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Original contribution

A comparative study of dexmedetomidine with midazolam and midazolam alone for sedation during elective awake fiberoptic intubation☆

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Abstract

Study Objective: To evaluate the efficacy of dexmedetomidine with midazolam (DEX-MDZ) versus midazolam only (MDZ) for sedation during awake fiberoptic intubation (AFOI).

Design: Randomized, double-blinded study.

Setting: Academic medical center.

Subjects: 55 ASA physical status I, II, III, and IV patients, aged 18-85 years, scheduled for non-emergency surgery with AFOI.

Interventions: All patients received intravenous (IV) glycopyrrolate 0.2 mg premedication, oxygen by nasal cannula, and topical local anesthetics to the airway. MDZ subjects received IV midazolam 0.05 mg/kg with additional doses to achieve a Ramsay Sedation Scale (RSS) score of ≥ 2. DEX-MDZ patients received midazolam 0.02 mg/kg followed by dexmedetomidine one μg/kg, then an infusion of dexmedetomidine 0.1 μg/kg/hr and titrated to 0.7 μg/kg/hr to achieve RSS$\geq$2.

Measurements: Observers' Assessment of Alertness/Sedation (OAA/S) and RSS were evaluated. The anesthesiologist rated AFOI ease of placement. Two observers rated patients' comfort and reaction to placement at three time points: preoxygenation, at introduction of the fiberoptic laryngoscope, and at introduction of the endotracheal tube (ET) before surgery. Following surgery, patients were asked if they recalled the AFOI and also to rate their satisfaction with the intubation.

Results: DEX-MDZ patients were significantly calmer and more cooperative during AFOI and had fewer adverse reactions to AFOI than did the MDZ patients. They also were more satisfied with the AFOI ($P < 0.001$) than were the midazolam-only patients. There were no significant hemodynamic differences between the two subject groups.

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Conclusions: Dexmedetomidine in combination with low doses of midazolam is more effective than midazolam alone for sedation in AFOI.

1. Introduction

Awake fiberoptic intubation (AFOI) is indicated for patients with an anticipated difficult intubation because of their anatomy, airway trauma, morbid obesity, or unstable cervical spine injuries [1]. The term "AFOI" is used to distinguish this procedure from fiberoptic intubation performed during general anesthesia. Although patients may be sedated for AFOI, it is essential that they be responsive and capable of maintaining their airway without assistance. The most common complications of this procedure are hypoxemia and aspiration [2].

Benzodiazepines combined with opioids are commonly used for anxiolysis and/or analgesia during AFOI. Unfortunately, this combination of drugs can cause respiratory depression, placing the patient at risk for hypoxemia and aspiration. In a study of volunteers, Bailey et al reported that the combination of midazolam and fentanyl increased the frequency of hypoxemia in 11 of 12 subjects and produced apnea in 6 of 12 subjects [3].

Dexmedetomidine has not been associated with respiratory depression when used alone, in spite of the deep levels of sedation it can produce [4-6]. Furthermore, dexmedetomidine facilitates a decrease in salivary secretions, which is a desirable effect during fiberoptic intubation [6]. Dexmedetomidine alone has been used for sedation and analgesia in patients with unstable cervical spines who undergo fiberoptic intubation prior to surgery [7]*. Grant et al used dexmedetomidine in three patients without any other sedatives or analgesics [7]. Patients received three different infusion rates ranging from 0.3 to 0.7 μg/kg/hr following a loading dose of one μg/kg over 10 minutes. All patients were sedated without respiratory depression and were able to perform a neurological evaluation after fiberoptic intubation. The effects of dexmedetomidine in decreasing sympathetic activity and providing cooperative sedation without respiratory depression may be beneficial for difficult airway patients undergoing AFOI. Dexmedetomidine injection is currently approved for sedation for up to 24 hours in intubated and mechanically ventilated patients in an intensive care setting.

In this study, a dexmedetomidine-midazolam combination was compared with midazolam alone for sedation during elective oral AFOI in adult patients.

* Zura A, Doyle DJ, Ebrahim Z, Inton M, Benzel E. Use of dexmedetomidine for awake intubation in a patient with an unstable cervical spine [Abstract]. Presented at the 57th Annual Meeting of the New York Postgraduate Assembly, December 12-16, 2003. New York: New York State Society of Anesthesiologists. (www.nyssa-pga.org).

2. Materials and methods

2.1. Experimental procedure

This double-blinded (patient and assessor), randomized comparison study was conducted with the Ohio State University Institutional Review Board approval and written, informed consent. All adult patients undergoing AFOI for non-emergency surgery were potential candidates for this study. Patients were excluded from this study if they were: 1) prisoners, 2) pregnant, 3) mentally ill, 4) under the age of 18 years, 5) known or admitted alcohol or drug abusers, or 6) allergic to the drugs involved in the study.

Patients' vital signs were monitored at one-minute intervals during the entire AFOI procedure. Fifteen minutes before introduction of the fiberoptic scope (the time point designated as FOS) patients were randomly assigned by computer-generated randomization schedule to the midazolam-only (MDZ) group or the dexmedetomidine-midazolam (DEX-MDZ) experimental group. All patients received intravenous (IV) glycopyrrolate 0.2 mg premedication and oxygen by nasal cannula. MDZ subjects received IV midazolam 0.05 mg/kg with additional doses at 0.05 mg/kg given until they were adequately sedated, as defined by a Ramsay Sedation Score (RSS) ≥2. DEX-MDZ patients received midazolam 0.02 mg/kg followed by dexmedetomidine one μg/kg bolus infusion over 15 minutes. DEX-MDZ patients then received an infusion of dexmedetomidine 0.1 μg/kg/hr infusion, which was then titrated up to 0.7 μg/kg/hr until they were adequately sedated (RSS≥2). Topical local anesthetics given were lidocaine 2% solution followed by a 4 mL injection of lidocaine 4% transtracheally.

Observers' Assessment of Alertness/Sedation (OAA/S) [8] and Comfort Scale [9] values were recorded during preoxygenation (Pre-Ox), at FOS, and at introduction of the endotracheal tube (time point designated as ET). Hemodynamics, including heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP), as well as oxygen saturation, were recorded during Pre-Ox, one minute prior to FOS, and then every minute for 5 minutes. These parameters were also recorded beginning one minute prior to ET and then every minute until the endotracheal tube was in place.

The anesthesiologist assessed ease of placement of the fiberoptic scope and endotracheal tube on a scale of 1 to 3, where 1 = easy, 2 = moderate, and 3 = difficult. One of two trained, independent, study-blinded observers (TDM or SDB) assessed patient reaction to placement of the fiberoptic