

Effect of dexmedetomidine on hemodynamic and recovery responses during tracheal extubation

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Abstract

Background: The α_2 adrenoreceptor agonist, Dexmedetomidine, provides excellent sedation with minimal cardiovascular instability or respiratory depression and may be a useful adjunct to facilitate smooth tracheal extubation. **Materials and methods:** We retrospectively analyzed the data of patients who underwent elective general surgical and ENT procedures, fifty patients were included in this study, patients who received an intravenous infusion of dexmedetomidine (group A) 0.4mcg/kg in 100ml NS over 15 min were compared to those who didn't receive dexmedetomidine (group B). Heart rate, systolic, diastolic, and mean arterial pressures were recorded while starting injection, at 1, 3, 5, 10, 15 minutes after starting injection, during extubation, at 1, 3, 5 minutes after extubation, and thereafter every 5 minutes for 30 minutes were collected and Quality of extubation which was evaluated on a 5-point scale and postoperative sedation on a 6-point scale were collected and analyzed. Any event of laryngospasm, bronchospasm, desaturation, respiratory depression, vomiting, hypotension, and undue sedation was noted from the data. **Results:** Heart rate, systolic, diastolic, and mean arterial pressures were significantly higher in group B ($P < 0.05$). The extubation quality score of the majority of patients was 2 in group A and 3 in group B. Sedation score of most patients was 3 in group A and 2 in group B. Bradycardia and hypotension incidences were higher in group B. One patient in group A and two patients in group B had vomiting. No patient had any other side effects. **Conclusion:** Dexmedetomidine 0.4 mcg/kg administered 15 minutes before extubation had been found to stabilize hemodynamics and facilitate smooth extubation and increase postoperative sedation.

Key Words: dexmedetomidine, α_2 adrenoreceptor agonist, smooth tracheal extubation, cardiovascular instability, laryngospasm, bronchospasm, desaturation, respiratory depression, undue sedation.

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Introduction

- Tracheal extubation is the discontinuation of an artificial airway when the indications for hypoxemia no longer exist.
- For smooth extubation, there should be no straining, movement, coughing, breath-holding, or laryngospasm.
- Extubation at light levels of anesthesia or sedation can stimulate reflex responses via tracheal and laryngeal irritation.
- Dexmedetomidine an α_2 adrenoceptor agonist with a distribution half-life of approximately 6 minutes has been successfully used for attenuating the stress response to laryngoscopy.
- The aim of the study was to evaluate the effect of dexmedetomidine on hemodynamic and recovery responses during extubation, quality of extubation, and postoperative sedation.

Materials and methods

- This is a retrospective observational study approved by the institutional ethical committee.
- Individual informed consent was taken from all the patients selected in the study.

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- The study was undertaken between September 2020 to September 2021.
- This study was carried out on 50 patients (25 in each group) between 20 to 45 years of age of either sex belonging to American Society of Anesthesiologists (ASA) physical status I and II who underwent elective general surgical and ENT procedures.
- Patients with cardiovascular or respiratory disorders, diabetes, hypertension, obesity, difficulty airway, pregnancy, and history of sleep apnea, and those for emergency procedures were excluded.
- Patients in group A received dexmedetomidine 0.4 mcg/kg intravenous (IV) in 100ml normal saline (NS) over 15 minutes while in group B patients received none.
- HR, systolic BP, and diastolic BP recordings were collected from the charts at 1,3,5,10 and 15 minutes intervals after the administration of the drug and SBP and DBP at the time of extubation and thereafter at 1,3 and 5 minutes after extubation followed by every 5minutes for 30 minutes.
- Quality of extubation which was noted based on cough immediately after extubation, using a 5-point rating scale was collected (Extubation Quality Score): 1 = no coughing, 2 = smooth extubation, minimal coughing (1 or 2 times), 3 = moderate coughing (3 or 4 times), 4 = severe coughing (5-10 times) and straining, 5 = poor extubation, very uncomfortable (laryngospasm and coughing>10 times).
- Postoperative sedation is graded according to Ramsay Scale.

- Power of study was calculated assuming a 15% change in HR and BP between baseline and extubation. The parameters were recorded and data were entered into Statistical Package for Social Sciences (SPSS 15.0).
- Statistical analysis was done using a paired-sample *t*-test and χ^2 test. *P*-value < 0.05 was considered statistically significant.

Results

The patients in the two groups were comparable in

	STUDY GROUP MEAN ± SD	CONTROL MEAN ± SD
AGE	32.8 ± 8.66	29.96 ± 8.59
WEIGHT	51.56 ± 9.93	52.20 ± 9.13
SEX	9.16	11.14
ASA GRADE	I/II	I/II

Age, weight, male: female ratio, and ASA physical status. The difference between the two groups was not statistically significant (*P* > 0.05)
Table 1

Table 2: HR Variation/SBP Variation/ DBP variation/ MAP variation

	HR Variation			SBP Variation			DBP variation			MAP variation		
	Study Mean ±SD	Control Mean ±SD	<i>P</i> value	Study Mean ±SD	Control Mean ±SD	<i>P</i> value	Study Mean ±SD	Control Mean ±SD	<i>P</i> value	Study Mean ±SD	Control Mean ±SD	<i>P</i> Value
Baseline	78.76 ±11.40	77.68 ±10.29	0.714	121.84 ±14.8	125 ±13.9	0.475	80.84 ±13.1	83.44 ±11.8	0.524	92.16 ±13.71	94.92 ±11.85	0.504
1 min	76.44 ±11.77	80.16 ±13.64	0.354	120.96 ±13.8	128.36 ±14.9	0.106	81.48 ±12.2	87.04 ±12.9	0.194	92.92 ±12.44	99 ±13.19	0.162
3 min	74.2 ±12.73	79.4 ±11.96	0.140	124.08 ±13.7	129.92 ±15.4	0.218	82.4 ±12.3	86.4 ±12.3	0.351	94.48 ±12.86	98.84 ±13.36	0.329
5 min	71.32 ±12.70	79.48 ±12.40	0.029	120.6 ±13.8	127.44 ±14.9	0.131	79.8 ±11.4	85.92 ±12.0	0.133	91.96 ±12.40	97.84 ±12.15	0.158
10 min	68.6 ±11.58	79.52 ±15.69	0.009	115.4 ±11.2	130.56 ±16.1	0.002	75.68 ±10.6	86.72 ±11.6	0.008	86.88 ±10.75	99.12 ±12.39	0.005
15 min	64.28 ±11.00	83.6 ±21.15	0.000	112.88 ±11.7	132.48 ±12.7	0.000	73.88 ±10.9	88.92 ±11.0	0.000	86.08 ±11.20	101.24 ±11.23	0.000
Reversal	72.92 ±12.36	98.84 ±14.97	0.000	118.92 ±12.9	148.92 ±17.1	0.000	76.96 ±10.4	100.72 ±11.4	0.000	90.08 ±10.85	114.96 ±13.22	0.000
Extubation	81.64 ±12.18	119.72 ±15.64	0.000	128 ±14.6	164.08 ±12.5	0.000	82.68 ±9.6	108.16 ±11.0	0.000	96.68 ±11.35	125.6 ±10.63	0.000
1 min	81.88 ±12.32	108.92 ±12.16	0.000	127.52 ±13.5	154.68 ±12.2	0.000	81.84 ±8.9	101.72 ±9.5	0.000	95.68 ±10.80	118.4 ±8.67	0.000
3 min	78.32 ±14.33	98.76 ±10.72	0.000	120 ±11.7	141.8 ±12.2	0.000	75.64 ±11.2	91.6 ±8.	0.000	88.28 ±11.02	107.4 ±7.92	0.000
5 min	76 ±14.21	89.76 ±9.20	0.000	116.08 ±11.9	130.56 ±12.3	0.001	71.56 ±10.5	82.6 ±8.0	0.002	84.44 ±10.96	97.48 ±9.43	0.001
10 min	72.44 ±13.26	81.4 ±7.37	0.005	111.28 ±12.7	124.4 ±13.2	0.001	68.52 ±10.1	76.36 ±8.6	0.013	81.04 ±11.12	90.04 ±9.23	0.008
20 min	69.44 ±11.90	76.8 ±7.27	0.021	108.04 ±12.7	119.68 ±10.8	0.003	66.48 ±10.5	77.44 ±10.8	0.002	78.8 ±10.56	90.92 ±11.53	0.001
30 min	69.04 ±10.44	74.24 ±7.30	0.056	106.12 ±11.9	118.64 ±11.8	0.001	65.32 ±10.2	74.72 ±10.7	0.005	77.96 ±10.18	88.6 ±12.17	0.003
40 min	68.08 ±10.47	74.48 ±5.70	0.013	105.96 ±12.0	116.72 ±12.1	0.004	64.8 ±10.6	75.24 ±8.3	0.001	77.2 ±10.87	87.8 ±9.64	0.003

Table 3 : Smooth Extubation Parameters

SCORE	Extubation Quality Score	Extubation Quality Score	Ramsay Scale	Ramsay Scale
	ARM A (study) No. of patients	ARM B (study) No. of patients	ARM A (study) No. of patients	ARM B (control) No. of patients
1	0	0	0	0
2	21	4	4	20
3	4	21	21	5
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0

We observed a significant difference in quality of extubation & level of postoperative sedation between the two groups (P = 0.04 & P = 0.017) Table 3

Smooth extubation: Discussion

- Extubation can be associated with several complications like coughing, respiratory and hemodynamic alterations.
- Dexmedetomidine has been successfully used to attenuate the hemodynamic responses to tracheal extubation.
- The present study was conducted to evaluate the effect of dexmedetomidine in a dose of 0.4 mcg/kg on hemodynamic responses during extubation, the quality of extubation, the level of postoperative sedation, and the prevalence of complications.
- Dexmedetomidine 0.4mcg/kg given as a single-dose bolus before tracheal extubation has been shown to attenuate airway-circulatory reflexes during extubation with no difference between the groups in the incidence of desaturation.
- We found that most patients in the study group were drowsy but responded to verbal commands (Ramsay Sedation Scale 3) after extubation when compared to the control group, where most patients belonged to Ramsay Sedation Scale 2.
- Our study found an insignificant difference in the incidence of vomiting between the two groups and none of the patients in either group developed respiratory depression, laryngospasm, bronchospasm, undue sedation, or desaturation. Similar findings have been made by *Guler et al.*

Conclusion

- To conclude, use of dexmedetomidine before extubation attenuates the hemodynamic response to extubation. It enables smooth extubation of the trachea and provides adequate sedation postoperatively.
- Dexmedetomidine increases the incidence of bradycardia and hypotension, but does not cause side effects like respiratory depression, laryngospasm, bronchospasm, undue sedation and desaturation.

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