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Research Article

Efficacy of different dexmedetomidine regimens in producing controlled hypotensive anesthesia during functional endoscopic sinus surgery

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KEYWORDS

Dexmedetomidine;
Hypotensive anesthesia;
Alpha adrenergic agonists;
Nitroglycerin

Abstract *Background:* The study was designed to assess the ability of dexmedetomidine in different regimens to produce controlled hypotensive anesthesia during functional endoscopic sinus surgery in adults and the need to add an additional hypotensive agent in the form of nitroglycerin to achieve the target MAP.

Methods: In this blinded randomized controlled trail, 45 Patients, aged from 18 to 50 years, ASA physical status I and II, underwent endoscopic sinus surgery were enrolled in the study. Before induction of GA, all patients received bolus dexmedetomidine 1 μ/kg iv more than 10 min. After induction, Patients were randomly allocated into three groups, group Dex-0.4, in which patients received dexmedetomidine infusion as 0.4 μg/kg/h, group Dex-0.8, in which patients received dexmedetomidine infusion as 0.8 μg/kg/h and group Dex-P, in which patients received saline infusion. The target MAP was 55–65 mmHg, if not achieved by the infused study drug, nitroglycerin infusion was added in a titrating manner started with 0.1 μg/kg/min and increased gradually till the target MAP is reached. The surgical field quality was assessed by using Fromme et al. bleeding score.

Results: The intraoperative MAP in group Dex-P and group Dex-0.8 was maintained within target range at all time intervals. In group Dex-0.4, the MAP showed fluctuation to fall below and increased above the target range at different time intervals. Unlike the other two groups, no nitroglycerin infusion was needed in group Dex-0.8. Fromme et al. bleeding score showed the lowest values in Dex-0.8 group and the highest values in group Dex-0.4. The differences between the three groups were statistically significant with ($P < 0.05$).

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Conclusion: Dexmedetomidine as bolus 1 μg/kg iv followed by iv infusion of 0.8 μg/kg/h or dexmedetomidine as pre-induction bolus 1 μg/kg iv followed by nitroglycerine iv infusion significantly decreased the mean arterial blood pressure to target values and provide satisfactory field quality.

1. Introduction

Functional endoscopic sinus surgery (FESS) is a minimally invasive procedure and is commonly performed under controlled hypotensive anesthesia [1].

Several pharmaceuticals have been used successfully to produce controlled hypotension during general anesthesia, for example inhalational anesthetics, direct vasodilators (sodium nitroprusside and nitroglycerin), beta adrenergic antagonists (propranolol and esmolol), alpha adrenergic agonists (clonidine and dexmedetomidine), calcium channel blockers, prostaglandin E1 (alprostadil) and adenosine [2] and μ-receptors agonists (remifentanil) [3,4].

Dexmedetomidine is a highly selective α2 adreno-receptor agonist with higher affinity to α2 adreno-receptor than clonidine, and this makes dexmedetomidine primarily sedative and anxiolytic [5]. The elimination half-life of dexmedetomidine ($t_{1/2\beta}$) is 2 h and the redistribution half-life ($T_{1/2\alpha}$) is 6 min, and this short half-life makes it an ideal drug for intravenous titration [6,7].

Several studies proved that intraoperative infusion of dexmedetomidine reduces the perioperative analgesic requirements [8,9], and others studies concluded that dexmedetomidine helps in reducing intraoperative blood pressure and provide satisfactory surgical field conditions [10–12].

The objectives of this prospective randomized controlled trial were to assess the efficacy of dexmedetomidine in different regimens to produce controlled hypotensive anesthesia during functional endoscopic sinus surgery in adults and the need to add an additional hypotensive agent in the form of nitroglycerin to achieve the target MAP. The primary outcome is the intraoperative MAP and the amount needed from an additional hypotensive agent nitroglycerin to achieve the targeted MAP. The secondary outcomes include intraoperative heart rate (HR), consumption of other vasoactive drugs (ephedrine, atropine), intra-operative surgical field quality, duration of recovery, postoperative sedation score and postoperative complications as hemodynamic instability, vomiting, desaturation or bleeding from surgical field.

2. Methodology

This study has been conducted in the of the Department of Anesthesia, ENT operating theater, Cairo University Hospitals through the period from June 2012 to June 2013 after being approved by the Departmental Research and Ethical Committee, and after obtaining informed consents from all patients. 45 Patients, aged from 18 to 50 years, ASA physical status I and II, underwent functional endoscopic sinus surgery were enrolled in the study. Patients with cardiovascular disease (hypertension, congestive heart failure, and coronary artery disease), cerebrovascular insufficiency, coagulation defects, history of renal or hepatic insufficiency, and hypersensitivity to the study drugs were excluded from the study.

On arrival to operating room, no sedation was given, iv line was cited and lactated ringer solution was infused 4–6 ml/kg/h. All patients were monitored with non-invasive blood pressure (BP), electrocardiograph ECG, pulse oximeter (SpO2) before induction of general anesthesia (GA), capnography for end-tidal CO2 ($_{ET}$CO2), radial artery cannula for intra-arterial blood pressure monitoring, and peripheral nerve stimulator (PNS) applied on the ulnar nerve for neuromuscular blockade after induction of GA. All patients received 1μ/kg iv dexmedetomidine bolus dose more than 10 min before induction of GA, then anesthesia was induced with propofol 2 mg/kg iv, fentanyl 1 μg/kg iv and atracurium besylate 0.5 mg/kg iv, when TOF count showed disappearance of T_1 (0/4), endotracheal intubation with appropriate size oral endotracheal tube was accomplished and lungs were mechanically ventilated to maintain the $_{ET}$CO2 30–35 mmHg. Anesthesia was maintained with inspired isoflurane 1.5 vol% and atracurium besylate top up doses 0.1 mg/kg/20–30 min was given guided with TOF count aiming to keep it as 1/4. Airway was secured by oro-pharyngeal packing and patients were positioned supine with head up 30°. Dexamethasone 0.2 mg/kg and metoclopramide 10 mg slowly iv were given as emesis prophylaxis.

Patients then were randomly allocated into three groups, group Dex-0.4, in which the patients received dexmedetomidine 0.4 μg/kg/h as continuous iv infusion at rate of 0.2 ml/kg/h from a prepared dexmedetomidine diluted in saline to a concentration of 2 μg/ml, group Dex-0.8 in which the patients received dexmedetomidine 0.8 μg/kg/h as continuous iv infusion at rate of 0.2 ml/kg/h from a prepared dexmedetomidine diluted in saline to a concentration of 4 μg/ml and group Dex-P (placebo) in which the patients received continuous iv infusion of 0.2 ml/kg/h of normal saline. The continuous iv infusion was maintained all through the procedure and terminated 10 min before termination of surgery and discontinuation of inhaled anesthetics. The syringes of the continuous infusion were prepared by an anesthesiologist who was not involved in data recording and infused through injector pumps with unidentified reservoirs to assure that the observing anesthesiologist remained blinded to the infused drug. The target MAP was 55–65 mmHg, if not achieved by the infused study drug, nitroglycerin infusion was added in a titrating manner started with 0.1 μg/kg/min and increased gradually till the target MAP is reached. If the MAP dropped below 55 mmHg, nitroglycerin infusion was decreased gradually till stopped and if the MAP is still below 55 mmHg, ephedrine 6 mg iv was given and could be repeated after 3 min. Atropine 0.01 mg/kg was given if HR decreased to 50 beat/min.

All patients were operated upon by the same surgeon. Bleeding in the surgical field and the quality of the visibility were assessed subjectively by the surgeon who was blinded to