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ORIGINAL ARTICLE

Dexmedetomidine and Peribulbar Anesthesia Adult Strabismus Surgery

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ABSTRACT

Background: Enhancing the features of the local anesthesia by us Dexmedetomidine in peribulbar anesthesia for strabismus surgery. **Aim** evaluate the effect of dexmedetomidine addition to peribulbar anesthesi strabismus surgeries in adult. **Methods:** A randomized controlled s included 58 patients who were divided into two groups, Group I: include patients who received peribulbar block by mixture of local anesthetics and Group II: included 29 patients who received peribulbar block addition of dexmedetomidine to local anesthetics. All cases under preoperative full ophthalmic examination. Onset and duration of sensory motor block, hemodynamic parameters, sedation level and duratio analgesia were assessed. **Results:** The onset of sensory and motor block shortened (p =0.021 and <0.001 respectively) and their duration prolonged (p <0.001) and duration of postoperative analgesia significantly extended in dexmedetomidine group (p <0.(Dexmedetomidine group achieved higher sedation scores and lower intra early postoperative pain score (p 0.001 and <0.001 respectively) with hi levels of patient and surgeon satisfaction. **Conclusion:** The additio dexmedetomidine with the local anesthetic mixture for peribulbar anesthes strabismus surgeries accelerates onset of anesthesia and akinesia of the g and prolongs their duration.

Keywords: Transcesarean, Dexmedetomidine, strabismus, anesthesia, peribulbar, local anesthesia

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INTRODUCTION

General anesthesia (GA) remains the most common anesthetic technique used in strabismus surgery as it is suitable for patients of all ages, complicated or repeated surgery and bilateral eye procedures. Recently, regional ophthalmic block can be used as the main anesthetic technique as it is economic, feasible with low risk**.** Other benefits of ocular regional block over GA include postoperative analgesia, decreased post-operative nausea and vomiting, the maintenance of oxygen saturation and cardiovascular stability, and a lower incidence of oculocardiac reflex [(1,2)]**.**

While they are uncommon, complications of regional anesthesia during eye surgery can endanger the patient's vision or life. Serious risks include retrobulbar haemorrhage, optic nerve injury, brain stem anaesthesia and globe perforation [(3)].

Wide range of adjuvant drugs have been tried for their potential to accelerate the onset of sensory or motor blockade, extend their duration, or delay the absorption of the administered local anesthetic aiming to decrease the risk of local anesthetic toxicity [(4)].

Dexmedetomidine is an alpha-2 agonist that achieves its action through stimulation of both central and peripheral alpha-2 receptors. This results in inhibition of neuronal firing and prevention of release of C-fibers transmitters such as norepinephrine and therefore inhibits nerve fiber action potential. This explains the antinociceptive effects of dexmedetomidine [(5)].

Dexmedetomidine was administered successfully with the local anesthetics to prolong its duration of action in brachial plexus block, epidural anesthesia, intrathecal anesthesia as well as in peribulbar block for cataract and vitreoretinal surgery [(6-9)].

In this study the effect and safety of adding dexmedetomidine to the local anesthetic mixture for peribulbar anesthesia in strabismus surgeries in adult patients was evaluated.

PATIENTS AND METHODS:

In this randomized controlled study patients scheduled for surgical correction of strabismus. Informed consents were signed by all patients and approval for the study was obtained from the Ethical Committee (No: 620-4-22). Also, the study was in line with the Declaration of Helsinki.

Sample size was estimated using G*Power 3 software. A calculated minimum sample of 54 patients with strabismus was needed. However; to avoid missed or lost to follow up patients 58 patients were enrolled. Included patients were randomly divided by independent staff into two groups. Group I: included 29 patients who received peribulbar block using mixture of 4 ml lidocaine 2% (Xylocaine, AstraZeneca, UK) + 4 ml bupivacaine 0.5% (Marcaine, AstraZeneca, UK) + 1 ml normal saline 0.9% containing hyaluronidase 150 I.U. (Hynidase, Shreya life Sciences, Waluj – Aurangabad, India). Group II: included 29 patients who received peribulbar block by the same mixture with addition of dexmedetomidine 0.5µg/kg (Precedex, Hospira, Rocky Mount, USA).

Patients older than 18 years with American Society of Anesthesiology (ASA) grading 1 and 2 were included while those with history of allergy to amide group of local anesthetics, posterior staphyloma and uncooperative patients were excluded. All cases underwent full pre and postoperative ophthalmic examination including measurement of visual acuity, refraction, angle of deviation, assessment of ocular motility and slit lamp examination. The peribulbar block was done by the same experienced anesthesiologist. Two injections technique was used for peribulbar block in all included patients [(10)].

Perioperatively, patients were fully monitored by independent anesthesiologist for ECG changes, pulse, oxygen saturation and blood pressure. Adverse effects were recorded as bradycardia (HR <50 beats/min), oxygen desaturation ($SpaO_2$ <92%) and hypotension (decrease in baseline mean blood pressure by 20% or more). The surgeries were done by the same experienced surgeon AFG.

Onset of sensory block (time lapse between completing injection of local anesthesia till abolishment of sensation as examined by corneal reflex) was recorded. Corneal sensation was evaluated using cotton wick. Onset of motor block “globe akinesia” (time lapse between completing injection of local anesthesia till abolishment of ocular motility) was also recorded. Akinesia was assessed by testing the ocular movements in each direction of gaze.

Sensory block duration (time lapse between abolishment of sensation / corneal reflex and commencement of postoperative pain) was recorded. Duration of motor block (time lapse between abolishment of ocular motility till fully returned of ocular motility and disappearance of diplopia) was recorded.

Intraoperative and postoperative patient sedation level was assessed using modified Ramsay sedation scale (RSS). Evaluation was done using score from 1- 6 representing a range from agitation to deep sedation **(11).**

Postoperative pain was assessed by asking the patient to grade it on the verbal analogue scale (VAS) from 0 to 10 (0 = no pain and 10 = severe pain). Moreover, duration of analgesia was defined as the time interval measured from injection of local anesthetic to first analgesic request by the patient.

Degree of patient satisfaction was evaluated using scale composed of four points by asking the patients to give score of their satisfaction regarding postoperative analgesia. Quality of the operative conditions assessed by the surgeon at the end of the surgery (surgeon satisfaction) was assessed using scale composed of four points from 0 to 3 (0= not pleased, 1= moderate, 2= good and 3= very high satisfaction). Lastly, any systemic or ocular complications such as nausea, vomiting, bradycardia, hypotension, diplopia or hematoma were recorded.

The data was analyzed by SPSS (statistical package for social science) version 26.0 on IBM compatible computer (SPSS Inc., Chicago, IL, USA). The qualitative data was described as number and percentage and analyzed by using Chi square. Quantitative data were tested for normality using Shapiro-Wilks test, assuming normality at $P > 0.05$. Quantitative data was described as mean, and standard deviation, analyzed using t-test, Mann Whitney U test, and one way ANOVA test of repeated measurements. The accepted level of significance in this work was started at 0.05 ($P < 0.05$ was considered significant).

RESULTS:

The present study was performed from April 2022 to February 2023 where 58 patients scheduled for surgical correction of strabismus were randomly assigned into two groups. Group I: included 29 patients who received standard peribulbar block and group II: included 29 patients who received peribulbar block with addition of dexmedetomidine. No significant differences regarding age, sex, type or duration of strabismus surgery as well as angle of deviation were found between both groups. Demographic and surgical characteristics of studied groups are presented in table (1).

Table 1 Demographic and surgical characteristics of studied groups

		Local only (n =29)	**Local + DexMed (n=29)**	**P value**
Age (year)		33.3 ± 9.6	33.4 ± 10.5	0.990*
Gender	Male	8 (27.6 %)	9 (31 %)	0.773**
	Female	21 (72.4 %)	20 (69 %)	
Diagnosis	Exotropia	22 (75.9 %)	20 (69 %)	0.557**
	Esotropia	7 (24.1 %)	9 (31 %)	
Eye	Right	9 (31 %)	14 (48.3 %)	0.180**
	Left	20 (69 %)	15 (51.7 %)	
Type of strabismus surgery	Lateral rectus recession (LRR)	22 (45.8 %)	21 (41.2 %)	0.943**
	Medial rectus plication (MRP)	16 (33.4 %)	17 (33.3 %)	
	Lateral rectus plication (LRP)	5 (10.4 %)	7 (13.7 %)	
	Medial rectus recession (MRR)	5 (10.4 %)	6 (11.8 %)	
Pre-operative angle (Δ D)	Mean ± SD	36.0 ± 6.7	36.6 ± 7.2	0.779***
Post-operative angle (ΔD)	Mean ± SD	5.9 ± 4.1	5.0 ± 4.8	0.455***
History of previous surgery	No	24 (82.8 %)	25 (86.2 %)	0.896**
	Yes	5 (17.2 %)	4 (13.8 %)	
Duration of surgery (minutes)		40.9 ± 5.2	43.1 ± 4.9	0.103***

***Student's t test, **Chi^2 test, ***Mann–Whitney U test**

Intraoperatively, both groups showed no significant difference when pulse was monitored except at 60-minute when heart rate was found significantly higher among the local only group (P = 0.033). In general, there was significant decrease in the serial heart rate measurements within the local+dexmed group along the intraoperative monitoring period but no bradycardia (**P <0.001**) (Fig 1).

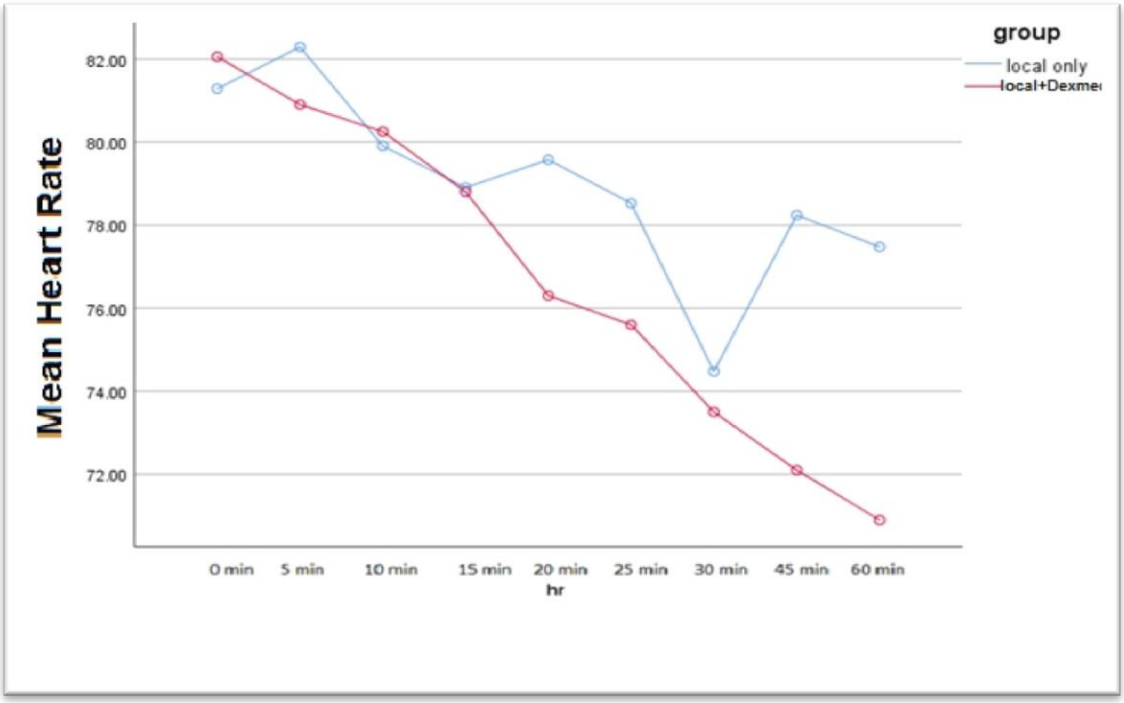

Fig. 1 Line graph displaying heart rate measurements among both groups

Comparison between both groups regarding intra-operative mean arterial pressure found that there was no significant difference between both groups. While, there was significant decrease in the serial mean arterial pressure measurement within the local+dexmed group along the intraoperative monitoring but no hypotension (P = **0.028**) (Fig 2).

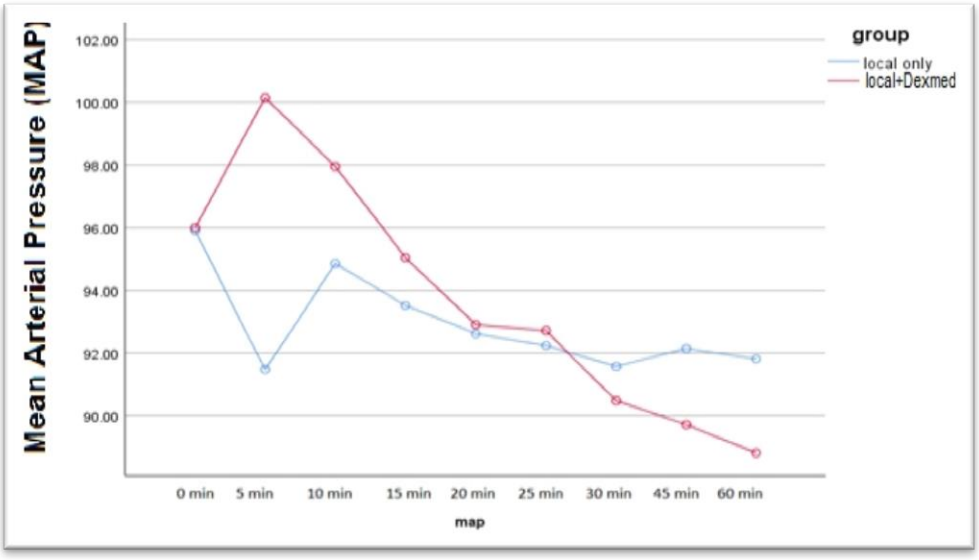

Fig. 2 Line graph displaying mean arterial pressure measurements among both groups

As regards to intra-operative O_2 saturation there was no significant difference between both groups except after 20 minutes when significant decrease in O_2 saturation was noted at 20, 25, 30, 45, and 60-minute in the local + dexmed group (p 0.036, p 0.006, p 0.004 and p <0.001 respectively) (Fig 3).

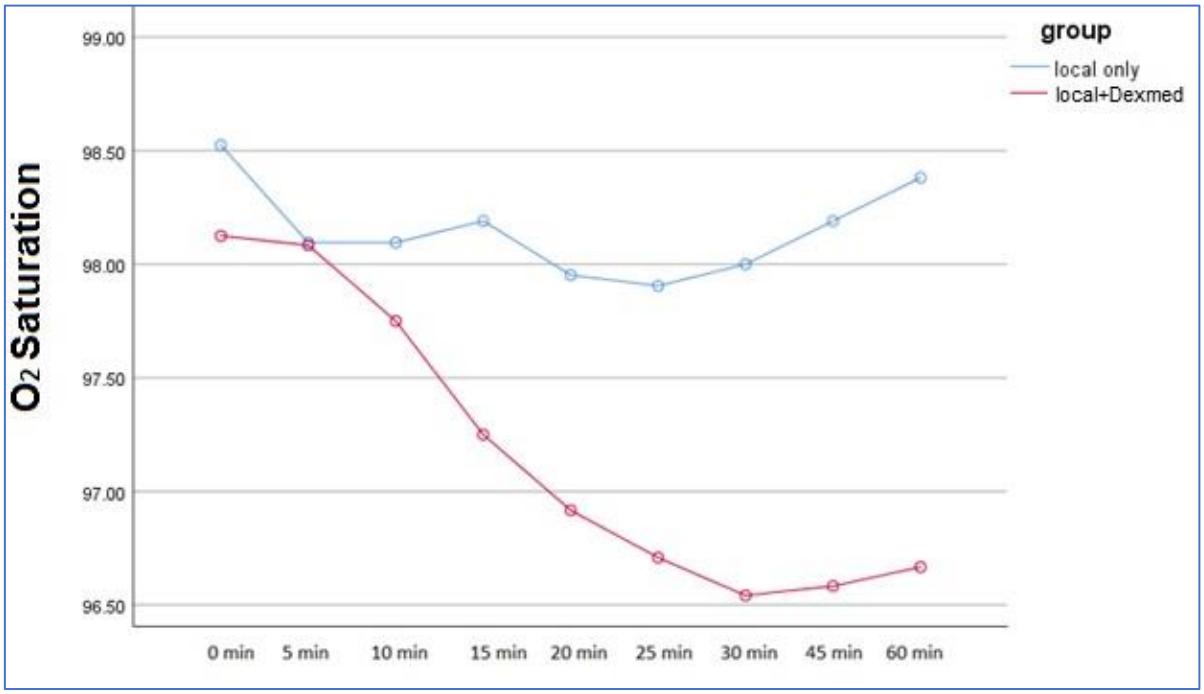

Fig. 3 Line graph displaying O_2 saturation measurements among both groups

Comparison between both groups regarding anesthetic characteristics found that the sensory block started significantly earlier and lasted longer in the local+dexMed group (p =0.021 and <0.001 respectively). Furthermore, the motor block started significantly earlier and lasted longer

in the local+dexMed group (p <0.001). In addition, the analgesia duration was significantly longer in the local+dexMed group (p <0.001) (Table 2).

Table 2 Mean anesthesia related characteristics of the studied group.

	Local only (n =29)	**Local + DexMed (n=29)**	**P value**
	Mean ± SD		
Sensory block onset time (min)	1.6 ± 0.8	1.4 ± 0.8	**0.021****
Sensory block duration (min)	100 ± 20.8	139.9 ± 16.7	**<0.001***
Motor block onset time (min)	5.8 ± 2.0	3.2 ± 1.6	**<0.001****
Motor block duration (min)	145.6 ± 19.5	195.6 ± 30.2	**<0.001***
Analgesia duration (hour)	2.9 ± 0.9	6.7 ± 1.7	**<0.001****

*Student's t test **Mann–Whitney U test

With regards to intraoperative sedation, while there was no significant difference between both groups at 15-minute, there was higher sedation score observed for local+dexmed group at 30, 45, and 60-minute of surgery as measured using Ramsay sedation score (RSS). There was a significant difference of serial intra-operative sedation level within both groups as there was increase in sedation level through the first 45 minutes intraoperative then decreased after that within the local+Dexmed group. On the other hand, gradual decrease in sedation level was noted during the intraoperative time within the local only group (Fig 4- a).

Comparison between both groups regarding sedation level using RSS found that there was increase in the sedation score within the local+Dexmed group at 2nd, 4th, 6th and 12th hour postoperatively. On the other hand, there was no significant difference between both groups at 8th and 10th hour. There was a significant difference between the serial post-operative sedation level (RSS) measurements within the both groups, as there was gradual decrease in the sedation score during the postoperative period in both groups (Fig 4- b).

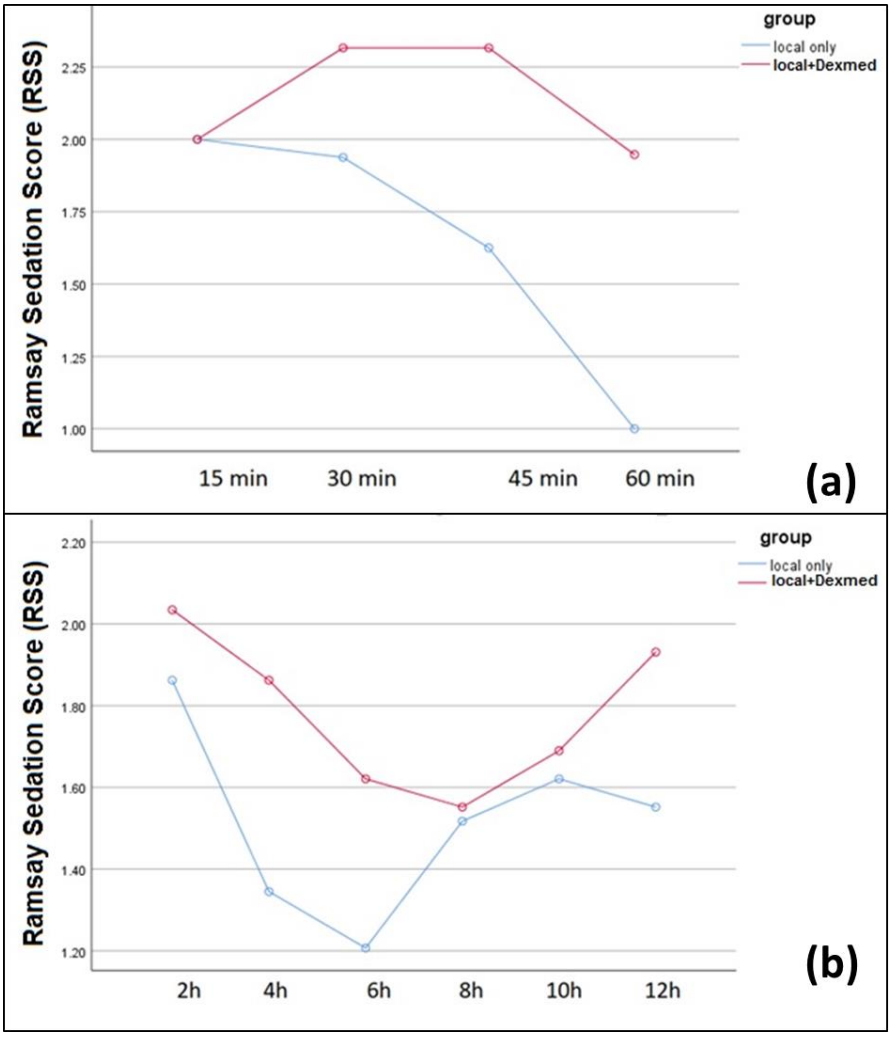

Fig. 4.a Line graph displaying RSS intra-operative measurements among both groups

4.b Line graph displaying RSS post-operative measurements among both groups

Table 3 Post-operative pain severity (VAS) measurements of the studied group

		Local only (n =29)	Local + DexMed (n=29)	P value[#]
At Baseline	No pain Mild Moderate Severe	29 (100 %) 0 0 0	29 (100 %) 0 0 0	**1.00**
Intraoperative	No pain Mild Moderate Severe	0 17 (58.6%) 12 (41.4%) 0	12 (41.4%) 15 (51.7%) 2 (6.9%) 0	**<0.001**
At 1hour	No pain Mild Moderate Severe	7 (24.1%) 22 (75.9%) 0 0	26 (89.7%) 3 (10.3%) 0 0	**<0.001**
At 3 hours	No pain Mild Moderate Severe	0 11 (37.9%) 18 (62.1%) 0	6 (20.7%) 23 (79.3%) 0 0	**<0.001**
At 6 hours	No pain Mild Moderate Severe	0 22 (75.9%) 7 (24.1%) 0	3 (10.4%) 17 (58.6%) 9 (31%) 0	**0.143**
At 8 hours	No pain Mild Moderate Severe	0 27 (93.1%) 2 (6.9%) 0	0 17 (58.6%) 12 (41.4%) 0	**0.002**
At 12 hours	No pain Mild Moderate Severe	5 (17.2%) 20 (69%) 4 (13.8%) 0	10 (34.5%) 17 (58.6%) 2 (6.9%) 0	**0.276**

 # Chi^2 test

Regarding post-operative pain assessment using verbal analogue score (VAS) no patient reported severe pain in both study groups during intraoperative period. During first four hours postoperatively local+dexmed group reported significantly higher number of patients with no pain and less number of patients with moderate pain with significantly lower pain score (p <0.001). During the period of 6-8 hours postoperatively, the local only group revealed lower pain scores compared to local+dexmed group (p 0.143 and 0.002 respectively) and this was coincide with administration of analgesics to that group after four hours. At 12 hour postoperatively

local+dexmed group again showed non-significant lower pain score compared to local only group (p 0.276) (table 3, Fig 5).

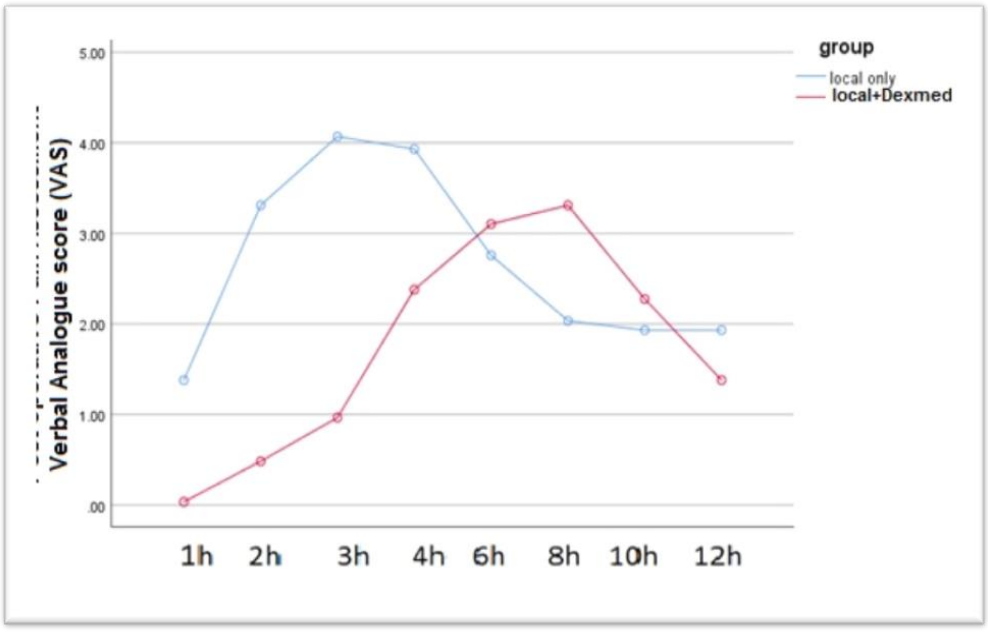

Fig. 5 Line graph displaying post-operative pain assessment, (VAS), among both groups

Comparison between both groups concerning patient and surgeon satisfaction found that there was significant higher levels of satisfaction among patients and surgeons in local + DexMed group (p <001).

None of the patients in both groups developed post-operative anesthetic complications such as nausea, vomiting, bradycardia, hypoxemia, or hypotension. Also no serious postoperative ocular complications were developed.

DISCUSSION:

Regional block is as an ideal anesthetic technique for ophthalmic surgeries. Reduction of anesthetic risk, suitability for elderly patients, preference for day surgery as well as decreased incidence of postoperative nausea and vomiting are among its advantages [(12)]. Various additives were added to local anesthetics to shorten the onset and prolong the duration of action with limited success [(13)].

The current study was concerned with evaluation the effect of adding dexmedetomidine to the local anesthetic mixture for peribulbar anesthesia in adult strabismus surgeries. As reported by other investigators studying effect of dexmedetomidine addition in ocular surgeries, no significant differences between the two studied groups regarding demographic or anesthesia related characteristics of the included patients [(14,15)].

The current study found no significant differences between the two study groups regarding heart rate (HR) or mean arterial blood pressure (MAP) measurements. Although compared to baseline, dexmedetomidine group showed more significant reduction of HR and MAP than local anesthetic group after 60 minutes. No bradycardia or hypotension was encountered.

Hafez et al reported that regarding the hemodynamic monitoring (the mean HR and MAP), there was no significant difference within all groups through their study or when comparing the dexmedetomidine groups to the control group **(16).** Other investigators assessed the effect of local versus intravenous dexmedetomidine as an additive to peribulbar anesthesia for cataract surgery. They reported significant decrease in heart rate in group of local mixture and IV dexmedetomidine during the time of infusion, while there was no significant change in MAP among the study groups **(8).**

No significant difference between study groups regarding O_2 saturation was found during the first quarter. While reduced levels were found in dexmedetomidine group from the second to fourth quarter of an hour. Compared to baseline, dexmedetomidine group showed more significant reduction of O_2 saturation than local anesthetic group after 60 minutes. This was in contrast to reports suggesting that comparable SPO_2 readings in dexmedetomidine and control groups **(17)**.

In the present study sensory and motor block started significantly earlier and persisted longer. In addition, duration of analgesia was prolonged in dexmedetomidine group. These results were compatible with **El-Ozairy and Tharwat** who examined the effect of adding two different doses of dexmedetomidine to levobupivacaine in peribulbar anesthesia and found that dexmedetomidine accelerated onset of sensory and motor block **(18)**. Other investigators also agree with these results. They found that administration of dexmedetomidine accelerated the onset of the peribulbar anesthesia, prolonged its duration and prolonged postoperative analgesia particularly when 50µg dose was used **(7)**.

Adding dexmedetomidine to local anesthetic was also found to significantly accelerate the onset of sensory block and onset of globe and lid akinesia. Moreover the duration of globe akinesia, lid akinesia, and analgesic duration were prolonged significantly in comparison to control group **(19).** On comparison of effect of three different doses of dexmedetomidine added to peribulbar anesthesia in vitreoretinal surgeries, investigators found that the dose of 25µg dexmedetomidine accelerated the onset of sensory and motor block, prolonged akinesia, prolonged postoperative analgesia, and reduced IOP in a statistically significant way **(16)**.

After 15 minutes of starting surgery, the mean sedation score was higher in the dexmedetomidine group while local only group revealed decrease in sedation level along the operative time.

Similar results were obtained by other studies where there was a statistically significant increase in the level of sedation in the dexmedetomidine group compared to the control group after 30 minutes from the peribulbar block **[20]**. Moreover **Gujral et al.** assessed the effect of dexmedetomidine as an additive to local anesthesia in peribulbar block for vitreoretinal surgery and found that the mean sedation score was higher in the group of local anesthetic mixture and dexmedetomidine **(9).** On the other hand, it was found that dexmedetomidine 50µg as an adjuvant to the local anesthetic accelerated onset of anesthesia and akinesia with extention of their duration without producing sedative effects which appeared in the intravenous group **(8).**

In the current study higher sedation levels were found in dexmedetomidine group compared to local only group among which gradual decrease in the sedation score period was noted during the postoperative period. Similar results were obtained by **Ahmed et al** who found dexmedetomidine to display substantially higher levels of sedation during the postoperative period [(20)].

In the present study duration for analgesia was extended in dexmedetomidine group compared to local only group as indicated by delayed first analgesia request. In agreement with this it was found that dexmedetomidine addition to ropivacaine in the retrobulbar block had increased its efficacy and extends its duration with lower VAS scores and analgesic requirements for vitreoretinal surgery in children [(21)]. Moreover, other investigators found that the time to first rescue analgesia in patients receive additional 25µg and 50µg dexmedetomidine was significantly prolonged in comparison with those in control group [(18)].

The current findings revealed that patient and surgeon satisfaction were significantly higher in dexmedetomidine group. This was in accordance with other studies that reported higher level of satisfaction for surgeons as well as of patients receiving additional dexmedetomidine in comparison to the control group. Patients and surgeon satisfaction were found to rise with increase the dose of dexmedetomidine [(16,19)].

None of the patients in both study groups developed serious perioperative or anesthetic complications such as nausea, vomiting, bradycardia, hypoxemia or hypotension. Comparable results were demonstrated by other investigators [(19,22)]. On the other hand, some investigators reported addition of dexmedetomidine to peribulbar block to induce bradycardia within 20% of the preanesthetic value. Others reported occurrence of hypotension with brachial plexus block [(23-25)].

Strabismus surgery under regional anesthesia needs patient cooperation that nearly restricts this procedure almost for adult patients. It is typically unilateral surgery as bilateral surgical procedure under local anesthesia could be cumbersome.

In conclusion, supplemental use of dexmedetomidine with the local anesthetic mixture for peribulbar anesthesia in strabismus surgeries accelerates onset of anesthesia and akinesia of the globe and prolongs their duration. It extends the time to first analgesic request and enhances the satisfaction of both patients and surgeons.

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