Section: Anesthesiology

Original Research Article

A COMPARISON OF KETAMINE-DEXMEDETOMIDINE AND KETAMINE-PROPOFOL COMBINATIONS FOR AWAKE FIBEROPTIC INTUBATION IN ADULT PATIENTS WITH SIMULATED CERVICAL INJURY

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Received : 28/02/2023
Received in revised form : 03/04/2023
Accepted : 17/04/2023

Keywords:
Awake fiberoptic, dexmedetomidine, propofol, ketamine, cervical spine injury.

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DOI: 10.47009/jamp.2023.5.3.131

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5 (3); 628-632

Abstract

Background: Awake fiberoptic bronchoscope guided intubation is considered to be the gold standard for the management of anticipated difficult airway. During the procedure, patient should remain sedated yet arousable, calm, and following verbal command without any respiratory compromise. Combinations of ketamine with propofol or dexmedetomidine are commonly used agents for providing sedation for awake fiberoptic bronchoscope guided intubation. Aim/objectives: The present study aimed to compare ketamine in combination with dexmedetomidine versus propofol in providing good intubating conditions along with hemodynamic stability during awake fiberoptic bronchoscope guided intubation in simulated cervical spine injury patients. **Materials and Methods:** Sixtysix patients posted for elective surgeries were included in this study and randomly divided into two groups. Group A received ketamine 0.5mg/kg with dexmedetomine 1mcg/kg over 10 minutes loading dose and a maintenance infusion of dexmedetomidine 0.5mcg/kg/hour. Group B received ketamine 0.5mg/kg with propofol 0.5mg/kg as bolus and boluses of 0.25 mg/kg ketamine and propofol each were repeated in order to maintain the required sedation level (Ramsay Sedation Score ≥ 2). Time taken for intubation, vocal cord opening, coughing and limb movements during the procedure were compared. An intubation score was. **Result:** Four cases had failed intubation. The mean intubation time was higher in Group A (4.2±0.0.79 minutes) than Group B (4.13±0.82 minutes) although it was not statistically significant (p = 0.75). The total intubation score was significantly higher in group B (5.4±1.5) than group A (4.7±1.04) (p = 0.04). The opening of vocal cord was better in Group A than Group B (p = 0.003). The other variables such as coughing and the limb movements were not statistically significant between the two Groups (p = 0.55 and p = 0.22 respectively). **Conclusion:** Ketamine with Dexmedetomidine combination is more effective in terms of better intubation score, less intubation time, more hemodynamic stability and lesser airway events than ketamine with propofol in awake fiberoptic bronchoscope guided intubation in simulated cervical spine injury patients.

INTRODUCTION

Awake Fiberoptic bronchoscopy guided intubation (FOB) is considered to be the gold standard for the management of anticipated difficult airway, lower airway pathology and in patients with cervical spine instability where neck extension needs to be avoided.[1] Patients should remain calm, sedated and following verbal commands during awake fiberoptic intubation procedure. Various pharmacologic agents are available to provide conscious sedation and optimal conditions for fiberoptic intubation. These include Sevoflurane, Benzodiazepines, ketamine, propofol, opioids (Fentanil, Remifentanyl), Clonidine and dexmedetomidine. Opioids, benzodiazepines and propofol are associated with risk of respiratory depression and hypoxia especially if used in combinations.[2]

Dexmedetomidine is a selective alpha 2 adrenoreceptor agonist. It provides analgesia and sedation without respiratory depression and also decreases salivary secretions, which provide optimal conditions for awake fiberoptic intubation.[2,3]

Propofol has sedative and hypnotic properties with quick onset and short recovery time but its use is limited in awake fiberoptic intubation because of higher incidence of respiratory depression, hypotension and airway obstruction.[4]

Ketamine provides excellent sedation, amnesia and analgesia, preserves muscle tone, maintains airway reflexes without respiratory depression. Increased salivary secretions which is not desirable during fiberoptic intubation. A combination of ketamine and propofol may preserve sedative and analgesic efficacy while reducing their respective side effects. They have opposite cardiovascular effects, thus balance each other when used in combination.[5]

Dexmedetomidine also reduces salivary secretions which counters the effect of increased airway secretions with ketamine. dexmedetomidine also attenuates ketamine induced cardio stimulatory effects and delirium. Scher and Giltin used dexmedetomidine combined with ketamine for awake fiberoptic intubation in a case of a 52-year male with failed previous fiberoptic intubations and found that this combination provides excellent intubating conditions.[6]

This prospective randomized controlled study was performed to compare the efficacy and safety of ketamine with dexmedetomidine and ketamine with propofol combinations for awake fiber optic bronchoscopy guided nasotracheal intubation in patients with simulated cervical spine injury in terms of intubating conditions, hemodynamic stability and adverse effects.

MATERIALS AND METHODS

To determine the sample size a power analysis was performed for the groups. Based on a pilot study on 10 patients in each group, the final sample size was calculated. With alpha error of 0.05 and 80% power of study it was determined that to detect at least 15% difference in mean intubation time between the groups, 30 patients in each group was required. Sixty patients aged 18-65 years of either sex, with American Society of Anesthesiologists (ASA) grade I or II posted for elective surgeries were included.

Exclusion criteria included major cardiac, neurological, hepatorenal or pulmonary illness, coagulation disorders, upper airway abnormalities, patients having history of hypersensitivity or allergic reactions to the study drugs.

Patients were allocated into two groups using a computer generated randomization table; Group A receiving a combination of ketamine with dexmedetomidine and Group B receiving a combination of ketamine with propofol.

After pre anesthetic evaluation, informed written consent was obtained from the patients. Awake fiberoptic bronchoscopy guided intubation procedure was explained in detail to the patients and queries and apprehensions were cleared. The anesthesiologist preparing the drugs and the observer were blinded to the study. Awake fiberoptic nasal intubation was performed by an experienced anesthesiologist. In the preoperative room, after checking bilateral nasal patency, two drops of 0.1% xylometazoline were put in each nostril. Nebulization with 5 ml of 4% lignocaine was done to anesthetize the airway mucosa with O2 4-6 liters/min for 15 minutes. On arrival in the operation room, the patient was placed in supine position. Multipara monitor was attached and baseline parameters such as heart rate, ECG, Spo2 and non-invasive blood pressure (NIBP) were recorded. Intravenous access with an 18 gauge cannula was secured and the patient preloaded with ringer lactate 10 ml/kg. 0.2 mg of Injection Glycopyrrolate was given intravenously.

Maximum dose of local anesthetic was calculated to avoid toxicity. Pledgets soaked with 2 ml of 2% lignocaine with adrenaline were put in each nostril. Philadelphia collar (Tyson, medium size) was applied to immobilize the patient's neck simulating a cervical spine injury. Oxygenation was done with nasal catheter (2-3 liters/min) throughout the procedure till intubation was either completed or abandoned. Heart rate, blood pressure, SpO2 and respiratory rate were recorded preoperatively and at prescribed intervals during the procedure.

Group A patients received a loading dose of dexmedetomidine 1 mcg/ kg over 10 minutes followed by a continuous infusion of dexmedetomidine at 0.5 mcg/kg/h. Upon completion of the dexmedetomidine bolus, patients received injection ketamine 0.5 mg/kg and then 2 min later it was repeated as 0.25 mg/kg in order to maintain the required sedation level.

Group B patients received a loading dose of injection propofol 0.5 mg/kg and injection ketamine 0.5mg/ kg. 2 min later doses were repeated as 0.25 mg/kg. Based on clinical response, 0.25 mg/kg

ISSN (O): 2687-5365; ISSN (P): 2753-6556

boluses of each drug were repeated to maintain the required sedation level (Ramsay Sedation Score≥2).
Once the Ramsay Sedation Score ≥2 was achieved, a fiberoptic bronchoscope (Karl Storz) loaded with appropriate size endotracheal tube was inserted through more patent nostril into the nasopharynx. The time from the start of insertion of fiberoptic scope into the nostril was taken as Tzero. Topical anesthesia was performed with "spray as you go technique" using 2 ml of 2% Lignocaine as the tip of the fiberoptic bronchoscope advanced to the carina. After visualization of the carina, the endotracheal tube was slided over the bronchoscope and inserted into the trachea. Correct placement of the endotracheal tube was confirmed by recording end tidal carbon dioxide and chest auscultation. This was considered as completion of successful intubation. After securing the endotracheal tube, general anesthesia was administered and surgery performed as routine.
Level of sedation was assessed by Ramsay Sedation Score as follows:
Score1: Anxious and agitated
Score 2: Cooperative and oriented
Score 3: Respond to commands only exhibit brisk response to light glabellar tap or loud auditory stimulus
Score 4: Exhibit sluggish response to light glabellar tap or loud auditory stimulus
Score 5: Unresponsive
Quality of sedation was assessed using a graded intubation score consisting of three parameters: vocal cord movements, cough reflex and limb movements as follows:

Vocal cord movements

- Score 1: Open
- Score 2: Moving
- Score 3: Closing
- Score 4: Closed,

Coughing

- Score 1: None
- Score 2: Slight (<2 cough in sequence),
- Score 3: Moderate (3-5 coughs in sequence)
- Score 4: Severe (>5 coughs in sequence)

Limb movements

- Score 1: None
- Score 2: Slight movement
- Score 3: Moderate movement
- Score 4: Severe movement

The primary outcome measure was total intubation score. Secondary outcomes were total intubation time, hemodynamic changes and side effects.
A lower intubation intubation score signified optimal conditions for the intubation procedure.
During the procedure, incidents of hypertension, hypotension, tachycardia, bradycardia, tachypnea, bradypnea, apnea or hypoxia (SpO2 <92%) were also recorded and managed accordingly.
Statistical analysis: A pilot study was performed with 10 patients in each group. With an alpha error of 0.05, power of study 80% and to detect at least 15% difference in mean intubation time between the groups, a sample size of 30 patients in each group was calculated.
Data was entered in Microsoft excel and analyzed using statistical software SPSS® statistical package version 16.0 (SPSS Inc., Chicago, IL, USA). Categorical data was represented as proportions and frequencies and Chi-square test was used to compare the data between the groups. Continuous variables were represented as mean and standard deviation and compared using unpaired student t tests between the two groups. P<0.05 was considered as significant.

RESULTS

All the patients were comparable in terms of demographic profile.
Opening of the vocal cords was better in Group A than Group B (p=0.003). The mean intubation time was higher in Group A (4.2±0.0.79 minutes) than Group B (4.13±0.82 minutes) although this was not statistically significant (p=0.75) [Table 1].
The other variables such as coughing and the limb movements were not statistically significant between the two Groups.
The total intubation score was significantly lower in group A (4.7±1.04) (p=0.04) than in group B (5.4±1.5).

Table 1: Intubation time

Groups	Intubation time in minutes (mean ± SD)
Group A	4.13±0.82
Group B	4.2±0.79
p	0.75

Table 2: Intubation Score

Parameters		Group A (n=30) (Mean±SD)	Group B (n=30) (Mean±SD)	p
Vocal cord movements	(1/2/3/4)a	24/6/0/0 (1.2±0.40)	15/9/6/0 (1.7±0.79)	0.003*
Coughing	(1/2/3/4)b	10/14/6/0 (1.80±0.73)	11/11/5/3 (2.0±0.98)	0.55
Limb movements	(1/2/3/4)c	15/11/3/1 (1.60±0.80)	8/17/5/0 (1.9±0.66)	0.22
Total score		4.7±1.04	5.4±1.5	0.04*

a (1-Open, 2–Moving, 3-Closing, 4-Closed, b (1-None, 2-Slight, 3-Moderate, 4-Severe), c (1-None, 2-Slight, 3-Moderate, 4-Severe). *Significant p value

ISSN (O): 2687-5365; ISSN (P): 2753-6556

The baseline heart rate, blood pressure and SpO2 were comparable in both the groups (p=0.61).

Heart rate was significantly lower (p<0.05) in Group A throughout the procedure. There was a significant drop in mean arterial pressure (p<0.01) in Group A (103.3 mmHg) than Group B (109 mm Hg) at 5 minutes (T5).

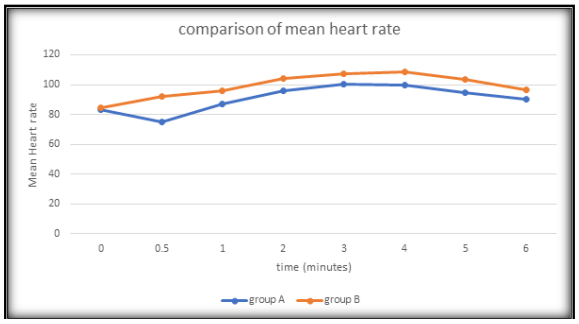

Figure 1: Comparison of mean Heart rate

Mean arterial pressure was lower in group A at other time intervals although not significant. There was no episode of severe bradycardia and hypotension in both the groups.

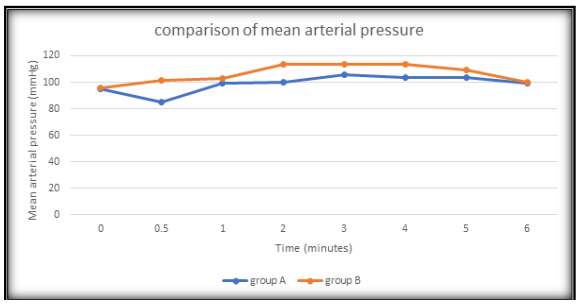

Figure 2: Comparison of mean arterial pressure

The oxygen saturation was significantly lower (p<0.05) in Group B than Group A at 1, 2 and 3 mins during the procedure. In Group B, 2 patients developed transient hypoxia, with the lowest recorded oxygen saturation 88% (baseline 97%).

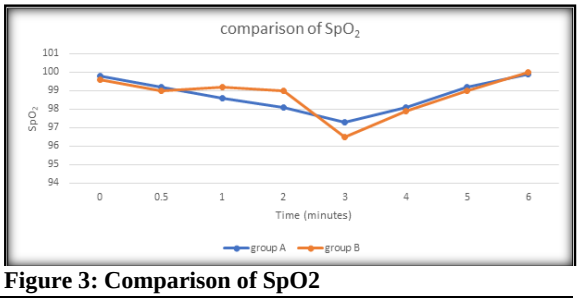

Figure 3: Comparison of SpO2

Incidence of dry mouth was significantly higher (p=0.038) in Group A than Group B (4 vs 0 cases).

DISCUSSION

Maintenance of adequate sedation, control of coughing and vocal cords movements while maintaining respiration and preventing hypoxia is desirable during awake fiberoptic bronchoscopy guided intubation. This study was conducted to compare the efficacy of ketamine in combination with dexmedetomidine and propofol for fiberoptic nasotracheal intubation in patients with simulated cervical spine injury. The study shows that both the regimens provide satisfactory intubating conditions with limited adverse effects, although ketamine with dexmedetomidine provides better conscious sedation in terms of better hemodynamic stability, lesser coughing and vocal cord and limb movements. The mean intubation time in this study was lower in the ketamine-dexmedetomidine group patients (4.13±0.82 minutes) which was comparable to the study by Li CW et al (4.6±1.4 minutes).[7]

Tsai et al compared dexmedetomidine and propofol target controlled sedation for awake fiberoptic intubation. In the dexmedetomidine group, they found a more favourable intubation score for vocal cord movements while cough and limb movements were not significant, similar to our study.[8]

Shah BK et al in a similar study comparing dexmedetomidine and midazolam infusion for sedating cardiac patients undergoing awake fiberoptic nasal intubation found that 60% of the midazolam group patients had limb movements in comparison to only 15% in dexmedetomidine group.[9]

In our study, the mean heart rate during endotracheal tube insertion was lesser in ketamine-dexmedetomidine group as compared to ketamine-propofol group. The mean arterial pressure was also lower in the former although this was statistically not significant. This is due to the dexmedetomidine induced decreased norepinephrine release and centrally mediated sympathetic tone.

Yavascaoglu et al emphasised that dexmedetomidine is more effective than esmolol in preventing the haemodynamic and intraocular pressure responses to tracheal intubation.[10]

Sinha et al have concluded that the use of dexmedetomidine- ketamine combination in awake fiberoptic nasotracheal intubation provided better hemodynamic stability and sedation than dexmedetomidine alone.[11]

Dexmedetomidine acts on postsynaptic α-2-adrenal receptors in the locus coeruleus which is involved in physiological response to anxiety and stress. It does not cause airway obstruction and respiratory depression. With high loading doses (1–2 μg/kg over 2 minutes), it may lead to irregular ventilation with episodes of apnea along bradycardia and hypotension. We used a combination of ketamine with dexmedetomidine to avoid these complications associated with dexmedetomidine alone.

In our study, the total intubation score was better in the ketamine-dexmedetomidine group. These patients were easily arousable and cooperative, following command without being irritable which is required for a successful awake fiberoptic bronchoscopy guided intubation.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

CONCLUSION

We concluded from our study that ketamine and dexmedetomidine combination was more effective than ketamine and propofol combination for providing conscious sedation in patients undergoing awake fiberoptic intubation which is reflected by better intubation score, lesser intubation time, better hemodynamic stability and lesser airway events.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556