Randomized Clinical Trial

Intravenous Versus Peribulbar Dexmedetomidine as an Adjunct to Local Anesthetics in Strabismus Surgery: A Randomized, Double-blinded Clinical Trial

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Background: Dexmedetomidine has not been adequately studied as an adjuvant to peribulbar anesthesia in strabismus surgery.

Objectives: We investigated how different routes of dexmedetomidine administration affect the peribulbar block characteristics in adults undergoing strabismus surgery.

Study Design: A randomized, double-blind clinical trial. The study was approved by the Institutional Ethics Committee (approval number: 520/3/2021) and registered at ClinicalTrials.gov (NCT05215158).

Setting: The trial included 46 patients aged 20–60 years with an American Society of Anesthesiologists Physical Status Classification System of I or II who were scheduled for unilateral strabismus surgery at a university hospital.

Methods: Patients were randomly assigned to an intravenous dexmedetomidine group (n = 15) who received 50 µg dexmedetomidine in 50 mL normal saline intravenously over 10 minutes, followed by a peribulbar block using a 10 mL mixture of 4 mL lidocaine 2%, 4 mL bupivacaine 0.5%, and 2 mL normal saline containing 150 international units (IU) hyaluronidase. The peribulbar dexmedetomidine group (n = 31) received 50 mL normal saline intravenously over 10 minutes, followed by a peribulbar block using a 10 mL mixture of 4 mL lidocaine 2%, 4 mL bupivacaine 0.5%, 1 mL normal saline with 150 IU hyaluronidase, and 1 mL normal saline containing 50 µg dexmedetomidine. Sensory and motor block onset and duration, analgesia duration, and patient and surgeon satisfaction were evaluated.

Results: Peribulbar dexmedetomidine prolonged the median duration of postoperative analgesia by 3.2 hours. Patients who received peribulbar dexmedetomidine benefitted from a longer time to request postoperative analgesia than those who got intravenous dexmedetomidine (7.17 ± 2.0 hours vs 5.79 ± 2.1 hours; $P = 0.048$). Motor block duration was longer in the peribulbar group compared to the intravenous group (198.34 ± 17.3 minutes vs 148.93 ± 13.7 minutes; $P = 0.001$). Patient and surgeon satisfaction was higher in the peribulbar dexmedetomidine group compared to the intravenous dexmedetomidine group ($P = 0.048$, $P = 0.016$, respectively). Strabismus surgery duration was shorter in the intravenous dexmedetomidine group than in the peribulbar group (38.01 ± 8.3 minutes vs 55.01 ± 11.9 minutes; $P < 0.001$).

Limitations: Our study took place at a single-center with a small sample size limited to adult patients undergoing strabismus surgery. The study was not powered to identify differences in speed of sensory block onset and duration, or speed of motor block onset. However, peribulbar dexmedetomidine prolonged the motor block's duration.

Conclusion: Peribulbar dexmedetomidine outperforms intravenous dexmedetomidine in terms of postoperative analgesia and motor block duration when used as an adjunct to peribulbar anesthesia for strabismus surgery. However, the intravenous group had significantly shorter surgical times.

Key words: Block adjunct, dexmedetomidine, peribulbar block, strabismus surgery

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Strabismus (misalignment of the eye/eyes) is caused by an imbalance in extraocular muscle activity. As a result, 2 distinct images, one from each eye, are conveyed to the brain, resulting in diplopia in adults (1).

Strabismus surgery refers to incisional surgical techniques on the extraocular muscles in order to align the eyes, minimize diplopia, and restore binocular vision. Strabismus surgery can be done under regional or general anesthesia (2). In a retrospective analysis of 510 patients, Vagge, et al (3) reported that peribulbar anesthesia was an efficient and safe choice for strabismus surgery in adults. One advantage of the established regional ophthalmic block is that it reduces the oculocardiac reflex, which is usually associated with strabismus surgery. The oculocardiac reflex induces sinus bradycardia, which can progress to atrioventricular block, ventricular fibrillation, or even asystole.

Despite excellent akinesia after ophthalmic regional block, many patients report discomfort during muscle traction and conjunctival manipulation, as well as a short duration of analgesia, requiring the addition of local anesthetic adjuvants (1). Dexmedetomidine, an α-2 adrenoreceptor agonist, has been presented as a safe and effective adjunct capable of enhancing the effectiveness and duration of single-shot brachial plexus nerve blocks (4). Several studies have been conducted to evaluate the effectiveness of adding dexmedetomidine to local anesthetics in peribulbar block for cataract surgery (5,6). However, the utility of dexmedetomidine with peribulbar anesthesia in strabismus surgery has not been adequately studied.

Our randomized, double-blinded clinical trial investigated how different routes of dexmedetomidine administration affect the peribulbar block characteristics in adults undergoing strabismus surgery. We compared the efficacy of intravenous versus peribulbar dexmedetomidine as an adjunct to a local anesthetic mixture in peribulbar block for strabismus surgery in adults. The primary outcome was the duration of analgesia; secondary outcomes were the onset and duration of sensory and motor blocks, hemodynamic variables, Ramsay Sedation Scale score, Numeric Rating Scale (NRS-11) score, patient and surgeon satisfaction, and perioperative side effects.

Methods

Ethics and registration: The Institutional Ethics Committee approved this study (approval number: 520/3/2021). It was then registered on ClinicalTrials.gov (NCT05215158). The study adhered to the criteria of the Consolidated Standards of Reporting Trials (CONSORT) guidelines. Study patients were taught about the study's objectives and risks before signing written informed consent. All methods were carried out in accordance with the Helsinki Declaration of 1964 and its revisions.

Patient Inclusion and Exclusion Criteria

The study included all patients aged 20-60 years with an American Society of Anesthesiologists Physical Status Classification System of I or II who were scheduled for unilateral strabismus surgery under peribulbar anesthesia. Exclusions included: under the age of 20 or above 60, a body mass index $\geq$ 35, systemic or bleeding disorders, ocular or neurological problems, intellectual disability, deafness, dementia, and those who were unwilling to participate in the trial.

Randomization

Patients were randomly assigned to one of 2 groups using computer-generated random numbers. The group assignment was concealed in sealed, opaque envelopes. An investigator not involved in patient anesthesia or outcome evaluation prepared the study drugs in standardized syringes with the same volumes for all groups based on the patient's study group assignment. Patients, anesthesiologist, block operators, surgeons, postoperative recovery nurses, and data collectors were all blinded to group assignment. In the intravenous dexmedetomidine group, patients were given 50 µg dexmedetomidine in 50 mL normal saline intravenously over 10 minutes, followed by a peribulbar block using a 10 mL mixture of local anesthetics—4 mL lidocaine 2%, 4 mL bupivacaine 0.5%—and 2 mL normal saline containing hyaluronidase 150 international units (IU).

In the peribulbar dexmedetomidine group, patients were given 50 mL of normal saline intravenously over 10 minutes, followed by a peribulbar block using a 10 mL mixture of local anesthetics—4 mL lidocaine 2% and 4 mL bupivacaine 0.5%—plus 1 mL normal saline containing hyaluronidase 150 IU, and 1 mL normal saline containing 50 µg dexmedetomidine.

Anesthesia

Patients were enrolled in the study after a proper preoperative assessment including a history, clinical examination, and routine laboratory investigations. All patients received nothing orally for at least 6 hours

preprocedure. On arrival at the operating room, standard monitoring was connected: electrocardiogram, noninvasive blood pressure, and pulse oximetry. The displayed data were recorded preoperatively (baseline). End-tidal CO_2 was monitored using the Medtronic Capnostream™ 35 with integrated supplemental oxygen administration at 3–5 L/min.

A 20G cannula was placed, and the 50 mL injectate was administered intravenously over 10 minutes before the peribulbar anesthesia. The patient was advised to fix his eyes on the ceiling while resting supine. The peribulbar block was conducted by a single trained investigator using a 10 mL injectate. A 25G needle was inserted through the skin beneath the globe at the junction of the lateral and middle thirds of the inferior orbital rim on the eye to be operated on. The needle was inserted with a bevel toward the globe at 16 to 24 mm depth to reach behind the equator. The depth was determined by observing the remaining length of the external part of the 25G (25 mm).

After negative aspiration, 5 mL of the injectate was given slowly; the remaining 5 mL was injected at 2 mm medial and inferior to the supraorbital notch at the same depth as before. This was followed by a gentle digital massage of the eyeball to help disseminate the local anesthetic mixture. The same surgeon did all the procedures; no patients got sedation beyond what was specified in the protocol.

Outcome Measures

The primary outcome measure of this study was analgesia duration, defined as the time interval between the abolishment of sensation determined by gauze soaked with iced normal saline or corneal reflex and the first postoperative request for analgesia. The secondary outcome measures included:

- The onset of sensory blocks (minutes) was assessed every 30 seconds and defined as the time lapse between the complete injection of local anesthetics and the abolishment of sensation using gauze soaked with iced normal saline or corneal reflex.
- The duration of sensory block (minutes) was assessed every 15 minutes and defined as the time lapse between the abolishment of sensation using gauze soaked with iced normal saline or corneal reflex and the commencement of postoperative pain.
- The onset of motor block (minutes) was evaluated every 2 minutes and defined as the time elapsed between the complete injection of local anesthetics and the complete abolishment of ocular motility (akinesia).
- The duration of motor block (minutes) was evaluated every 15 minutes and defined as the time lapse between the complete abolishment of ocular motility (akinesia) and the full return of ocular motility and the disappearance of diplopia.
- Motor block onset and duration were evaluated using a 3-point scale with values ranging from zero to 2 in each of the 4 directions (superior, inferior, medial, and lateral): 0-complete akinesia, one-limited movement, and 2-normal movement (7).
- Heart rate, mean arterial pressure, and oxygen saturation were recorded every 5 minutes for the first 30 minutes and every 15 minutes until the end of surgery. Hypotension was defined as a 20% decrease in mean arterial pressure from baseline or a mean arterial pressure less than 65 mm Hg and was treated with incremental doses of intravenous ephedrine (6 mg) as needed. Bradycardia, defined as a heart rate of less than 50 beats per minute, was treated with intravenous atropine 0.5–1.0 mg. Desaturation (oxygen saturation < 90% on room air) was addressed by increasing supplemental oxygen.
- The Ramsay Sedation Scale (8) was used to assess sedation levels at 15, 30, 45, and 60 minutes, as well as 2, 4, 6, 8, 10, and 12 hours postinjection.
- A Numeric Rating Scale (NRS-11) (0 = no pain, 10 = most severe pain) was used to assess pain at one, 2, 3, 4, 6, 8, 10, and 12 hours postoperatively. Patients were treated with a combination of intravenous acetaminophen (1 g) and ketorolac (30 mg) when NRS was ≥ 3.
- Surgery length was defined as the time lapse between the complete abolishment of ocular motility (akinesia) and the end of surgery.
- Patient satisfaction with the perioperative analgesia was assessed on a scale of one to 3: one (dissatisfied), 2 (neutral), and 3 (satisfied).
- Surgeon satisfaction with the surgical field was assessed on a scale of one to 3: one (dissatisfied), 2 (neutral), and 3 (satisfied).
- Patients were monitored for signs of bradycardia, hypotension, oxygen desaturation, nausea, and vomiting in the first 12 hours postsurgery.

Sample Size Calculation and Statistical

Analysis

Sample size calculation was carried out using G*Power 3 software (Heinrich Heine University) (9). A calculated minimum sample of 28 cases was scheduled for unilateral strabismus surgery (10). The sample was randomly assigned into one of 2 groups with a 1:2 sample distribution (n = 14:28 the intravenous dexmedetomidine group and the peribulbar dexmedetomidine group, respectively) to detect an effect size of 0.4 in the mean postoperative duration of analgesia with an error probability of 0.05 and 80% power.

The collected data were verified, coded by a researcher, and analyzed using the IBM SPSS Statistics 24.0 (IBM Corporation). Descriptive statistics—means, standard deviations, medians, ranges, and percentages—were calculated. For test of significance, Aχ2, Fisher's exact, or Monte Carlo exact test was used to compare the difference in the distribution of frequencies between the different groups as appropriate. The Shapiro-Wilk test was used to test data normality. Student's t test was calculated to test the mean differences in continuous variables between groups. A 2-way repeated measure analysis of variance test was calculated to test the mean differences of the data that follow a normal distribution and have repeated measures (between groups, within groups, and overall difference). A Kaplan–Meier curve was plotted to explore the differences in the duration of postoperative analgesia among the studied groups using a log-rank test. A P value < 0.05 was considered significant.

Results

Fifty-five patients were assessed for eligibility for this trial. We excluded 9 patients because 4 declined to participate, 2 were uncooperative, and 3 were younger than 20. Thus, 46 patients were included in the trial and randomly allocated to one of the 2 groups.

One of the patients in the peribulbar group became apprehensive and frightened during the local anesthetic administration. Two patients (one from each group) did not achieve complete ocular globe akinesia within 15 minutes of block insertion; therefore, all 3 patients successfully underwent general anesthesia. The three patients were withdrawn from the trial leaving 43 to complete the study (Fig. 1).

The baseline patient characteristics data were similar between the study groups. The length of strabismus surgery was shorter in the intravenous dexmedetomidine group than in the peribulbar dexmedetomidine group (P < 0.001) (Table 1).

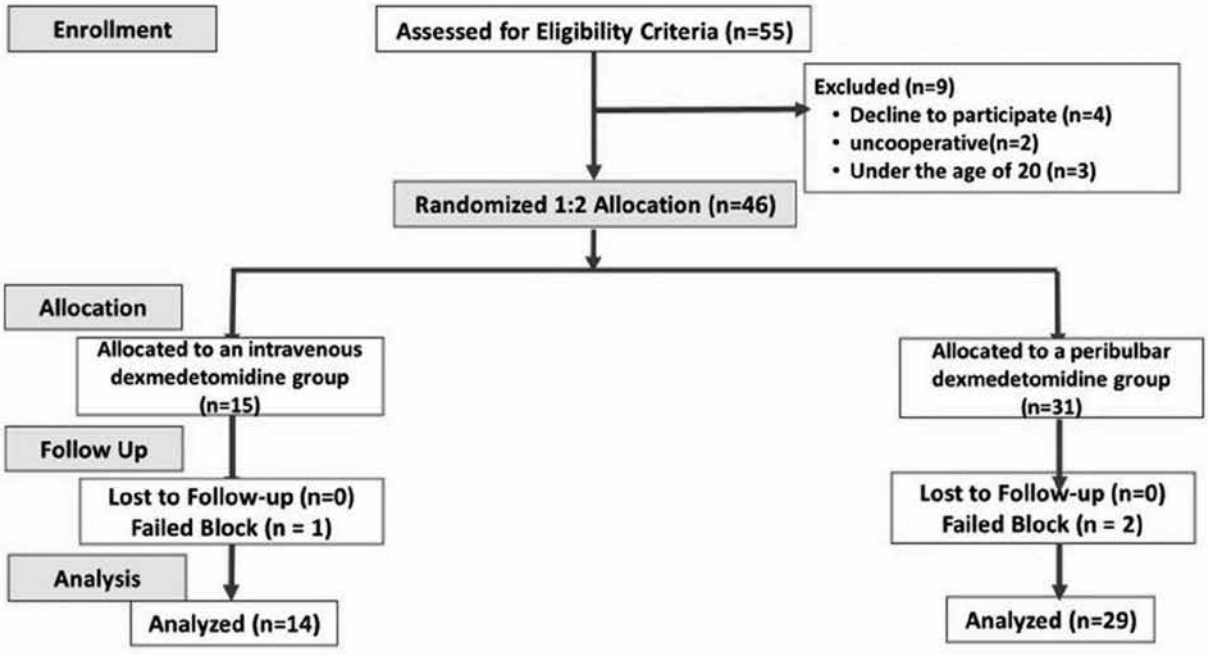

Fig. 1. *Consolidated Standards of Reporting Trials (CONSORT) flow chart.*

The duration of postoperative analgesia was significantly longer in the peribulbar dexmedetomidine group by 3.2 hours compared with the intravenous dexmedetomidine group, as shown by the Kaplan-Meier curve with a log-rank *P* value < 0.001 (Fig. 2). Postoperative pain scores were lower in the peribulbar dexmedetomidine group (0.97 ± 0.1, 2.38 ± 0.5, and 3.10 ± 0.3) compared to the intravenous dexmedetomidine group (1.71 ± 0.5, 3.36 ± 0.5, and 4.01 ± 0.4) at 3, 4, and 6 hours postsurgery (*P* = 0.038, 0.041, and 0.033, respectively) (Fig. 3).

Sensory block onset time, duration, and motor block onset time were comparable between the study groups with no statistically significant differences. However, the duration of the motor block was significantly longer in the peribulbar dexmedetomidine group compared with the intravenous dexmedetomidine group (*P* = 0.001). Time to the first request for postoperative analgesia when the NRS-11 score was ≥ 3 was prolonged (*P* = 0.048) in the peribulbar dexmedetomidine group than in the intravenous dexmedetomidine group (Table 2).

There was no significant difference in heart rate or mean arterial pressure between the intravenous

Table 1. *Baseline patient characteristics and surgical data.*

	Intravenous Dexmedetomidine (n = 14)	Peribulbar Dexmedetomidine (n = 29)	*P* Value
Age (Mean ± SD)	34.93 ± 10.3	36.01 ± 11.6	= 0.772
Gender			
Men	9 (64.3%)	17 (58.6%)	= 0.705
Women	5 (35.7%)	12 (41.4%)	
Anthropometrics			
Weight (kg)	81.75 ± 4.9	79.95 ± 6.7	= 0.374
BMI	27.69 ± 1.8	27.23 ± 2.3	= 0.528
ASA			
ASA I	11 (78.6%)	26 (89.7%)	= 0.773
ASA II	3 (21.4%)	3 (10.3%)	
Length of surgery (min)			
	38.01 ± 8.3	55.86 ± 11.9	< 0.001

Continuous variables are presented as mean ± SD. Categorical variables are presented as numbers (%). BMI, body mass index (kg/m^2); ASA, American Society of Anesthesiologists Physical Status Classification System

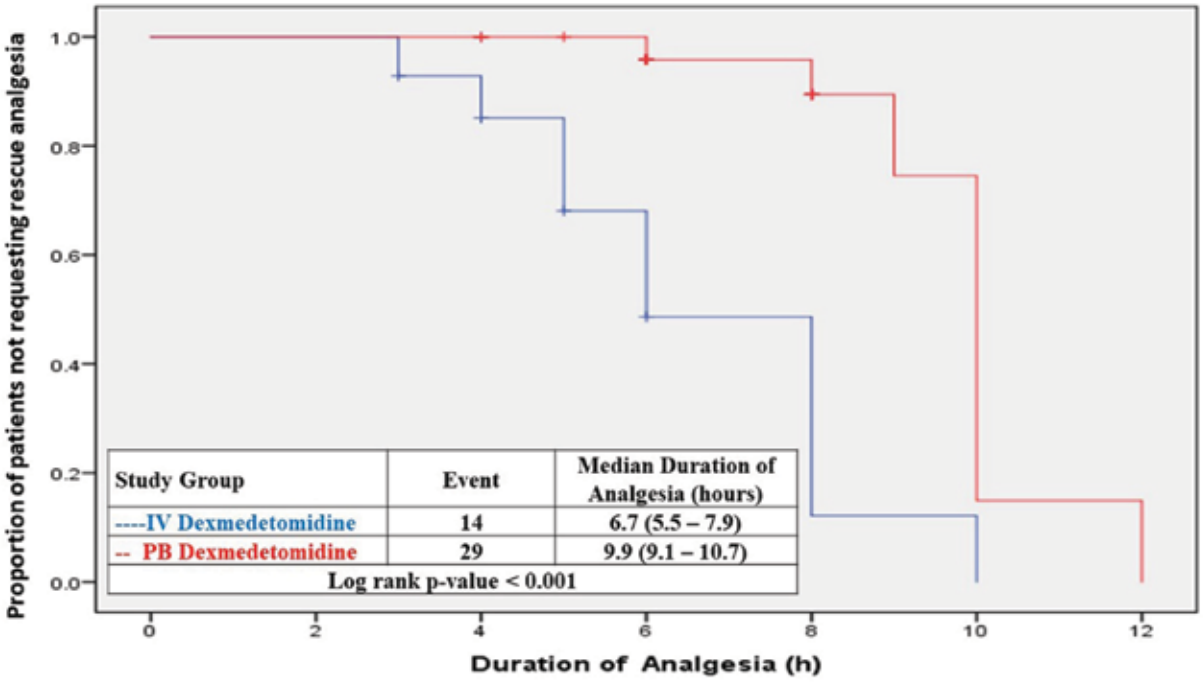

Fig. 2. *Kaplan–Meier curve explores differences in the duration of analgesia among the study groups. Log-rank test P < 0.001.*

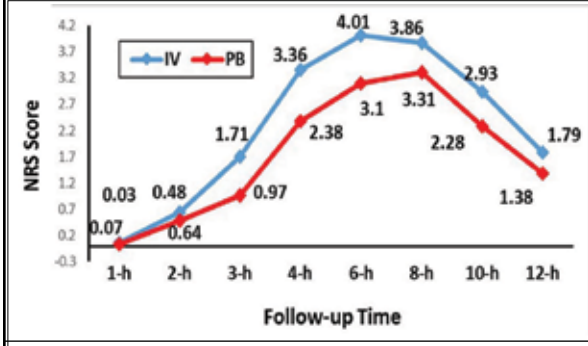

Fig. 3. *Comparison of NRS-11 scores between the study groups.*

Table 2. *Peribulbar block characteristics and incidence of satisfaction.*

(Mean ± SD)	Intravenous Dexmedetomidine (n = 14)	Peribulbar Dexmedetomidine (n = 29)	*P* Value
Sensory Block Onset Time (min)			
	1.21 ± 0.4	1.26 ± 0.7	= 0.843
Sensory Block Duration (min)			
	125.57 ± 16.7	139.97 ± 19.6	= 0.187
Motor Block Onset Time (min)			
	2.79 ± 1.2	2.97 ± 1.4	= 0.686
Motor Block Duration (min)			
	148.93 ± 13.7	198.34 ± 17.3	= 0.001
Length of surgery (min)			
	38.01 ± 8.3	55.86 ± 11.9	< 0.001
Time to the first postoperative analgesia (h)			
	5.79 ± 2.1	7.17 ± 2.0	= 0.048
Patients' satisfaction			
Dissatisfied	2 (14.3%)	0 (0%)	
Neutral	4 (28.6%)	6 (20.7%)	= 0.048
Satisfied	8 (57.1%)	23 (79.3%)	
Surgeon' satisfaction			
Dissatisfied	0 (0 %)	0 (0 %)	
Neutral	4 (28.6%)	1 (3.4%)	= 0.016
Satisfied	10 (71.4%)	28 (96.6%)	

Continuous variables are presented as mean ± SD, Categorical variables are presented as numbers (%)

and peribulbar dexmedetomidine groups from baseline until the end of the surgery. The intravenous dexmedetomidine group demonstrated a significant (P = 0.002) steady decline in heart rate and mean arterial pressure from baseline to surgery completion. Likewise, mean arterial pressure in the peribulbar dexmedetomidine group decreased significantly (P < 0.001) from baseline to operation completion (Figs. 4 and 5).

Mean Ramsay Sedation Scale scores in the intravenous dexmedetomidine group were higher at 15, 30, 45, 60 minutes, and 2 hours post drug infusion (P = 0.006, 0.003, 0.001, 0.001, and 0.035, respectively) than in the peribulbar dexmedetomidine group. The mean Ramsay Sedation Scale scores dropped significantly with time in both study groups until the end of the trial; this was more evident in the intravenous dexmedetomidine group (P < 0.001) (Table 3).

Patient and surgeon satisfaction scores were higher in the peribulbar dexmedetomidine group (P = 0.048 for patients, P = 0.016 for surgeons) compared with the intravenous dexmedetomidine group. During the study, we had no instances of hemodynamic instability, desaturation, or other adverse effects such as nausea and vomiting.

Discussion

In the context of multimodal analgesia, we studied the efficacy of intravenous dexmedetomidine versus peribulbar dexmedetomidine as an adjuvant to local anesthetics in strabismus surgery. We found that peribulbar dexmedetomidine increases analgesic duration, motor block duration, and patient and surgeon satisfaction.

Intravenous dexmedetomidine has been associated with significant sedation and a shorter surgery duration. Our findings are generally in line with a recent systematic review that confirmed perineural dexmedetomidine is superior to intravenous dexmedetomidine as a peripheral nerve block adjunct. Perineural dexmedetomidine was shown to produce longer durations and a faster onset of sensory and motor block in the majority of trials (10).

Marhofer, et al (11) used 20 µg dexmedetomidine as a perineural and systemic adjunct to ropivacaine for ultrasound-guided ulnar nerve block in human volunteers. They reported that perineural dexmedetomidine enhanced block duration by 60%, whereas intravenous dexmedetomidine increased block duration by 10% when compared to the control group. Most previous research has found that perineural dexmedetomidine prolongs peripheral nerve block without demonstrating any neurotoxicity (4,12). However, only a few studies have documented results with peribulbar block (13).

Our clinical trial is the first to investigate how different routes of dexmedetomidine administration as an adjuvant to local anesthetics affect the peribulbar

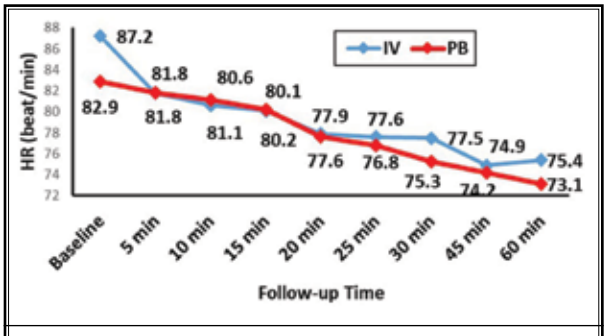

Fig. 4. *Comparison of heart rate between the study groups.*

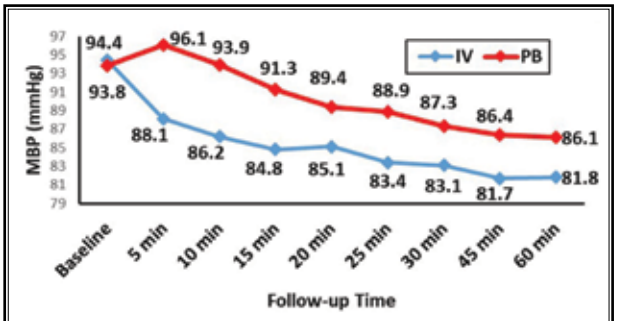

Fig. 5. *Comparison of mean arterial blood pressure between the study groups.*

block characteristics in adults having strabismus surgery. We observed that peribulbar dexmedetomidine provided significantly longer postoperative analgesia than intravenous dexmedetomidine. Patients in our study who received peribulbar dexmedetomidine had lower postoperative pain levels and a longer delay to the first request for postoperative analgesia than those who received intravenous dexmedetomidine. Previous studies reported that when dexmedetomidine was added to the local anesthetic mixture for peribulbar block, the time to rescue analgesia was significantly longer than when the anesthetic mixture was used alone (14). The effects of dexmedetomidine on neural activity extend beyond its interactions with α-2 adrenergic receptors. Dexmedetomidine produces analgesia centrally by inhibiting substance P release in the nociceptive pathway at the dorsal root neuron level (11). Peripherally, dexmedetomidine modulates neuronal activity and prolongs analgesia by inhibiting potassium and sodium currents as well as blocking the hyperpolarization-activated cation currents (Ih current) (15,16).

According to a recent meta-analysis (17) of 39 trials investigating the efficacy of adjuvants in ocular regional anesthesia, dexmedetomidine had a 41% increase in analgesic duration, equal to a 40–100 minute absolute increase. Channabasappa, et al (6) demonstrated that 50 µg dexmedetomidine added to local anesthetics decreases the onset of corneal anesthesia and globe akinesia while increasing block duration and postoperative analgesia in patients receiving peribulbar anesthesia for cataract surgery. Furthermore, adding 25 µg dexmedetomidine to the peribulbar local anesthetic mixture significantly prolonged the duration of globe analgesia 260 minutes (178–284 minutes) compared to the control group 179 minutes (107–197 minutes) in vitreoretinal procedures (18).

Table 3. *Ramsay Sedation Scale scores in the study groups.*

(Mean ± SD)	Intravenous Dexmedetomidine (n = 14)	Peribulbar Dexmedetomidine (n = 29)	*P* Value*
15 min	2.79 ± 0.7	2.28 ± 0.6	= 0.006
30 min	2.71 ± 0.6	2.21 ± 0.4	= 0.003
45 min	2.71 ± 0.6	1.97 ± 0.2	= 0.001
60 min	2.57 ± 0.5	2.03 ± 0.2	= 0.001
2 h	1.93 ± 0.3	1.62 ± 0.5	= 0.035
4 h	1.86 ± 0.4	1.86 ± 0.4	= 0.996
6 h	1.86 ± 0.4	1.69 ± 0.5	= 0.503
8 h	1.57 ± 0.5	1.55 ± 0.5	= 0.775
10 h	1.57 ± 0.5	1.55 ± 0.5	= 0.775
12 h	1.50 ± 0.4	1.63 ± 0.3	= 0.503
P-value**	= 0.003	= 0.034	*P*<0.001#

Continuous variables are presented as mean ± SD. Categorical variables are presented as numbers (%).SD, standard deviation. *comparison between groups, **comparison within a group, #interaction between group and time

In contrast to previous findings, our study groups showed comparable block onset times and sensory block durations, which could be attributed to the study not being sufficiently powered to detect significant differences in block onset timings and durations. However, the motor block duration was longer in the peribulbar dexmedetomidine group. Eldeen, et al (19) showed that adding clonidine to local anesthetics prolonged peribulbar anesthesia post cataract surgery, even though there was no significant difference in sensory and motor block onset time in their trial.

In line with our results, Abdelhamid, et al (5) found that adding dexmedetomidine to local anesthetics in a peribulbar block for cataract surgery significantly increased the duration of the motor block (282.4 ± 39 minutes, $P < 0.001$) when compared to an intravenous

dexmedetomidine infusion (213.1 ± 41.2 minutes) and the control (180.1 ± 22.6 minutes) groups. Furthermore, Hafez, et al (18) showed that adding 25 µg dexmedetomidine to the peribulbar local anesthetic mixture lengthened the duration of globe akinesia ($P > 0.05$) compared to the control group.

Significant sedation and higher Ramsay Sedation Scale scores have been observed with intravenous dexmedetomidine infusion during peribulbar block for cataract surgery compared to dexmedetomidine added to the local anesthetic mixture (5). These findings are consistent with the results of this study, which reported that the intravenous dexmedetomidine group had higher Ramsay Sedation Scale scores than the peribulbar dexmedetomidine group up to 2 hours postinfusion. Moreover, previous studies found that adding 25 µg or 50 µg of dexmedetomidine to the local anesthetic mixture for peribulbar anesthesia resulted in more sedation than the control group within the first 60 minutes of injection (6,14,20). The sedative effect of dexmedetomidine is due to the selective activation of the α-2 adrenoceptor in the pons locus coeruleus, which results in a dose-dependent reduction of norepinephrine release (21).

Strabismus surgery duration was shorter in the intravenous dexmedetomidine group than in the peribulbar dexmedetomidine group, possibly because of increased sedative levels in these patients, allowing them to participate properly during surgery. Intravenous dexmedetomidine displayed a significantly lower heart rate than peribulbar dexmedetomidine (5). In contrast, our findings revealed no significant difference in heart rate from baseline to the end of the procedure between the intravenous and peribulbar dexmedetomidine groups. This could be explained by the different dexmedetomidine doses and infusion times used in the 2 studies. We identified a failed block in 2 patients in the peribulbar group and one in the intravenous group who required general anesthesia. We potentially considered a higher failure risk in the peribulbar group.

Our study has some limitations. First, it is a single-center, small sample-size study limited to adult patients having strabismus surgery. Second, the study was not adequately powered to identify statistical differences in sensory and motor block onset and durations. Third, the Ramsay Sedation Scale was used to assess sedation levels rather than bi-spectral index monitoring, which yielded more objective values.

Conclusions

Peribulbar dexmedetomidine is more beneficial than intravenous dexmedetomidine as an adjuvant to local anesthetics in peribulbar anesthesia for strabismus surgery. Peribulbar dexmedetomidine prolongs postoperative analgesia and motor block durations and improves patient and surgeon satisfaction. However, in our study the intravenous group had significantly shorter surgical times.

References

1. Chua AWY, Chua MJ, Leung H, Kam PCA. Anaesthetic considerations for strabismus surgery in children and adults. *Anaesth Intensive Care* 2020; 48:277-288.
2. Palte HD, Cavuoto KM, Sundararaman L, Gayer S, Schiffman J, Capo H. The quest for effective pain control during suture adjustment after strabismus surgery: A study evaluating supplementation of 2% lidocaine with 0.4% ropivacaine. *J Pain Res* 2015; 8:33-37.
3. Vagge A, Simonetti F, Marenco M, Burtolo C, Musolino M, Traverso CE. Peribulbar anesthesia for strabismus surgery in adult patients. *Eur J Ophthalmol* 2021; 31:3367-3371.
4. Vorobeichik L, Brull R, Abdallah FW. Evidence basis for using perineural dexmedetomidine to enhance the quality of brachial plexus nerve blocks: A systematic review and meta-analysis of randomized controlled trials. *Br J Anaesth* 2017; 118:167-181.
5. Abdelhamid A, Mahmoud AAA, Abdelhaq M, Yasin H, Bayoumi ASM. Dexmedetomidine as an additive to local anesthetics compared with intravenous dexmedetomidine in peribulbar block for cataract surgery. *Saudi J Anaesth* 2016; 10:50-54.
6. Channabasappa S, Shetty V, Dharmappa S, Sarma J. Efficacy and safety of dexmedetomidine as an additive to local anesthetics in peribulbar block for cataract surgery. *Anesth Essays Res* 2013; 7:39.
7. Sarvela PJ. Comparison of regional ophthalmic anesthesia produced by pH-adjusted 0.75% and 0.5% bupivacaine and 1% and 1.5% etidocaine, all with hyaluronidase. *Anesth Analg* 1993; 77:131-134.
8. Ramsay MAE, Savege TM, Simpson BRJ, Goodwin R. Controlled sedation with alphaxalone-alphadolone. *Br Med J* 1974; 2:656-659.
9. Franz F, Erdfelder E, Lang A-G,Buchner A. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods* 2007; 39:175-191.
10. Hussain N, Brummett CM, Brull R, et al. Efficacy of perineural versus intravenous dexmedetomidine as a peripheral nerve block adjunct: A systematic review. *Reg Anesth Pain Med* 2021; 46:704-712.
11. Marhofer D, Kettner SC, Marhofer P, Pils S, Weber M, Zeitlinger M. Dexmedetomidine as an adjuvant to ropivacaine prolongs peripheral nerve block: A volunteer study. *Br J Anaesth* 2013; 110:438-442.
12. Brummet CM, Norat MA, Palmisano JM, Lydic R. Perineural administration

of dexmedetomidine in combination with bupivacaine enhances sensory and motor blockade in sciatic nerve block without inducing neurotoxicity in rat. *Anesthesiology* 2008; 109:502-511.

13. Gujral GS, Agarwal M, Gautam P, Shrivastav A, Singh S. Evaluation of the effect and safety of dexmedetomidine as an additive to local anesthesia in peribulbar block for vitreoretinal surgery. *Indian J Ophthalmol* 2019; 67:636-640.
14. El-Ozairy H, Tharwat A. Comparative study of the effect of adding two different doses of dexmedetomidine to levobupivacaine/hyaluronidase mixture on the peribulbar block in vitreoretinal surgery. *Ain-Shams J Anaesthesiol* 2014; 7:393.
15. Chen BS, Peng H, Wu SN. Dexmedetomidine, an α2-adrenergic agonist, inhibits neuronal delayed-rectifier potassium current and sodium current. *Br J Anaesth* 2009; 103:244-254.
16. Brummett CM, Hong EK, Janda AM, Amodeo FS, Lydic R. Perineural dexmedetomidine added to ropivacaine for sciatic nerve block in rats prolongs the duration of analgesia by blocking the hyperpolarization- activated cation current. *Anesthesiology* 2011; 115:836-843.
17. Bodenbender JP, Eberhart L, Paul C, et al. Efficacy of adjuvants in ophthalmic regional anesthesia: A systematic review and network meta-analysis. *Am J Ophthalmol* 2023; 252:26-44.
18. Hafez M, Fahim MR, Abdelhamid MHE, Youssef MMI, Salem AS. The effect of adding dexmedetomidine to local anesthetic mixture for peribulbar block in vitreoretinal surgeries. *Egypt J Anaesth* 2016; 32:573-579.
19. Eldeen HM, Faheem MR, Sameer D, Shouman A. Use of clonidine in peribulbar block in patients undergoing cataract surgery. *Aust J Basic Appl Sci* 2011; 5:247-250.
20. Bakr RH, Abdelaziz HMM. Rocuronium versus dexmedetomidine as an adjuvant to local anesthetics in peribulbar block: A double blind randomized placebo controlled study. *Egypt J Anaesth* 2017; 33:221-226.
21. Scott-Warren VL, Sebastian J. Dexmedetomidine: Its use in intensive care medicine and anaesthesia. *BJA Educ* 2016; 16:242-246.