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Research Article

Safety and efficacy of dexmedetomidine sedation for elective fiberoptic bronchoscopy: A comparative study with propofol

Randa Ali Shoukry *

Anaesthesiology and Intensive Care, Ain Shams University, Egypt

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KEYWORDS

Dexmedetomidine;
Propofol;
Fentanyl;
Sedation;
Fiberoptic bronchoscope

Abstract *Background:* Dexmedetomidine has sedative and sympatholytic effects. The use of dexmedetomidine in flexible fiberoptic bronchoscopy will attenuate hemodynamic response without respiratory depression. The aim of this study was to evaluate the clinical efficiency and safety of dexmedetomidine, and to compare it with the combination of propofol-fentanyl as sedation during flexible fiberoptic bronchoscopy.

Patients and methods: Seventy-two patients scheduled for elective fiberoptic bronchoscopy were included and divided into two equal groups. In propofol-fentanyl group (group PF) patients received 0.5–1 mg/kg propofol and 1 μg/kg of fentanyl. Boluses of 20 mg of propofol were given to give a sedation level of 3–4 according to Ramsay sedation score. In dexmedetomidine group (group D), dexmedetomidine 1 μg/kg over 10 min was given as a loading dose, followed by a maintenance infusion of 0.2–0.7 μg/kg/h to keep the same level of sedation. Heart rate, blood pressure and oxygen saturation were recorded.

Results: Heart rate and mean arterial blood pressure values were significantly lower in group D compared to group PF all over the procedure. Group D had higher oxygen saturation values than group PF. Incidence of desaturation was more frequent in PF group (16.66%) compared to 5.55% in group D. There was no significant difference in patient satisfaction between the two groups.

Conclusion: Dexmedetomidine and propofol-fentanyl are effective sedatives for patients undergoing flexible fiberoptic bronchoscopy. The sympatholytic and respiratory stability effects of dexmedetomidine make it an attractive and safe alternative for sedation during FOB.

1. Introduction

Flexible fiberoptic bronchoscopy (FOB) is usually performed by pulmonologist, and is the gold standard for visualizing the airway allowing many diagnostic and therapeutic interventions. The widespread use of the flexible bronchoscope makes

* Address: 8 Ismail Ghanim St., Al-Nozha, Cairo, Egypt. Tel.: +20 1001404426.
E-mail address: randa_shoukry@hotmail.com

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the physicians rising importance on the use of sedation as adjunct to topical anesthesia [1]. Many sedative protocols have been investigated. Midazolam in addition to an opioid is the most common combination used to improve patient tolerance and satisfaction [2]. Using intermittent propofol boluses provides good tolerance and fast recovery for patients undergoing FOB [3]. The addition of opioids may provide antitussive effect, and also they modify the pharmacokinetics of propofol, which decreases the required propofol dose [4,5]. Opioids are frequently used in FOB in combination with benzodiazepines as they provide analgesic, anti-tussive and sedative effects. Alfentanil is ideal for FOB as it has fast onset and short duration [6,7]. Fentanyl is 100 times as potent as morphine with rapid onset and short elimination half-life which makes it suitable for use in bronchoscope [1]. Dexmedetomidine (Precedex™, Dexmedetomidine HCl Injection, Hospira Healthcare Corporation) is a highly selective α2-adrenergic agonist; it has sedative and analgesic properties. Dexmedetomidine does not cause respiratory depression in comparison with other sedatives [8]. It has sympatholytic effect that causes reduction in heart rate and blood pressure, which correlates with reductions in plasma levels of catecholamines [9,10]. These effects make dexmedetomidine an attractive choice for sedation during FOB. This prospective randomized trial was designed to evaluate the clinical efficacy and safety of dexmedetomidine, and to compare it with the combination of propofol-fentanyl for sedation during flexible fiberoptic bronchoscopy.

2. Patients and methods

This prospective randomized study was conducted in Ain-Shams University hospital in a period of nine months. After obtaining approval from department ethical committee, 72 adult patients aged 18–70, ASA I to III scheduled for elective flexible fiberoptic bronchoscopy were studied. FOB was performed for diagnostic purposes, with or without lung biopsy e.g. in patients with a hilar mass or nodule, lung cancer staging, hemoptysis and interstitial lung disease.

Written informed consent was obtained from all patients. Exclusion criteria included patients with oxygenation failure (baseline oxygen saturation 90% or less), bronchial asthma, or had chronic obstructive pulmonary disease with forced expiratory volume in 1 s (FEV1) less than 50% of the predicted. Patients with heart rhythm disturbance, bradycardia (heart rate less than 60 BPM), hypotension (systolic arterial pressure <100 mmHg), untreated coagulopathy, acute myocardial ischemia, chronic or acute intake of any sedative drugs or other α2 agonists, and intubated patients were also excluded. None of the patients received any premedication.

All patients received topical airway anesthesia with lidocaine spray 10% in the oral cavity and injection of lidocaine 2% 8 ml aliquots via the bronchoscope suction port as it was advanced to suppress cough reflex, and this was performed by the bronchoscopist. Fiberoptic bronchoscopy was performed transorally in the supine position. During the procedure, supplementary oxygen via a nasal cannula 3 L/min was given to all patients. Continuous ECG, pulse oximetry and non-invasive blood pressure every 3 min were recorded. Patients were monitored during the procedure and until discharge from the post anesthesia care unit.

Patients were randomly allocated into two equal groups using computer-generated random list, and 72 sealed envelopes were prepared and coded (36 envelopes for each group). In propofol-fentanyl group (group PF), a loading dose 0.5–1 mg/kg of propofol and 1 μg/kg of fentanyl were given to give a sedation level of 3–4 according to Ramsay sedation score (Table 1) [11]. A bolus of 20 mg of propofol was given to maintain the same level of sedation. Propofol boluses administration was based on clinical response. In the Dexmedetomidine group (group D), dexmedetomidine was given at a rate of 1 μg/kg over 10 min as a loading dose, followed by a maintenance infusion rate of 0.2–0.7 μg/kg/h to keep the same level of sedation. In both groups cough, movement or agitation, were considered indicators of inadequate sedation to adjust the rate of dexmedetomidine infusion or give bolus dose of propofol.

Time to start the procedure, defined as the time from giving the sedative drug to the beginning of bronchoscopy was recorded. Changes in mean arterial blood pressure, heart rate, and oxygen saturation were recorded at specific time intervals; before giving the sedation (baseline), after administration of the study drug and until the patient achieved a sedation score of 3 (T1), at the beginning of the procedure, during advancing the bronchoscope through the vocal cords (T2), and every 3 min for three successive times. Incidence of adverse events was recorded and managed as follows: Oxygen desaturation (sat $<$ 90%) was managed by increasing oxygen flow to 6 L/min or jaw support if required. Persistent hypoxia for more than one min necessitated withdrawal of bronchoscope and mask ventilation. If desaturation is not corrected by mask ventilation for more than two minutes endotracheal intubation should be done. Hypotension (systolic BP $<$ 90 mmHg) was managed by IV crystalloids resuscitation. Bradycardia (heart rate $<$ 50 bpm) was treated with IV atropine 0.01 mg/kg. Any other adverse outcomes were reported if happened.

Drug administration was terminated and disconnected from the patient when the bronchoscopist indicated that the procedure was finished. Patients were transferred to the postanesthesia care unit and stayed until fully awake. Once the patients were oriented they were questioned how comfortable/uncomfortable they felt during the procedure, they were asked to rate their level of satisfaction during FOB on a three point scale (satisfied, neutral, or unsatisfied), and this was performed by independent nurse anesthetists blinded to the type of sedation regimen.

2.1. Sample size

In a study carried out by Ryu et al. [12] the incidence of oxygen Desaturation in the PR group (propofol–remifentanil) group

Table 1 Ramsay sedation scale [11].

1	Patient is anxious or agitated
2	Patient is cooperative, oriented and tranquil
3	Patient responds to commands only
4	Patient exhibits brisk response to light glabellar tap or loud auditory stimulus
5	Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus
6	Patient exhibits no response

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