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Effect of dexmedetomidine versus fentanyl on recovery responses to tracheal extubation in vitrectomy, randomized, controlled trial

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Abstract

Background: Our study was to compare the effects of fentanyl 1 mcg/kg IV and dexmedetomidine 0.5 mcg/kg IV as single bolus doses on the IOP, quality of extubation, hemodynamic responses during extubation, postoperative sedation, postoperative pain, and complications.

Methods: Sixty patients were recruited randomly into three groups. 5 min before extubation, Group (I): received IV 10 ml of normal saline. Group (II): received fentanyl 1 mcg/kg IV in 10 ml of normal saline. Group (III): received 0.5 mcg/kg dexmedetomidine IV in 10 ml of normal saline. Our primary outcome was the intraocular pressure; our secondary outcomes were hemodynamic, extubation quality, extubation and recovery duration, postoperative pain, postoperative sedation, and complications.

Results: The dexmedetomidine group IOP upon extubation was shown to be more stable than the fentanyl group. The preoperative and at the end of the operation hemodynamics measured in the three groups did not show any appreciable changes. However, we found that patients receiving dexmedetomidine saw much smaller increases in HR, and MBP following medication administration compared to patients receiving fentanyl, and both groups also experienced significantly lower increases than the control group. Dexmedetomidine considerably improved extubation quality compared to fentanyl, and both groups were significantly better than the control group. The dexmedetomidine group had considerably shorter extubation times than the other two groups.

Conclusion: In contrary to fentanyl 1 mcg/kg IV, dexmedetomidine 0.5 mcg/kg given IV 5 minutes before extubation stabilizes IOP, and hemodynamic responses to extubation, and promotes smooth extubation without extending recovery time or increasing postoperative complications.

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1. Introduction

Tracheal extubation is a critical phase in the process of the emergence of general anesthesia. Reflex sympathetic activity, which is triggered by stimulation of the epipharyngeal and laryngopharyngeal structures, causes extubating problems such as coughing, agitation, bronchospasm, tachycardia, hypertension, arrhythmias, myocardial ischemia, increased intracranial and intraocular pressure (IOP). These problems are short but significant, which healthy individuals can tolerate, but they can be hazardous for those with intracranial disorders, hypertension, or coronary artery disease [1].

The lack of straining, movement, coughing or laryngospasm is necessary for smooth extubation. Numerous medications, such as magnesium sulfate, lidocaine, opioids, esmolol, calcium channel blockers, and propofol, have been shown to attenuate these responses but they have drawbacks and adverse effects [1,2]. Dexmedetomidine, an agonist of the Alpha 2-adrenoreceptor with a distribution half-life of around 6 minutes, has been effectively utilized to reduce the stress reaction to laryngoscopy [3,4].

Dexmedetomidine is a highly selective alpha 2-Adrenergic receptor agonist with an alpha 2 to alpha 1 ratio (1620:1 compared to 220:1 for clonidine). It has hemodynamic stabilizing, sedative, analgesic, perioperative sympatholytic, and anesthetic-sparing effects without respiratory depression [5].

Reduced salivation, enhanced glomerular filtration, reduced IOP and lowered shivering threshold are some other advantages of Dexmedetomidine [6].

Dexmedetomidine has been demonstrated to lessen the likelihood of developing agitation when given following induction [7]. Additionally, in ophthalmic and vascular procedures, it has been shown to dose-dependently lower arterial blood pressure, heart rate, and it decreases hemodynamic and plasma catecholamine responses after intubation and extubation [3,8,9].

Fentanyl has been shown to control the sneeze reflex and decrease the incidence of coughing during and after extubating [10,11] It has also been shown that fentanyl may lessen cardiovascular responses after tracheal extubation as it significantly attenuates the hemodynamic responses to tracheal extubation due to the reduction of catecholamine release. [12,13].

In this study, we aimed to assess the effect of dexmedetomidine or fentanyl in patients undergoing ophthalmic surgery (vitrectomy). Our primary outcome was the

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IOP, which was measured on the unaffected eye when the patient was supine. Our secondary outcomes were hemodynamics, extubation quality, extubation and recovery duration, postoperative pain, postoperative sedation, and the incidence of postoperative complications.

2. Methods

Trial registration: Registration in Pan African Clinical Trial Registry (www.pactr.org) with registration number PACTR201712002752134.

This prospective, randomized, blind, controlled study was conducted from November 2013 to April 2014 at the anesthesia department of Minia University's hospital, after departmental approval.

Patients scheduled for vitrectomy, ASA I and II, both sexes, and ages ranging from 18 to 65 years were included in our research. All patients provided their written informed permission.

In this research, we excluded patients with known allergies to the used medications, patients with significant systemic diseases (e.g., ASA ≥ III), pregnant and nursing mothers, and patients who refused to participate in the research.

Computer-generated random numbers were used to split the patients into three groups, each consisting of 20 patients.

The prepared drugs were given to patients by an investigator who was blinded to the research group allocation and the nature of the medications administered. Also, the investigator who assessed the study outcomes was blinded to the study group allocation and the nature of the medications given.

The medical history was carefully taken. A general examination was performed, including a physical examination of the chest, heart, abdomen, and other systems. Standard investigations were conducted.

On arrival at the operative room, standard monitoring was established as noninvasive blood pressure, electrocardiogram, and pulse oximetry [PCI monitor (model Advisor USA)]. After the insertion of an intravenous cannula in a peripheral vein intraoperative fluids were used. Preparations for general anesthesia and resuscitation drugs were prepared.

Induction of anesthesia was done by thiopental (4–5 mg/kg) and cisatracurium (0.15 mg/kg) was used for muscle relaxation. Maintenance with isoflurane, residual neuromuscular block was antagonized with neostigmine 0.05 mg/kg and atropine 0.02 mg/kg.

Patients received a single bolus IV injection five minutes before extubation over 60 seconds of either 10 ml of normal saline as a control (control group), 1 mcg/kg of fentanyl in 10 ml of normal saline (fentanyl group), or 0.5 mcg/kg of dexmedetomidine in 10 ml of normal saline (dexmedetomidine group).

We assessed: oxygen saturation, heart rate, and mean blood pressure before induction, at the end of the operation, and 1, 3 min after drug administration, and at extubation, 1, 3, 5, and 10 min after extubation. In the supine position, the ophthalmologist assessed the IOP of the non-operative eye using Perkins tonometry 10 minutes after the induction of anesthesia (baseline), at extubation, 5, 10, and 20 minutes following extubation.

Extubation quality was assessed based on coughing immediately after extubation using a 5 points rating scale [14]: a score of 1 indicated that there was no coughing, a score of 2 indicated that there was smooth extubation (minimal coughing 1 or 2 times), a score of 3 indicated that there was moderate coughing 3 or 4 times, a score of 4 indicated severe coughing 5–10 times and straining and a score of 5 indicated that there was poor extubation (laryngospasm and coughing >10 times).

At 10, 20, and 30 minutes after extubation, the postoperative sedation was evaluated using a 6-point Ramsay sedation scale [15].

Using a visual analogue pain score (VAPS) [16], a subjective method of assessing pain. The VAPS is a straight, vertical 10-cm line, with 0 cm standing for "no pain" and 10 cm for the "worst agony". The VAPS was used to measure postoperative pain at 30 minutes, an hour, two hours, three hours, and four hours. The first dose of postoperative analgesia for patients with a VAPS score of ≥ four was administered intravenously as a nonsteroidal injection (Ketorolac 30 mg). It was recorded when the first request for analgesia was made (from the time of recovery to the first request for analgesia). A modified Aldrete score [17,18] was used to evaluate the patient's recovery. When a patient's overall score is ≥ 9, with a minimum of 2 in respiratory and oxygen saturation, and there are no postoperative problems like bleeding or vomiting, discharge from the post-anesthesia care unit is appropriate.

Any negative side effects or problems involving the airways were noted, including laryngospasm, bronchospasm, desaturation, bradycardia, hypotension, hypertension, nausea, and vomiting.

2.1. Sample size

The Epi Info application was used to determine the sample size (version 7). Each group had 20 patients after adjusting the confidence interval to a 95% level and the acceptable margin of error to 5%.

2.2. Statistical analysis

Using SPSS (Statistical Package for Social Sciences) version 20, the acquired data were coded, tabulated, and statistically examined. For numerical data, descriptive statistics were calculated using the mean and standard deviation; for categorical data, they were calculated using the number and percentage.

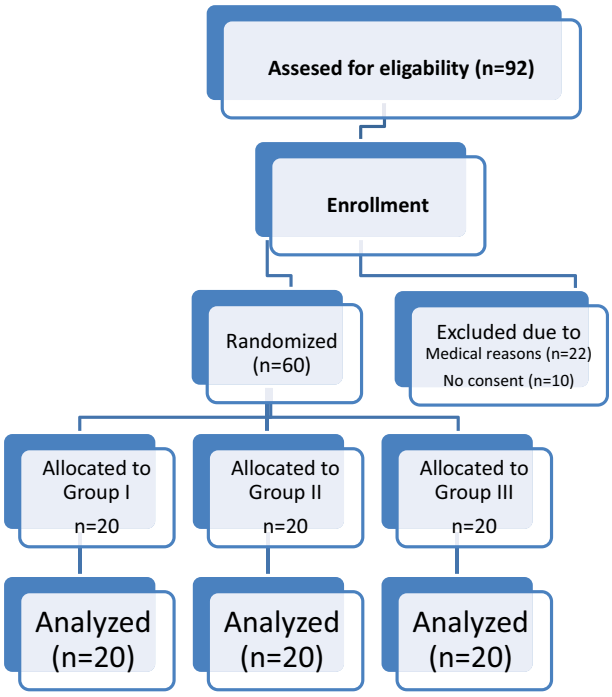

Figure 1. Flow Diagram.

The one-way ANOVA tests for quantitative variables were used to assess data that were normally distributed across the three groups. Additionally, post-hoc tests were run for every two groups, the Kruskal Wallis test was employed for data that were not normally distributed across the three groups and Mann-Whitney U tests were run for every two groups. Chi-square analysis is used to compare qualitative data between groups. P values of 0.050 or below were considered significant.

3. Results

Only 70 of the 92 patients who had been hospitalized for vitrectomy between November 2013 to April 2014 and who satisfied the inclusion criteria were given a place in the trial. Ten patients declined to take part in the investigation. So 60 participants were therefore randomly assigned to the trial (Figure 1).

As demonstrated in (Table 1), there were no significant differences in the three groups for age, sex, weight, height, ASA classification, anesthetic duration, or recovery time. But as regards the extubating time, it was much shorter in the dexmedetomidine group compared to the other two groups. There was no appreciable difference between the fentanyl group and the control group.

3.1. Intraocular pressure

The baseline IOP in the control group was 12.2 ± 1.3 mmHg, and it rose considerably at the moment of extubation, reaching 21.5 ± 2.8 mmHg. Five, ten, and twenty minutes later, it returned to the baseline, reaching 14.1 ± 2.5 mmHg.

The fentanyl group's basal IOP was 12.9 ± 1.4 mmHg. IOP increased significantly less than in the control group, reaching 15.2 ± 3.6 mmHg at the moment of extubation. Following extubation, it dropped towards the basal line, reaching 13.3 ± 3.4 mmHg, 12.9 ± 1.37 mmHg, and 12.9 ± 1.37 mmHg at 5 minutes, 10 minutes, and 20 minutes.

IOP stability was better in the dexmedetomidine group, with a baseline value of 12.9 ± 1.2 mmHg. At the time of extubation, IOP rose significantly less than in the control group, reaching 14.7 ± 2.7 mmHg. IOP then decreased toward the basal line at 5 minutes, 10 minutes, and 20 minutes after extubation, reaching 12.9 ± 1.4 mmHg, 12.8 ± 3.1 mmHg, and 12.8 ± 3.1 mmHg, respectively (Table 2).

3.2. Hemodynamic

There was no noticeable difference between the three groups for changes in HR throughout the preoperative period and during surgery (P values 0.434 and 0.322). The fentanyl and dexmedetomidine groups had substantially lower heart rates than the control group after one minute, three minutes of drug administration, at the moment of extubation, and after one minute, three minutes, five minutes, and ten minutes following

Table 1. Patient characteristics.

Variables	Group I Control group	Group II Fentanyl group	Group III Dexmedetomidine group	P value I vs II	P value I vs III	P value II vs III
Age: year	36 ± 13.73	44 ± 15.2	35.35 ± 18.21		0.166	
Sex:						
Male.	13 (65%)	10 (50%)	13 (65%)		0.535	
Female.	7 (35%)	10 (50%)	7 (35%)			
Weight: Kg	78.5 ± 7.39	80.9 ± 7.29	78.15 ± 8.72		0.486	
Height: Cm	175.25 ± 4.54	173.75 ± 13.6	172.6 ± 6.99		0.662	
ASA class:						
I.	19 (95%)	16 (80%)	17 (85%)		0.364	
II.	1 (5%)	4 (20%)	3 (15%)			
Anesthesia time	49.5 ± 11.5	51.5 ± 12.3	50.5 ± 13.6		0.879	
Recovery time	16.1 ± 2.2	16.7 ± 1.9	15.6 ± 1.6		0.199	
Extubation time	10.8 ± 1	10.8 ± 0.9	8.9 ± 1	1.000	0.001*	<0.001#

Data are expressed as means ± SD or numbers and percentages. * = statistically significant differences to the control group.
= statistically significant differences between the dexmedetomidine and the fentanyl group.

Table 2. Intraocular pressure (mmHg).

Variables	Group I Control group	Group II Fentanyl group	Group III Dexmedetomidine group	P value I vs II	P value I vs III	P value II vs III
10 min after induction	12.2 ± 1.3	12.9 ± 1.4	12.9 ± 1.2		0.150	
At extubation	21.5 ± 2.8	15.2 ± 3.6	14.7 ± 2.7	<0.001*	<0.001*	0.643
5 min after extubation	14.1 ± 2.5	13.3 ± 3.4	12.9 ± 1.4		0.362	
10 min after extubation	14.1 ± 2.5	12.9 ± 1.37	12.8 ± 3.1		0.184	
20 min after extubation	14.1 ± 2.5	12.9 ± 1.37	12.8 ± 3.1		0.184	

Data are expressed as means ± SD. * = statistically significant difference to control group.

Table 3. Heart rate (beat/min).).

Variables	Group I Control group	Group II Fentanyl group	Group III Dexmedetomidine group	P value I vs II	P value I vs III	P value II vs III
Preoperative.	99.2 ± 11.31	97.9 ± 11.7	94.2 ± 14.8		0.434	
At the end of surgery	98.5 ± 3.7	67 ± 50.3	100.2 ± 33.4		0.322	
After 1 min of administration	106.6 ± 8.4	95.4 ± 9.8	84.4 ± 16.5	0.001*	<0.001*	0.008#
After 3 min of administration	107.9 ± 8.4	94.1 ± 11.8	82.1 ± 14.9	<0.001*	<0.001*	0.003#
At extubation	114.3 ± 10.7	91.3 ± 8.9	79 ± 12.2	<0.001*	<0.001*	0.001#
After 1 min of extubation	112.1 ± 9.2	90.9 ± 10.9	75.6 ± 10.7	<0.001*	<0.001*	<0.001#
After 3 min of extubation	110.9 ± 7.4	90.5 ± 10.9	73.9 ± 9.2	<0.001*	<0.001*	<0.001#
After 5 min of extubation	107.7 ± 7.1	89.8 ± 10.1	73.1 ± 8.05	<0.001*	<0.001*	<0.001#
After 10 min of extubation	103.8 ± 7.6	90.2 ± 7.7	72.3 ± 7.9	<0.001*	<0.001*	<0.001#

Data are expressed as means ± SD. * = statistically significant differences to the control group.
= statistically significant differences between the dexmedetomidine and the fentanyl group.

Table 4. Mean arterial pressure (mmHg).

Variables	Group I Control group	Group II fentanyl group	Group III Dexmedetomidine group	P value I vs II	P value I vs III	P value II vs III
Preoperative	100.8 ± 9.6	105.8 ± 14.8	106.1 ± 12.8		0.317	
At the end of surgery	100.8 ± 9.3	91 ± 5	103.2 ± 14.9		0.374	
After 1 min of administration	101.1 ± 9.6	95.9 ± 9.4	99.9 ± 15.7		0.161	
After 3 min of administration	103.7 ± 6.9	94.6 ± 10.3	91.9 ± 13.9	0.004*	0.005*	0.626
At extubation	108.3 ± 9.2	96.6 ± 10.2	88.7 ± 9.5	<0.001*	<0.001*	0.012#
After 1 min of extubation	108.6 ± 9.8	95.7 ± 9.9	90.6 ± 10.1	<0.001*	<0.001*	0.110
After 3 min of extubation	105.1 ± 7.6	95.6 ± 10.1	86.4 ± 6.8	0.001*	<0.001*	0.001#
After 5 min of extubation	102.9 ± 8.5	97.9 ± 10.9	87.1 ± 5.8	0.218	<0.001*	0.001#
After 10 min of extubation	101.6 ± 8.2	98 ± 11.1	84.9 ± 5.6	0.202	<0.001*	<0.001#

Data are expressed as means ± SD. * = statistically significant difference to the control group.
= statistically significant differences between the dexmedetomidine and the fentanyl group.

extubation (P value 0.001). Dexmedetomidine considerably reduced the HR in comparison to the fentanyl group (P values 0.008, 0.003, 0.001) as shown in (Table 3).

As demonstrated in (Table 4), there was no statistically significant difference regarding MAP between the three groups after the surgery, one minute after the study medication was administered, or during the preoperative time.

The MAP in the fentanyl and dexmedetomidine groups significantly decreased in contrast to the control group after 3 minutes of drug administration, and 1 minute after extubation, but there was no evident difference between the fentanyl and dexmedetomidine groups.

The MAP in the fentanyl and dexmedetomidine groups was substantially reduced at the time of extubation and three minutes after extubation compared to the control group. When compared to the fentanyl group, the MAP in the dexmedetomidine group was much lower.

There was no discernible difference between the control group and the fentanyl group at 5 and 10 minutes after extubation, whereas the MAP in the dexmedetomidine group was significantly lower than that of the control group. When compared to the fentanyl group, the MAP in the dexmedetomidine group was much lower.

3.3. *Extubation quality*

The quality of extubating varied significantly across the three groups, as we saw. In the dexmedetomidine group (group III), 15% of patients had minimal coughing, while 85% of patients had no coughing and were able to be extubated without difficulty. Only 20% of patients in the fentanyl group (group II) no coughing and were smoothly extubated, compared to 40% who had minimal coughing, 35% who had moderate coughing, and 5% who had severe coughing. No patients in the control group (group I) had minimal coughing, 30% of patients displayed moderate coughing, and 30% of patients displayed severe coughing. Only 5% of patients had no coughing and could be extubated smoothly, compared to 35% of patients who had poor extubation, as seen in (Figure 2).

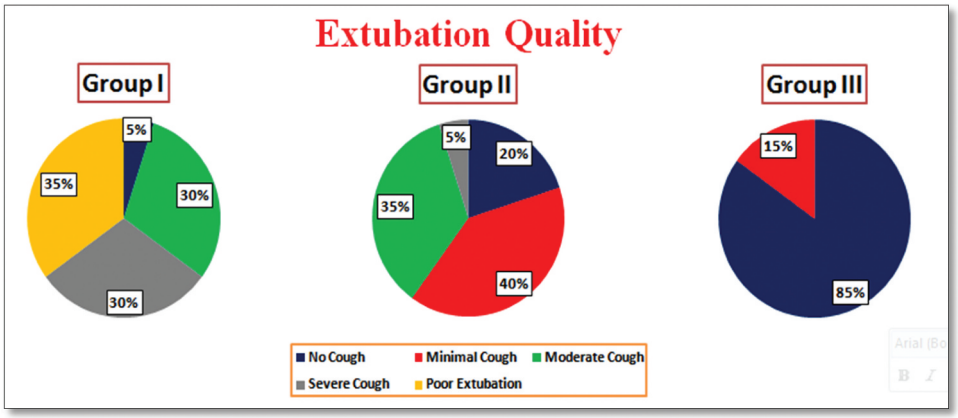

Figure 2. Extubation quality.

Table 5. Ramsay sedation score for patients.).

Ramsay sedation score (time)	Group I Control group	Group II Fentanyl group	Group III Dexmedetomidine group	P value		
10 min.	1.75 ± 1.11	3.9 ± 0.8	2.8 ± 0.5	<0.001*	<0.001*	<0.001#
20 min	1.05 ± 0.2	2 ± 0.3	2 ± 0	<0.001*	<0.001*	1.000
30 min	1.45 ± 0.6	1.55 ± 0.5	1.8 ± 0.7	0.182		

Data are expressed as means ± SD. * = statistically significant difference to the control group.
= statistically significant differences between the dexmedetomidine and the fentanyl group.

3.4. The postoperative sedation

As seen in (Table 5), the degree of sedation, as measured by the Ramsay sedation score at 10 minutes following extubation, the dexmedetomidine and fentanyl groups were better than the control group as the patients were drowsy but were responding to commands when compared to the control group in which patients were anxious and agitated with significant difference between the fentanyl and dexmedetomidine groups.

The dexmedetomidine and fentanyl groups exhibited a significant difference in the degree of sedation 20 minutes after extubation because the patients were more cooperative and oriented but still only mildly sedated when compared to the tense and agitated patients in the control group, with no significant difference between the fentanyl and dexmedetomidine groups.

The changes in the Ramsay sedation score were not significantly different across the three groups after 30 minutes.

3.5. The postoperative pain

Our study found no significant difference between the fentanyl and dexmedetomidine groups when compared to the control group as regards VAPS except at one hour following extubation (Table 6).

(1st analgesic request) the initial analgesic request took substantially longer in the fentanyl group than in the control group, 70 ± 24.5 min, and 180 ± 64.1 min, respectively. The initial analgesic request took also substantially longer in the dexmedetomidine group than in the control group 70 ± 24.5 min and 120 ± 0. The fentanyl group's first analgesic requests were much more prolonged than those of the dexmedetomidine group (Figure 3).

3.6. Postoperative recovery criteria

The Modified Aldrete score was greater in the fentanyl and dexmedetomidine groups when compared to the control group 10 minutes after extubation, and it was also higher in the dexmedetomidine group as compared

Table 6. Visual analogue pain scale.

Variables	Group I Control group	Group II Fentanyl group	Group III Dexmedetomidine	P value		
				I vs II	I vs III	II vs III
30 min	2 ± 0.56	1.6 ± 0.7	1.85 ± 0.6		0.198	
1 h.	2.8 ± 0.9	1.8 ± 0.5	2.1 ± 0.6	<0.001*	0.006*	0.174
2 h.	2.5 ± 0.6	2.6 ± 0.8	2.8 ± 0.9		0.501	
3 h.	2.5 ± 0.5	2.6 ± 0.9	2.1 ± 0.9		0.221	
4 h.	2.7 ± 0.5	2.75 ± 0.8	2.25 ± 0.8		0.125	

Data are expressed as means ± SD. * = statistically significant differences to the control group.

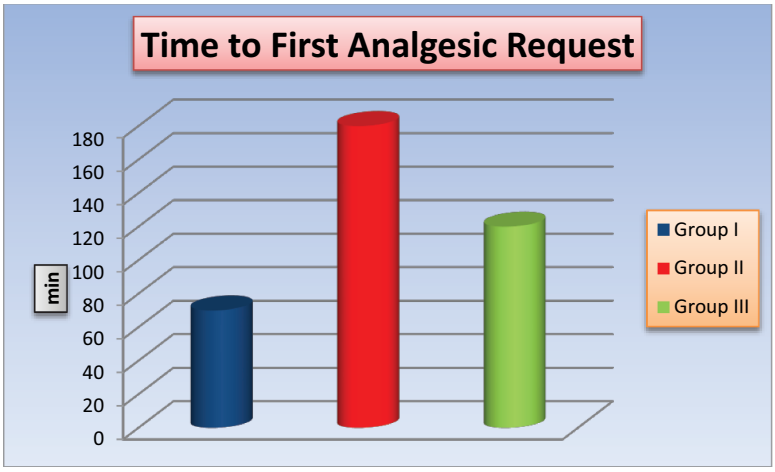

Figure 3. Time to first analgesic request.

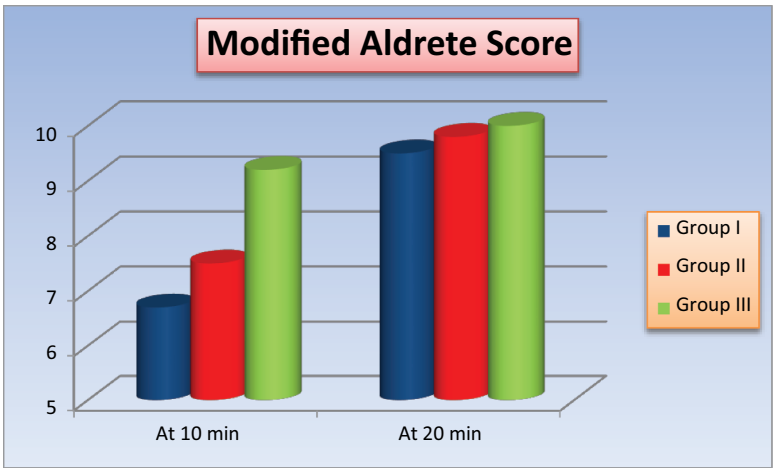

Figure 4. Modified Aldrete score.

Table 7. Airway complications & adverse effects.

Variables	Group I Control group	Group II Fentanyl group	Group III Dexmedetomidine group	P value
Laryngospasm:	3 (15%)	1 (5%)	0 (0%)	0.153
Bronchospasm:	0 (0%)	0 (0%)	0 (0%)	– – -
Desaturation:	0 (0%)	0 (0%)	0 (0%)	– – -
Bradycardia:	0 (0%)	0 (0%)	1 (5%)	0.362
Hypotension:	0 (0%)	0 (0%)	0 (0%)	– – -
Hypertension:	2 (10%)	0 (0%)	0 (0%)	0.126
Nausea:	6 (30%)	8 (40%)	6 (30%)	0741
Vomiting:	2 (10%)	2 (10%)	0 (0%)	0.343

Data are expressed as numbers and percentages. No statistically significant differences between the three groups

to the fentanyl group. After 20 minutes following extubation, there was no discernible difference between the fentanyl and dexmedetomidine groups however, the Modified Aldrete score was considerably higher in both the fentanyl and dexmedetomidine groups compared with the control group, as shown in (Figure 4).

3.7. Airway complications and adverse effects

Laryngospasm was detected in three patients in the control group, one patient in the fentanyl group, and not detected in the dexmedetomidine group which was managed by applying positive-pressure ventilation with 100% oxygen, by bag and mask. Bronchospasm and desaturation weren't detected in any of the three groups.

Bradycardia was detected in one patient in the dexmedetomidine group only but not detected among the control group or fentanyl group with no significant difference between the three groups.

Hypotension wasn't detected among any of the three groups. Hypertension was detected only in two patients in the control group with no significant difference between the three groups.

Nausea was detected in 6 patients in the control group, 8 patients in the fentanyl group, and 6 patients in the dexmedetomidine group with no significant difference between the three groups, no medication was received as nausea was self-limiting and patients got better without treatment

Vomiting was repeated in 2 patients in the control group, and 2 patients in the fentanyl group in which patients received 10 mg Metoclopramide IV but vomiting wasn't detected in the dexmedetomidine group with no significant difference between the three groups as shown in (Table 7)

4. Discussion

Our study's objective was to compare the effects of fentanyl 1 mcg/kg IV and dexmedetomidine 0.5 mcg/kg IV as single bolus doses on the quality of extubation, IOP, hemodynamic responses during extubation, postoperative sedation, postoperative pain, and postoperative complications.

In the current investigation, we found that dexmedetomidine, given as a single bolus dosage of 0.5 mcg/kg five minutes before tracheal extubation, stabilized IOP, attenuated hemodynamics, and improved the quality of the extubation without delaying recovery or increasing the incidence of postoperative complications.

In the current research, we found that the dexmedetomidine group's extubation quality was better than the fentanyl group's, and both groups performed significantly better than the control group.

This is supported by the study of **Aksu et al., 2009** [19] who compared the effect of dexmedetomidine 0.5 mcg/kg and fentanyl 1 mcg/kg 5 min before extubation in patients undergoing Rhinoplasty. They found that the dexmedetomidine group was significantly better than the fentanyl group regarding extubation quality as the incidence of no coughing was significantly higher in patients in the dexmedetomidine group compared with those in the fentanyl group.

Guler et al., 2005 [20] research, which evaluated the effects of dexmedetomidine 0.5 mcg/kg and a placebo five minutes before extubation, provided support for our current findings. Patients were randomly divided into two groups of 30 each for the trial. It was shown that the extubation quality in the dexmedetomidine group was much higher than in the placebo group.

Also, **Rai et al., 2019** [21] in their study, compared the effects of fentanyl 1 mcg/kg and dexmedetomidine 0.75 mcg/kg in attenuating airway reflexes during recovery and extubation on fifty patients undergoing abdominal and lower limb surgeries under general anesthesia. The Study medications were given 15 min before the end of surgery as an infusion and over 15 min after extubation. They found that the extubation quality was better in the dexmedetomidine group compared to the fentanyl group.

Amutharani et al., 2019 [22] in their research compared dexmedetomidine versus fentanyl or placebo in decreasing stress response to tracheal extubation in one hundred eighty patients undergoing elective general surgery. They concluded that Dexmedetomidine 0.5 mcg/kg infusion administered 10 minutes before tracheal extubation was better compared to fentanyl 1 mcg/kg infusion in attenuating the hemodynamic stress response with comparable adverse effects.

In our present study, the dexmedetomidine group exhibited greater IOP stability than the other two groups at the time of extubation.

The research by **Jaakola et al., 1992** [8], randomly assigned thirty patients having cataract surgery to receive either dexmedetomidine 0.6 mcg/kg or saline 10 min before inducing anesthesia, IOP decreased after the administration of dexmedetomidine. After intubation, the dexmedetomidine group's heart rate and IOP were lower than those of the patients receiving a placebo. Within 10 minutes after intubation, the systolic and diastolic arterial pressures were both significantly lower in the dexmedetomidine group. According to these results, dexmedetomidine may be a useful addition to anesthesia for ocular surgery.

IOP has been measured in **Mowafi et al's studies** [23] for 40 patients undergoing general anesthesia. Patients were randomly premedicated with IV dexmedetomidine 0.6 mcg/kg or saline. Measurements of IOP were taken before (baseline), after the premedication, after thiopental, after succinylcholine, right after intubation, and then every 2 minutes for 6 minutes. The IOP in the dexmedetomidine group did not differ from the baseline value and was substantially lower than in the saline group.

The findings of our investigation conflict with those of **Lili et al**. [2012, 24]. IOP was measured after sevoflurane inhalation (Baseline) and 10 minutes after an IV injection of dexmedetomidine 0.5 mcg/kg or normal saline in their research on 60 pediatric patients having vitreoretinal surgery. There was no difference between the groups. Dexmedetomidine 0.5 mcg/kg had no impact on intraoperative hemodynamics or IOP, but it did lessen emergent agitation and reduce the hemodynamic response to extubation. Their investigation's use of a different IOP measuring period may be the cause of the disparity between our research and theirs.

In our study, we noticed that there was no statistically significant difference in preoperative and at end of surgery hemodynamic data between the three groups. But we noticed that patients receiving dexmedetomidine saw considerably smaller increases in MAP and HR after medication delivery than patients receiving fentanyl and that both groups likewise experienced significantly smaller increases than the control group.

The results of **Bindu et al**. [2013, 25] have reinforced our findings. After being randomly separated into two groups, 50 patients scheduled for elective general, urological, and gynecological operations were examined. In a double-blind procedure, Groups A and B received intravenous infusions of dexmedetomidine 0.75 mcg/kg or normal saline, respectively, 15 minutes before the predicted completion of the surgery. Before starting the injection, 1, 3, 5, 10, and 15 minutes later, and 1, 3, and 5 minutes after extubation, the following variables were measured: HR, SBP, DBP, and MAP. They found that the dexmedetomidine group saw much lower increases in heart rate, and blood pressure, than the saline group.

Our current research was also validated by **Aksu et al., 2009** [19], who randomly divided the patients into two groups (20 patients per group). 5 min before extubation, patients either got fentanyl 1 mcg/kg IV over 5 minutes or dexmedetomidine 0.5 mcg/kg IV over 5 minutes prior to extubation. When compared to patients who got fentanyl, those who received dexmedetomidine saw considerably smaller increases in HR, SBP, and DBP after being extubated.

Sixty patients were randomly assigned to one of the two groups in **Vaswani et al 2017** [26] research to examine the effects of dexmedetomidine and fentanyl on hemodynamic treatment in patients having laparoscopic surgery. Patients received a loading dose of the study drug of 0.5 mcg/kg intravenously during a 10-minute interval before intubation. Then, until the surgery was concluded, patients received an infusion of 0.2 to 0.7 mcg/kg/hour. Dexmedetomidine significantly reduces the stress response during intubation compared to fentanyl, with smaller increases in HR, SBP, DBP, and MAP. Dexmedetomidine, as opposed to fentanyl, causes greater attenuation of the stress response to tracheal intubation, following pneumoperitoneum, and during the intraoperative period. As a result, they came to the conclusion that dexmedetomidine causes improved hemodynamic stability in patients undergoing elective laparoscopic surgery. This is because it reduces HR, SBP, DBP, and MAP more than fentanyl does.

The efficacy of a conventional dosage of propofol versus low-dose dexmedetomidine as infusions to avoid hemodynamic instability with pneumoperitoneum and speed recovery was compared in the research by **Janardhana and Thimmaiah, 2019** [27]. 70 patients scheduled for laparoscopic surgeries were randomly selected into two groups. Dexmedetomidine 0.1 mcg/kg over 10 minutes before and 0.2 mcg/kg/h infusion after intubation until the end of pneumoperitoneum and the other group received propofol 100 mcg/kg/min after intubation till the end of pneumoperitoneum. They noticed that dexmedetomidine maintained hemodynamic stability more effectively than Propofol. The propofol group recovered faster than dexmedetomidine, which had considerable postoperative sleepiness for up to 90 minutes. They came to the conclusion that propofol speeds up recovery and dexmedetomidine delivers more hemodynamic stress response attenuation to pneumoperitoneum.

In the current study, the dexmedetomidine + fentanyl group's pain score on the visual analogue scale was considerably lower at one hour than in the control group with no difference between the fentanyl and dexmedetomidine groups. However, after 30 minutes, 2, 3, or 4 hours following surgery, there were no discernible changes between the three groups.

In the current research, the Ramsay sedation score at 10 minutes after extubation was considerably higher in the fentanyl and dexmedetomidine groups compared to the control group. When compared to the dexmedetomidine group, the scale in the fentanyl group was greater. Also, the dexmedetomidine and fentanyl groups had greater levels at 20 minutes after extubation than the control group, there was no discernible difference between both groups.

The research conducted by **Bindu et al., 2013** [25] assured the current study result. The degree of postoperative sedation varied significantly between the two groups. The dexmedetomidine group included 84% of patients who were on Ramsay Sedation Scale 3, as opposed to the control group's 80% of patients who've been 2 on the Ramsay Sedation Scale. They found that pre-extubation dexmedetomidine administration decreased the hemodynamic response to extubation. It allows for easy tracheal extubation with adequate postoperative sedation.

In their 2009 research, **Aksu et al., 2009** [19] examined the effects of fentanyl and dexmedetomidine on the postoperative sedation score. They observed that there was no appreciable difference between the two groups in terms of postoperative sedation ratings. They employed a different scoring method for postoperative sedation scores than the scale we used in our current analysis, which might account for the discrepancy between our research and their study results.

Modified Aldrete scores in the current research were considerably higher in the fentanyl and dexmedetomidine groups compared to the control group at 10 minutes after extubation, as well as in the dexmedetomidine group compared to the fentanyl group. Twenty minutes after extubation, were considerably higher in the fentanyl and dexmedetomidine groups compared to the control group with no discernible difference between the two groups.

In the current investigation, we found no discernible difference in anesthetic and recovery times across the three groups. The **Aksu et al., 2009** [19] research provided more support for these conclusions.

The dexmedetomidine group in the current research had a much shorter extubation time than the other two groups however, the fentanyl group did not vary significantly from the control group.

There was no discernible difference in extubation time between the dexmedetomidine and fentanyl groups, according to the **Aksu et al., 2009** [19] research.

We noticed that the first request for analgesia in the fentanyl group was substantially lengthier than that in the other two groups. The Dexmedetomidine group duration was also considerably longer than the control group.

As regards airway complications and adverse effects, the incidence of laryngospasm and hypertension was higher in the control group. However, the incidence of nausea was higher in the fentanyl group and the incidence of vomiting was equal in both the control and fentanyl groups without any significant difference observed between the three groups. These results were supported by **Aksu et al., 2009** [19], **and Bindu et al., 2013** [25].

We concluded that the use of 0.5 mcg/kg IV dexmedetomidine 5 min before extubation provides more stability in the IOP than fentanyl and enables smooth extubation without prolonging recovery or increasing postoperative complications.

5. Limitations of the study

Limitations of the study were that we didn't measure the plasma nor epinephrine levels which could precisely predict the suppression of sympathetic responses to extubation. The study medications were given as a single bolus dosage rather than a continuous infusion, which might be considered in future research.

Disclosure statement

No potential conflict of interest was reported by the authors.

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