



## Original Research Article

# Effect of single dose dexmedetomidine given prior to extubation on extubation conditions in adult patients following general anaesthesia

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## ABSTRACT

**Introduction:** Extubation is usually associated with undesirable increase in hemodynamics. Dexmedetomidine has shown to provide smooth and hemodynamically stable emergence. Primary objective of the present study was to assess incidence of cough at extubation following single dose dexmedetomidine given prior to extubation. Secondary objectives included assessment of changes heart rate and blood pressure at extubation, post operative nausea, vomiting and shivering.

**Materials and Methods:** This randomized control study was conducted in 40 ASA I-II patients with 20 in each group. Group A received 0.75mcg/kg dexmedetomidine and group B received normal saline, 30min prior to end of surgery as an infusion over 10min. Cough scores were recorded at the end of extubation. Students T test and Chi square test were used as applicable for statistical analysis.

**Results:** Incidence of cough at extubation was comparable in both groups (66.7% vs. 63.6%,  $p = 1.00$ ). Baseline mean arterial pressure was comparable in both groups, but at 3min after extubation it was significantly lower in Group A. Heart rate, postoperative nausea, vomiting, shivering and sedation scores did not show any significant difference between the two groups ( $p > 0.05$ ).

**Conclusion:** An infusion of dexmedetomidine at 0.75mcg/kg prior to extubation did not affect the severity of cough but resulted in improved hemodynamics after extubation.

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## 1. Introduction

Intubation and extubation are associated with varying degrees of cardiovascular and airway responses leading to hemodynamic instability, arrhythmias, coughing and bronchospasm.<sup>1,2</sup> The extubation responses are of little importance in patients without comorbidities. However coughing during emergence from general anaesthesia is considered a critical event as it may lead to surgical bleeding, laryngospasm, hemodynamic instability,<sup>3</sup> and could even be life threatening in patients who are at risk for complications related to increase in intracranial or intraocular pressure.<sup>1,4</sup> In patients with intracerebral space occupying lesions (ICSOL), where a sudden change in blood pressure in immediate post-extubation phase could lead on to rise in intracranial pressure (ICP) and

decreased cerebral perfusion pressure (CPP) resulting in intracranial bleed.<sup>5,6</sup> Following ear surgeries smooth tracheal extubation is mandatory as coughing can dislodge tympanic membrane grafts.<sup>7</sup>

It is generally agreed that with rapid and complete emergence from general anaesthesia, fewer patients develop airway-related complications.<sup>8</sup> Addition of dexmedetomidine 1mcg/kg at the end of surgery has shown to provide the best quality of emergence from general anaesthesia with control of cough, agitation, hypertension, tachycardia, and shivering.

We hypothesized that dexmedetomidine administered at a dose of 0.75mcg/kg might reduce the occurrence of cough and emergence phenomenon at extubation. The primary objective of the present study was to assess the incidence of cough at extubation following single dose dexmedetomidine administered before extubation. Secondary objectives were to assess the heart rate and blood pressure responses

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during extubation, time to extubation, sedation scores, post operative nausea, vomiting and shivering at pre-defined time points.

## 2. Methods

The study was a prospective randomized study approved by the institution ethics committee (IEC-AIMS-2019-ANES-021 dated 18.02.2019). After obtaining informed written consent for participation in the study, 40 adult patients aged 18-80 years belonging to American Society of Anaesthesiologists physical status (ASA PS) class I-II of both genders undergoing elective surgeries were enrolled. Patients allergic to dexmedetomidine, patients suffering from mental health problems, pregnant patients, obese patients (BMI >30), patients with history of recent upper respiratory tract infection in the last 4 weeks were excluded.

Patients were randomly assigned to two groups by a computer-based randomization program (<http://www.random.org/>). The randomization result was kept sealed in an envelope and only the study personnel who was blinded to the patient assessment was allowed to open the envelope and prepare the assigned drug. Patients belonging to group A received 0.75mcg/kg dexmedetomidine and patients belonging to group B received normal saline. All patients were premedicated with midazolam 2mg IV and glycopyrrolate 0.2mg IV.

On arriving in the operating room pulse oximetry, electrocardiogram and non-invasive blood pressure were attached. Fentanyl 2mcg/kg was given to all patients. After pre-oxygenating, patients were induced with titrated doses of propofol 2mg/kg till there was loss of response to verbal commands. Following atracurium 0.5mg/kg iv and after 3 minutes of mask ventilation, patients were intubated using an endotracheal tube of internal diameter 7.0 mm (female) or 8.0 mm (male). The patients were ventilated with tidal volume of 8 mL/kg ideal body weight to maintain endtidal carbon dioxide levels at 30-35 mm Hg. Isoflurane 1.0-1.5 MAC and fentanyl 0.5mcg/kg boluses were used to maintain mean arterial pressure and heart rate within 20% of baseline intraoperatively with intermittent atracurium to maintain muscle relaxation.

Anaesthesia was maintained with isoflurane, oxygen and air. Half an hour before the anticipated end of surgery, the study drug was given as an infusion over 10min. Group A received 0.75mcg/kg dexmedetomidine and group B received normal saline. Paracetamol (1 g) and ondansetron (0.1 mg/kg) were administered intravenously. At conclusion of surgery, isoflurane was turned off (time noted as T<sub>0</sub>) and 100% oxygen at 6 L/min was used till extubation. Once satisfactory spontaneous efforts were detected, neostigmine (0.05mg/kg) and glycopyrrolate (0.01mg/kg) were used intravenously for reversing actions of neuro muscular blockers. Following reversal patient was called gently and continuously to open the eyes. When the patient had opened

eyes in response to such verbal stimuli and had recovered normal respiration, the study subjects were extubated (time noted as T<sub>E</sub>).

All patients were transferred to the post-anesthetic care unit (PACU) after surgery. Any significant fall in blood pressure was managed by IV fluid bolus (100-200ml) followed by incremental epinephrine 3mg or phenylephrine 50mcg boluses. If heart rate decreased to less than 50/min, IV atropine 0.6mg was given. Cough score was recorded before and after extubation (Table 1). Systolic, diastolic, mean blood pressure, heart rate were noted at predefined time points (T<sub>0</sub>, 3min, 6min, T<sub>E</sub>, 3min). Patients' level of sedation was assessed using Ramsay sedation scale. Post operative nausea and vomiting as well as shivering were scored (Table 1).

Cough score, mean arterial pressure, heart rate and sedation scores were compared based on Student's T test. Postop nausea, vomiting and shivering scores were analyzed using Chi square test. IBM SPSS Statistics 20 (SPSS Inc., Chicago, Illinois, USA) was used for statistical analysis.

**Table 1:** Grading of cough, PONV, shivering

<b>Cough</b>	
0	No cough
1	Mild, single cough
2	Moderate, > 1 cough lasting < 5 sec
3	Severe, sustained cough or lasting for > 5 sec
<b>PONV</b>	
0	Absent
1	Mild nausea
2	Severe nausea
3	Vomiting
<b>Shivering</b>	
0	No shivering
1	Mild, fasciculations of face or neck
2	Moderate, visible tremor in > 1 muscle group
3	Severe, gross muscular activity involving whole body.

**Table 2:** Comparison of post operative cough score (Cough grade)

	0	1	p value
Group A	66.7%	33.3%	
Group B	63.6%	36.4%	1.00

## 3. Results

## 4. Discussion

Extubation following general anaesthesia could be accompanied by adverse airway and hemodynamic responses.<sup>1</sup> The reflex responses can get initiated secondary to tracheal and laryngeal stimulation when extubation is attempted at light levels of anesthesia or sedation.<sup>2</sup>

**Table 3:** Comparison of mean arterial pressure

	Group A		Group B		p value
	Mean	S.D	Mean	S.D	
Baseline	86.33	11.65	87.73	13.138	0.703
T0	92.11	19.00	99.91	13.71	0.110
3 min	98.67	16.68	108.3	11.57	0.437
6 min	105.78	11.68	100.0	12.32	0.285
TE	99.56	7.46	101.3	14.45	0.965
3 min	89.27	9.77	100.78	11.97	0.033

**Table 4:** Comparison of heart rate

	Group A		Group B		p value
	Mean	S.D	Mean	S.D	
Baseline	79.67	10.74	84.91	17.72	0.732
T0	69.33	6.14	77.45	10.20	0.039
3 min	71.44	6.04	85.45	16.78	0.027
6 min	74.11	10.14	88.40	20.04	0.102
TE	89.67	20.68	100.27	20.269	0.304
3 min	84.56	17.84	96.0	15.57	0.170

**Table 5:** Comparison of PONV and sedation

Comparison of PONV							
	0-1 hour				p value	1-2 hour	
	0	1	2	0		1	p value
Group A	11.1%	77.8%	11.1%	0.019	11.1%	88.9%	0.450
Group B	0.0%	27.3%	72.7%		0.0%	100%	
Comparison of postoperative sedation							
	At extubation				p value	30 min after extubation	
	0	1	2	0		1	p value
Group A	22.2%	66.7%	11.1%	0.329	66.7%	33.3%	0.074
Group B	54.5%	36.4%	9.1%		100%	0.0%	

**Table 6:** Shivering

	Shivering		p value
	0	1	
Group A	100%	0%	0.094
Group B	63.6%	36.4%	

Smooth extubation ideally results in the absence of straining, coughing, laryngospasm<sup>6</sup> and breath holding. Good recovery from anaesthesia requires the patients to be conscious, hemodynamically stable,<sup>1</sup> pain-free with preserved airway reflexes and breathing adequately.<sup>9</sup> Inadequate recovery from anaesthesia can cause aspiration, loss of airway patency or inadequate ventilatory drive.<sup>6</sup> Coughing with the tracheal tube in situ could be one of the cause of atelectasis at the end of surgery.<sup>9</sup>

Dexmedetomidine, which has a half-life of about 6 minutes has proven its efficacy in blunting the stress responses to laryngoscopy.<sup>8</sup> Infusions of dexmedetomidine have been shown to provide smooth emergence from anaesthesia by attenuating agitation, cough, and hemodynamic changes in both children and adults.<sup>1</sup> It also causes suppression of cough reflex and obtunds increase in BP and HR

associated with emergence from anaesthesia.<sup>10</sup> It spares responsiveness to carbon dioxide and causes less respiratory depression.<sup>1,11</sup>

Various methods are there in practice aiming to prevent coughing during emergence, like application of topical local anaesthetics<sup>12</sup> and use of hypnotics and opioids<sup>3,10</sup> to deepen plane of anaesthesia. Intratracheal local anaesthetic instillation, intracuff lidocaine,<sup>9</sup> intravenous lignocaine,<sup>4</sup> short acting opioids such as fentanyl and remifentanyl,<sup>2,4</sup> esmolol, labetalol, diltiazem, prostaglandin-E1 and verapamil have been used to attenuate these hemodynamic and respiratory responses during extubation in the past but with certain limitations.<sup>5</sup> Remifentanyl is ultrashort acting and carries risk of respiratory depression.<sup>5</sup> Extreme high blood pressure can be dangerous as it can result in cerebral vascular accidents, especially in the geriatric age

group. Rapid pulse rate is also equally detrimental as it can trigger arrhythmias.<sup>2</sup> Therefore a smooth emergence from anaesthesia may be helpful in ensuring maintenance of stable hemodynamics after extubation.<sup>1</sup> This is especially important in patients following major head and neck surgery and in those with un-ruptured cerebral aneurysm, so as to avoid emergence crisis leading to severe coughing and associated unstable hemodynamic changes.<sup>3,6</sup> In vulnerable patients, the changes in ejection fraction and cardiac work during recovery can induce undesirable complications, such as myocardial ischaemia.<sup>13</sup>

Recovering from anaesthesia often results in elevated catecholamine concentration<sup>10,13</sup> following discontinuation of anaesthesia which is further aggravated by laryngeal stimulation occurring during extubation. Dexmedetomidine, a potent alpha-adrenoceptor agonist, with 8 times greater affinity than clonidine,<sup>2,12</sup> decreases the sympathetic outflow and noradrenergic activity thereby counteracting the hemodynamic fluctuation occurring at the time of extubation.<sup>13</sup> It activates receptors in the medullary vasomotor center, and reduces norepinephrine turnover and decreases central sympathetic outflow.<sup>2,13</sup> This results in alterations in sympathetic function and manifests as decreased blood pressure and heart rate. Central stimulation of parasympathetic outflow and inhibition of sympathetic outflow from the locus ceruleus in the brainstem plays a prominent role in the sedation and anxiolysis produced by dexmedetomidine.<sup>5,8,12</sup>

Intraoperative hypothermia is a serious risk factor for post-anesthetic shivering.<sup>12</sup> Postoperative shivering usually causes uneasy feelings and is complicated by tachycardia, hypertension and cardiac ischemia. The anti-shivering effect of dexmedetomidine may be mediated in the hypothalamus.<sup>14</sup> As patients come out of anaesthesia, some may develop psychological dysfunctions like delirium, confusion or even cognitive dysfunction. This may be associated with an increased risk of postoperative morbidity. Dexmedetomidine has been shown to significantly decrease the RSAS score and thereby the incidence of emergence agitation in surgical patients.<sup>15</sup>

The present study has some limitations. As it was an open label study, the anaesthesiologists who assessed coughing might have been able to guess the group assignment based on the hemodynamic changes during emergence. This could have potentially affected the assessment of coughing. A larger sample size might have yielded more accurate results.

## 5. Conclusion

An infusion of dexmedetomidine at 0.75mcg/kg prior to extubation did not affect the severity of cough but resulted in improved hemodynamics at predefined time points after extubation.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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