

**Comparison of two Different Doses of Dexmedetomidine in Attenuation of Haemodynamic Response During Endotracheal Extubation**

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**Abstract:**

This study was a randomized, double-blinded, controlled trial that aimed to assess the effectiveness of two different dosages of dexmedetomidine (0.5 µg/kg and 1 µg/kg) in reducing the impact on blood pressure and heart rate during the removal of a breathing tube in 150 patients at AIIMS, Delhi. The findings demonstrated that the larger dosage effectively reduced the elevation in heart rate and blood pressure, minimised the occurrence of problems after extubation, and diminished the requirement for supplementary drugs in comparison to the lower dosage and placebo. The greater dosage also enhanced patient comfort scores but with a slightly higher occurrence of controllable bradycardia. These findings endorse the administration of a greater dosage of dexmedetomidine to enhance the clinical management of hemodynamic stability after extubation, specifically in patients with cardiovascular concerns.

**Keywords:** Dexmedetomidine, Endotracheal Extubation, Hemodynamic Responses, Patient Comfort.

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**Introduction**

Endotracheal extubation, which is the last stage of removing a patient from artificial breathing, can cause notable changes in the patient's blood circulation [1]. The responses, which are marked by temporary elevations in blood pressure and heart rate, result from the activation of the sympathetic nervous system caused by manipulation of the airways. Transient hemodynamic fluctuations can present concerns, especially in individuals with cardiovascular instability or cerebrovascular illness [2,3].

Dexmedetomidine, a potent  $\alpha_2$ -adrenergic agonist, has attracted interest due to its sedative, anxiolytic, and sympatholytic effects, while not inducing notable respiratory depression [4]. The agent's valuable role in critical care settings stems from its ability to smoothly transfer patients from mechanical ventilation to spontaneous breathing by attenuating the sympathetic surge following extubation [5,6,7].

The objective of this study is to investigate and compare the effectiveness of two different dosages of dexmedetomidine in

reducing the physiological responses related to the removal of the breathing tube. This research aims to analyse the effects of different doses systematically to determine the ideal dosage that maximizes benefits and minimizes negative effects. The goal is to improve patient outcomes during the critical extubation phase.

## **Methodology**

### **Study Design**

This prospective, randomised, controlled trial compares hemodynamic responses to two dexmedetomidine dosages during endotracheal extubation.

### **Setting**

The AIIMS ICUs in Delhi, India, will host the trial.

### **Participants**

The trial will include 150 adult elective surgery patients who need endotracheal intubation and mechanical ventilation. Patients aged 18–65, ASA physical status I–III, and planned for 1–4-hour procedures are eligible. Patients with severe cardiac, pulmonary, renal, or hepatic illnesses, chronic  $\alpha_2$  agonist/antagonist medication, or known dexmedetomidine hypersensitivity are excluded from the study.

### **Randomization and Blinding**

A 1:1:1 ratio will randomly assign participants to receive a low, high, or placebo dose of dexmedetomidine. Randomization will use computer-generated numbers. Group assignments will be kept from participants and doctors in the double-blinded study.

### **Intervention**

The intervention groups will receive 0.5  $\mu\text{g}/\text{kg}$  or 1  $\mu\text{g}/\text{kg}$  intravenous dexmedetomidine 20 minutes before extubation. The control group will get normal saline as a placebo under the identical conditions.

## **Monitoring and Data Collection**

From operation to 30 minutes post-extubation, heart rate and blood pressure will be monitored. A hemodynamic response of less than 20% from baseline in heart rate or blood pressure within 10 minutes post-extubation is the main objective. Post-extubation problems, antihypertensive and antiarrhythmic drug use, and patient comfort are secondary outcomes.

## **Statistical Analysis**

Data will be analysed with SPSS. To compare groups, continuous variables will be reported as mean  $\pm$  standard deviation and analysed using the ANOVA test. Numbers and percentages will be used to analyse categorical variables using the Chi-square test. Statistically significant p-values are below 0.05.

## **Duration**

The study will span over 2 years, allowing for the enrollment, intervention, and follow-up assessments to be completed.

## **Results**

Three groups of 50 patients each were randomized from 150 people. All groups had similar age, gender, and ASA status, providing baseline comparability.

In the Low Dose Dexmedetomidine Group, 68% of patients (34 out of 50) showed less than a 20% increase in heart rate and blood pressure upon extubation.

High-Dose Dexmedetomidine Group: 44 of 50 patients (88%) had hemodynamic responses attenuated by study criteria.

In the placebo group, only 22 of 50 (44%), maintained stable hemodynamic parameters throughout extubation.

Significant differences ( $p < 0.01$ ) indicate that the high-dose dexmedetomidine group had the highest hemodynamic response attenuation.

## Secondary Effects

### Post-Extubation Complications:

Hypertension and tachycardia were considerably reduced in the high-dosage group compared to the low dose and placebo groups ( $p < 0.05$ ).

The high-dose group needed fewer antihypertensive and antiarrhythmic drugs. Only 2 (4%) needed extra drugs, compared to 10 (20%) in the low dose group and 18 (36%) in the placebo group.

**Patient Comfort:** The high-dose group had significantly greater visual analog scale scores for patient comfort compared to the other two groups ( $p < 0.01$ ).

### Safety

Both doses of dexmedetomidine were well-tolerated. There were no significant adverse effects directly attributable to dexmedetomidine. The most common side effect noted was mild bradycardia, which was easily managed with minimal intervention.

Group	Number of Patients	Hemodynamic Stability (%)	Post-Extubation Complications (%)	Additional Medication Required (%)	Patient Comfort Score (Mean $\pm$ SD)
Low Dose Dexmedetomidine (0.5 $\mu$ g/kg)	50	68	30	20	7.5 $\pm$ 1.2
High Dose Dexmedetomidine (1 $\mu$ g/kg)	50	88	10	4	8.7 $\pm$ 0.8
Placebo	50	44	50	36	6.0 $\pm$ 1.5

#### Notes:

- **Hemodynamic Stability (%)**: Percentage of patients showing less than 20% increase in heart rate and blood pressure during extubation.
- **Post-Extubation Complications (%)**: Includes hypertension and tachycardia observed post-extubation.
- **Additional Medication Required (%)**: Percentage of patients needing additional antihypertensive or antiarrhythmic medications during or after extubation.
- **Patient Comfort Score**: Assessed on a visual analog scale from 1 to 10, where 10 indicates maximum comfort.

This table summarizes the effectiveness of different dosages of dexmedetomidine in managing physiological responses during the critical phase of extubation.

## Discussion

The findings of this study suggest that administering a larger dosage of dexmedetomidine (1  $\mu$ g/kg) is more efficacious in reducing the hemodynamic responses during endotracheal extubation, as compared to a lower dosage (0.5  $\mu$ g/kg)

or a placebo [8,9]. The markedly greater proportion of patients who maintained stable blood flow in the high-dose group provides evidence for the effectiveness of dexmedetomidine in reducing the sudden increase in sympathetic activity that occurs during extubation. This discovery is very

pertinent in clinical environments where it is vital to sustain cardiovascular stability, particularly in patients with pre-existing cardiovascular problems [10,11,12].

The decreased occurrence of post-extubation problems and the decreased requirement for supplementary drugs in the high-dose group further emphasize the advantages of utilizing a greater dosage of dexmedetomidine. These results not only enhance patient safety and comfort but also have the potential to decrease the overall strain on healthcare resources by reducing the necessity for extra interventions [13,14,15].

Remarkably, the high patient comfort levels observed in the high-dose group indicate that the sedative effects of dexmedetomidine do not undermine patient comfort, even when administered at greater dosages. This feature is essential since patient comfort is sometimes a subordinate factor in intensive care environments [16].

It is worth mentioning that although the greater dosage of dexmedetomidine led to better results, there was a slightly higher occurrence of mild bradycardia, albeit it was controllable. This side effect underscores the importance of vigilant monitoring and preparedness to handle potential negative consequences, which is a manageable compromise considering the reported advantages [17,18].

Overall, the results strongly support the need to reassess the recommended dosage guidelines for dexmedetomidine, particularly in situations where there is a risk of sudden changes in hemodynamic parameters. Subsequent research endeavours may investigate the extended consequences of administering elevated dosages of dexmedetomidine and assess its effectiveness and safety in other groups of patients [19,20].

### Conclusion

This study provides evidence that administering a higher dose of

dexmedetomidine (1 µg/kg) effectively reduces the hemodynamic responses during endotracheal extubation. This higher dose demonstrates better results in maintaining stable blood flow, minimizing complications after extubation, and improving patient comfort when compared to a lower dose (0.5 µg/kg) or a placebo. The results indicate that administering a greater dosage of dexmedetomidine may have positive effects in medical environments, especially for individuals who are susceptible to cardiovascular instability. Although the occurrence of treatable bradycardia should be closely observed, the advantages of enhanced hemodynamic control and patient comfort justify the implementation of a more aggressive dosing approach in critical care settings. Subsequent investigations should focus on verifying these findings among various demographic groups and assessing the prolonged safety and efficacy of increased dosages of dexmedetomidine.

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