic and the relatively shallow depth of the subconjunctival injection, an average patient actually will not feel any injection being given at all. None of the patients in the two groups required any postoperative analgesic. Davis 2nd DB et al[17] in his study demonstrated Peribulbar anaesthesia as a safer alternative, to retro bulbar anaesthesia and stated that 'complications of retro bulbar anaesthesia are greatly minimized in peribulbar anaesthesia'. But the safety profile shown in the initial published series of 16,224 peribulbar anaesthesia has not been replicated in the 'real world'.[19] A national survey Eke T et al showed that the two techniques have similar incidences of globe perforation and brain-stem depression.[18,19] The Sub conjunctival block also prone for complications like subconjunctival haemorrhage or excess oedema of the conjunctiva, anterior penetration of the globe etc.[20,21] But the absence of significant post operative complications like brain stem anaesthesia, optic nerve damage, globe perforation and unplanned hospital admissions in both groups may be due to the high volume of cataract surgery being done in our Institute by experienced surgeons. The onset of blockade was significantly faster in subconjunctival group than in peribulbar group. In the pioneer study by Smith demonstrated surprising ocular akinesia with only a subconjunctival injection of bupivacaine 0. 5 % and hyaluronidase. The anaesthetic rapidly diffuses to the superior rectus and the horizontal recti muscles and also delayed minimal intraconal diffusion is possible which again favours surgeons who prefer mild akinesia. Hence sub conjunctival anaesthesia may be preferred in high volume cataract centres and day care cataract camp settings.

CONCLUSIONS

We observed that even though the haemodynamics, safety and efficacy of subconjunctival anaesthesia is similar to peribulbar anaesthesia for cataract surgery, subconjunctival anaesthesia is a better alternative to peribulbar anaesthesia due to its faster onset of action and absence of serious inherent complications of peribulbar anaesthesia.

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