Dexmedetomidine premedication for fiberoptic intubation in patients of temporomandibular joint ankylosis: A randomized clinical trial

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ABSTRACT

Background: Fiberoptic intubation is the gold standard technique for difficult airway management in patients of temporomandibular joint. This study was aimed to evaluate the clinical efficacy and safety of dexmedetomidine as premedication with propofol infusion for fiberoptic intubation. **Methods:** Consent was obtained from 46 adult patients of temporomandibular joint ankylosis, scheduled for gap arthroplasty. They were enrolled for thisdouble-blind, randomized, prospective clinical trial with two treatment groups – Group D and Group P, of 23 patients each. Group D patients had received premedication of dexmedetomidine 1 μg/kg infused over 10 min followed by sedative propofol infusion and the control Group P patients were given only propofol infusion to achieve sedation. Condition achieved at endoscopy, intubating conditions, hemodynamic changes and postoperative events were evaluated as primary outcome. **Results**: The fiberoptic intubation was successful with satisfactory endoscopic and intubating condition in all patients. Dexmedetomidine premedication has provided satisfactory conditions for fiberoptic intubation and attenuated the hemodynamic response of fiberoptic intubation than the propofol group. **Conclusion**: Fiberoptic intubation was found to be easier with dexmedetomidine premedication along with sedative infusion of propofol with complete amnesia of the procedure, hemodynamic stability and preservation of patent airway.

Key words: *Dexmedetomidine, fiberoptic intubation, propofol, sedation*

INTRODUCTION

The management of difficult airway is one of the most challenging tasks for the anesthesiologist, when manoeuvres of head tilt and jaw thrust are impossible to implement. In these circumstances, fiberoptic intubation is an effective and reliable technique to manage the difficult airway in patients. The technique requires an adequately sedated patient, patent airway with blunting of airway reflexes and spontaneous ventilation, especially when airway is difficult.[1] Temporomandibular joint ankylosis patients show difficult airway due to immobility of joint and restricted mouth opening, and should be planned to be intubated with the fiberoptic bronchoscope.

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Many methods of sedation for fiberoptic intubation, such as benzodiazepines, propofol or opioids, have their limitations. These challenging patients may be benefited from dexmedetomidine, which is a selective α2 adrenergic agonist that has been used clinically for its sympatholytic, analgesic and sedative effects.[2] Dexmedetomidine does not cause clinically relevant respiratory depression and attenuates the sympathoadrenal response to endotracheal intubation.[3] A sedation regimen using low-dose dexmedetomidine combined with titrated doses of benzodiazepines and ultra-short acting narcotics with local airway anesthesia has been used for airway manipulation. A target-controlled infusion can provide consistent pharmacodynamics effects with a safe and predictable sedation level.[4]

There are not many trials investigating the use of dexmedetomidine as premedication with propofol infusion for fiberoptic intubation. The present clinical trial was

aimed to compare and examine the efficacy, safety and suitability of dexmedetomidine as premedication along with propofol infusion with only propofol infusion for fiberoptic intubation in spontaneously breathing patients of temporomandibular joint ankylosis, scheduled for gap arthroplasty.

METHODS

After approval from the Institutional Ethical Committee and written informed consent, 46 patients with ASA physical status I–II of 14–38 years of either gender scheduled for elective gap arthroplasty for temporomandibular joint ankylosis were enrolled in this double-blind, controlled, prospective randomized clinical trial. Fiberoptic nasal intubation under sedation was planned for all patients because of difficult airway due to restricted mouth opening and no jaw movement at the temporomandibular joint. Exclusion criteria included severe bradycardia, any type of severe bradycardia, atrioventricular block, liver disease, thrombocytopenia or coagulopathy. All patients underwent preoperative anesthetic check up with routine investigations before enrolment, and their basic data were recorded.

Group allocation was done by a computer-generated code based on two-way randomization. All patients of Group P (n=23) were given propofol infusion while Group D (n=23) patient received a loading dose of dexmedetomidine 1 μg/kg infused over 10 min followed by propofol infusion to achieve sedation. Drug preparation was done by an anesthesiologist who was blinded to the randomization schedule and was unaware of the study protocol. The observer was also totally blind about the groups or medication received by the patients.

Preparation of patient

Patients were explained the indication, risks and benefits of fiberoptic intubation under sedation and cooperation needed. Topical nasal vasoconstriction was achieved with xylometazoline hydrochloride 0.1% w/v nasal drops and cotton wool-tipped swabs soaked in 4% lidocaine with adrenaline in both the nostrils to reduce the bleeding and satisfactory analgesia for nasotracheal intubation. Vital parameters of heart rate, arterial blood pressure, arterial oxygen saturation and continuous electrocardiogram were recorded at baseline, and then every 3 min thereafter. An intravenous infusion of Ringer lactate was stared in the nondominant arm. They were premedicated with intravenous metoclopramide 10 mg and glycopyrrolate 0.2 mg 15 min prior to the procedure. Nasal oxygenation through the nasopharyngeal airway with 100% oxygen (2 L/min) was started 3 min before the procedure. Group P patients were given propofol infusion while Group D patients received a loading dose of dexmedetomidine 1 μg/kg infused over 10 min followed by propofol infusion, adjusted to achieve the desired level of sedation. The nostril with least resistance during nasal packing was chosen for nasal intubation while the other nostril was used to deliver 100% oxygen via the nasopharyngeal airway with the patient breathing spontaneously. One anesthesiologist controlled the drug infusion while another anesthesiologist performed the fiberoptic intubation. Intubating conditions were graded by the consultant anesthesiologist who performed the fiberoptic intubation.

Procedure of fiberoptic intubation

Before starting the procedure, the light source was checked and the bronchoscope was refocused on the printed material and on the gauze piece. The tip of the bronchoscope was defogged with 70% isopropyl alcohol.[5] It is lightly lubricated along its entire length with a water-soluble agent, lidocaine jelly, to facilitate passage through appropriate-sized flexometalic cuffed endotracheal tube. Fiberoptic nasal intubation was stared once the desired level of sedation was achieved. As the bronchoscope was advanced, topical anesthesia of the lower airway was done to supplement the anesthesia until the posterior aspect of the tongue or the epiglottis was visualized. If the posterior pharyngeal wall was encountered, the tip of the bronchoscope was turned down to visualize the glottis. If the epiglottis obstructs vision, the bronchoscope was manipulated under the epiglottis to see the vocal cords. The bronchoscope was then advanced closer to the larynx and 2 mL lidocaine 2% was sprayed onto the glottis via the working channel of the fiberscope and another 2 mL lidocaine 2% was delivered between the vocal cords. External laryngeal and neck manipulation was done whenever required. Excessive force on the bronchoscope was avoided to minimize laryngeal trauma and damage to the delicate fibers at the tip of the bronchoscope. Once the bronchoscope entered the trachea, the endotracheal tube was advanced over it. After securing the endotracheal tube, general anesthesia was administered.

The primary outcome measures were conditions achieved at bronchoscopy, intubation and postintubation. Other parameters recorded were bronchoscopy time (from insertion of the fiberoptic bronchoscopy in the nostril to visualization of the carina), intubation time (insertion of tracheal tube into the nose to confirmation of tracheal intubation with capnograph), any hypoxic episode (SPO_2 <90%), number of attempts at intubation and postoperative adverse events of hoarseness and sore throat.

Intubation scores were assessed by vocal cord movement (1 open, 2 moving, 3 closing, 4 closed), coughing (1 none, 2 – slight, 3 moderate, 4 severe) and limb movements (1 none, 2 slight, 3 moderate, 4 severe). Sedation was assessed by the Ramsay sedation scale (1 anxious, agitated or restless; 2 co-operative, oriented and tranquil; 3 respond to command; 4 asleep with brisk response to stimulus; 5 asleep with sluggish response to stimulus; and 6 asleep with no response). Hemodynamic changes of heart rate and mean arterial blood pressure were recorded of both groups at preinduction (baseline), at the end of propofol infusion when adequate level of sedation was achieved and immediately after intubation.

Study population size and statistical analysis

The sample size was based on an initial pilot observation, which indicated that 1214 patients were to be randomized to each group in order to ensure a power of 0.80 for detecting clinically meaningful difference in intubation scores with a type-1 error of 0.05. Assuming a 5% dropout rate, 46 patients were enrolled. The results obtained are presented in a tabulated manner and analyzed using unpaired Student's ttest for numerical data and Mann Whitney U test for ordinal data using SPSS software for windows. A $P<0.05$ was considered significant.

RESULTS

Forty-six adult consenting patients of temporomandibular joint ankylosis, scheduled for gap arthroplasty, were randomized into two treatment groups of 23 patients each. There were no clinical significant differences in the patient demographic profiles [Table 1].

Desired sedation level could be achieved easily in both groups but, in the dexmedetomidine group, it had taken lesser time with a lesser dose of propofol. The procedure was much better tolerated by the dexmedetomidine group, with more favorable intubation scores for vocal cord opening than did the propofol group [Table 2]. Airway obstruction occurred more frequently in the propofol group than in the dexmedetomidine group. The intubation time was not different between the groups. All 46 patients were successfully intubated at the first attempt. Only three patients of the propofol group and one patient of the dexmedetomidine group had a bout of coughing. There were no episodes of desaturation ($SpO_2 < 95\%$), bradycardia (heart rate <50 beats/min), hypotension (systolic blood pressure <90 mmHg) or chest wall rigidity in either group.

Hemodynamic parameters of heart rate and mean arterial pressure were compared. Baseline heart rate and mean arterial pressure did not differ significantly between the groups. The heart rate decreased significantly in the dexmedetomidine group at the end of drug infusion;this was not seen in the propofol group. Intubation has caused an increase in heart rate and mean arterial blood pressure in both groups from the baseline, but it was less marked in the dexmedetomidine group.

Table 1: Demographic profile of patients

	Dexmedetomidine group (*n*=23)	Propofol group (*n*=23)
Age (Years)	26.82±11.78	29.79±10.87
Gender M:F	15: 8	16:7
Weight (kKg)	49.27±6.58	47.73±9.16
Height (cm)	139.47±18.67	142.23±15.48
ASA I/II	17/6	14/9

Data are expressed as mean±SD

Table 2: Different scores recorded during fiberoptic intubation

	Dexmedetomidine group (*n*=23)	Propofol group (*n*=23)	*P* value
Success	23	23	NS
Intubation scrores			
Vocal cord movement; 1/2/3/4	16/7/0/0	12/6/5/0	0.04*
Cough	1	3	0.12
Limb movement; 1/2/3/4	14/5/3/1	9/6/7/1	0.08
Intubation time (min)	3.9±2.9	4.2±2.5	NS
Propofol requirement (mg)	65.5±12.8	138.45±37.42	<0.001**

*P<0.05 significant, **P<0.001 highly significant

DISCUSSION

The present study has evaluated dexmedetomidine premedication for sedation to facilitate the fiberoptic intubation with propofol for gap arthroplasty in patients of temporomandibular joint ankylosis. The study showed that fiberoptic intubation was much convenient, smooth and with less adverse events when dexmedetomidine was used as premedication. All patients had been intubated successfully in the first attempt. Our primary outcome measures, bronchoscopy and intubation condition, were improved with dexmedetomidine sedation.

Dexmedetomidine is a highly selective, potent a 2 adrenergic receptor agonist. It has sedative, analgesic and anxiolytic properties, with no effect on the respiration. They provide hemodynamic and sympathoadrenal stability by reducing the circulating catecholamines. Satisfactory balanced anesthesia with rapid emergence can be achieved with lower doses of co-administered drugs. It can be used either as the sole agent or an adjuvant to

facilitate awake intubation in patients with anticipated difficult airways.[2,4,6,7]

Many agents like fentanyl, midazolam, ketamine, propofol and remifentanil have been used to facilitate fiberoptic intubation, but dexmedetomidine has many properties to make it suitable for use during fiberoptic intubation.[8] Abdelmalak *et al*. reported a series of successful awake fiberoptic intubations using dexmedetomidine for sedation in patients with difficult airway.[9] Chu *et al*. reported that a loading dose (1 μg/kg) of intravenous dexmedetomidine provided conscious sedation without respiratory depression or upper airway obstruction for fiberoptic nasotracheal intubation.[10] In our study, patients of the dexmedetomidine group showed better intubating conditions and hemodynamic stability. Yavacaoglu *et al*. reported that dexmedetomidine prevented the hemodynamic responses to tracheal intubation more effectively than esmolol.[11]

Propofol is widely used to facilitate tracheal intubation, and was comparable with those provided using dexmedetomidine but with less favorable intubating conditions with a higher degree of airway obstruction.[12] Rai *et al*. and Lallo *et al*. reported that remifentanil provided better conditions for fiberoptic intubation when compared with propofol.[13,14]

Narcotic analgesics could provide mild sedation, analgesia and reduction of airway reactivity, but there is a risk of aspiration and apneic spell. The disadvantage of using benzodiazepines was their effect on consciousness, respiration and cardiovascular status. Dexmedetomidine supplied adequate sedation without adding narcotic-induced respiratory depression. Spontaneous ventilation has the obvious advantage of avoiding apnea during bronchoscopy.[15,16]

Glycopyrrolate premedication improves visualization during laryngoscopy by reducing secretions; thus, topical local anesthetic solutions are less diluted and remain at the desired site of application. Lidocaine is the commonly used local anesthetic agent with a wide margin of safety. The total dose should be limited to 3 mg/kg as absorption of lignocaine from the mucosa is rapid, and its toxicity is directly correlated with its blood concentration. A major proportion of the total dose of lignocaine is required to anesthetize the nose, pharynx and larynx to control the cough, which is of paramount importance for fiberoptic intubation to viewing the glottis with vocal cords and its forward movement toward carina.

In our study, improved conditions were observed using dexmedetomidine as premedication due to its analgesic and sedative effects; thus, the procedure was smoother and faster than the propofol group. Successful intubation was possible due to control of secretions, adequate topical anesthesia and adequate level of sedation and proper defogging of the fiberoptic lens.

CONCLUSION

Dexmedetomidine and propofol provided satisfactory intubating conditions for fiberoptic intubation in patients of temporomandibular joint ankylosis. Dexmedetomidine appeared to provide preservation of patent airway, better intubating conditions and hemodynamic stability with less adverse effects.

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