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Original Research Article

Prospective, Randomized Clinical Assessment of the Effect of Single Dose Dexmedetomidine Given Prior to Extubation Following General Anaesthesia

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Abstract

Aim: Effect of single dose dexmedetomidine given prior to extubation-on-extubation conditions in adult patients following general anaesthesia.

Material and methods: This prospective, randomized, study was carried out in the Department of Anaesthesia and Critical Care, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India for 15 months. After obtaining informed written consent for participation in the study, 50 adult patients aged 18-70 years belonging to American Society of Anaesthesiologists physical status (ASA PS) class I-II of both genders undergoing elective surgeries were enrolled.

Results: Incidence of cough at extubation was comparable in both groups (68% vs. 66%, p 1.11). 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 at predefined time points after extubation.

Keywords: Dexmedetomidine, Hemodynamics, Extubation.

Introduction

Smooth extubation requires the absence of straining, movement, coughing, breath holding or laryngospasm [1]. Further, it is particularly important to avoid increases in heart rate and blood pressure in intraocular-, neuro-, and vascular surgery. Many techniques and drugs have been proposed for the attenuation of cardiovascular and airway responses, but

none have been completely successful [2,5].

Dexmedetomidine, a potent alpha adrenoceptor agonist which dose-dependently reduces arterial blood pressure and heart rate [6,7], decreases the haemodynamic and plasma catecholamine response to intubation and extubation [8,10]. Extubation at light levels of anaesthesia/sedation can stimulate reflex responses via tracheal and laryngeal irritation [11]. However, two studies on the effects of dexmedetomidine during extubation failed to mention its effects on coughing and other airway reflexes [9,10].

Opiates and local anaesthetics have been used to reduce this reflex [12,14], but both techniques have limitations. Dexmedetomidine is used for sedation and analgesia in intensive care units, where its relative lack of effect on respiration is an advantage [15]; it is thus theoretically appropriate for reducing airway and circulatory reflexes during emergence from anaesthesia. In this study, we aimed to investigate its effects during extubation on coughing, airway reflexes and haemodynamics.

Material and methods:

This prospective, randomized, study was carried out in the Department of Anaesthesia and Critical Care, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India for 15 months.

Methodology

After obtaining informed written consent for participation in the study, 50 adult patients aged 18-70 years belonging to American Society of Anaesthesiologist 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. 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_0) 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_E). 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 was noted at predefined time points (T_0, 3min, 6min, TE, 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 25.0 (SPSS Inc., Chicago, Illinois, USA) was used for statistical analysis.

Results:

Incidence of cough at extubation was comparable in both groups (68% vs. 66%, p 1.11). 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 ($p>0.05$)

Table 1: Grading of cough, PONV, shivering

Cough	
0	No cough
1	Mild, single cough
2	Moderate, > 1 cough lasting < 5 sec
3	Severe, sustained cough or lasting for > 5 sec
PONV	
0	Absent
1	Mild nausea
2	Severe nausea
3	Vomiting
Shivering	
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	68%	32%	
Group B	66%	34%	1.11

Table 3: Comparison of mean arterial pressure

	Group A		Group B		
	Mean	S. D	Mean	S. D	p value
Baseline	87.43	10.75	88.83	12.23	0.61
T0	93.21	18.10	100.81	12.81	0.21
3 min	99.77	15.78	109.21	10.67	0.53
6 min	106.88	10.78	101.10	11.42	0.38
TE	100.66	6.56	102.40	13.55	0.86
3 min	90.37	8.87	101.88	10.87	0.04

Table 4: Comparison of heart rate

	Group A		Group B		
	Mean	S. D	Mean	S. D	p value
Baseline	80.77	9.84	85.81	16.82	0.74
T0	70.43	5.24	78.55	9.30	0.04
3 min	72.54	5.14	86.55	15.88	0.03
6 min	73.21	9.24	89.50	19.14	0.11
TE	90.77	19.78	101.37	19.37	0.31
3 min	85.66	16.94	97.1	14.67	0.18

Table 5: Comparison of PONV and sedation

Comparison of PONV	0-1 hour				0-2 hour		
	0	1	2	p value	0	1	p value
Group A	10%	80%	10%	0.019	10%	90%	0.48
Group B	0.0%	30%	70%		100%	0.0%	-
Comparison of postoperative sedation		At extubation			30 min after extubation		
	0	1	2	p value	0	1	p value
Group A	20%	66%	10%	0.35	66%	34%	-
Group B	50%	34%	10%		100%	0.0%	

Discussion:

Smooth extubation ideally results in the absence of straining, coughing, laryngospasm and breath holding. Good recovery from anaesthesia requires the patients to be conscious, hemodynamically stable, pain-free with preserved airway reflexes and breathing adequately. Inadequate recovery from anaesthesia can cause aspiration, loss of airway patency or inadequate ventilatory drive. Coughing with the tracheal tube in situ could be one of the causes of atelectasis at the end of surgery [16]. Dexmedetomidine, which has a half-life of about 6 min- utes has proven its efficacy in blunting the stress responses to laryngoscopy. Infusions of dexmedetomidine have been shown to provide smooth emergence from anaesthesia by attenuating agitation, cough, and hemodynamic changes in both children and adults. It also causes suppression of cough reflex and obtunds increase in BP and HR associated with emergence from anaesthesia [17]. It spares responsiveness to carbon dioxide and causes less respiratory depression [18].

Various methods are there in practice aiming to prevent coughing during emergence, like application of topical local anaesthetics [19] and use of hypnotics and opioids [17] to deepen plane of anesthesia.

Intratracheal local anaesthetic instillation, intracuff lidocaine [16], intravenous lignocaine, short acting opioids such as fentanyl and remifentanil, 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. Remifentanil is ultrashort acting and carries risk of respiratory depression. 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. Therefore, a smooth emergence from anaesthesia may be helpful in ensuring maintenance of stable hemodynamics after extubation. 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. In vulnerable patients, the changes in ejection fraction and cardiac work during recovery can induce undesirable complications, such as myocardial ischaemia [20].

Recovering from anaesthesia often results in elevated catecholamine concentration [17,20] 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 [19], decreases the sympathetic outflow and noradrenergic activity thereby counteracting the hemodynamic fluctuation occurring at the time of extubation. It activates receptors in the medullary vasomotor center and reduces norepinephrine turnover and decreases central sympathetic outflow [20]. 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 ceruleous in the brainstem plays a prominent role in the sedation and anxiolysis produced by dexmedetomidine [19].

Intraoperative hypothermia is a serious risk factor for post-anesthetic shivering [12]. 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 [21]. As patients come out of anaesthesia, some may develop psychological dysfunctions like delirium, confusion or even cognitive dysfunction.

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.

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