Journal of Clinical Anesthesia (2006) **18**, 24–28

ELSEVIER

Journal of Clinical Anesthesia

Original contribution

Fentanyl or dexmedetomidine combined with desflurane for bariatric surgery☆

James M. Feld MD, William E. Hoffman PhD*, Martin M. Stechert MD, Ian W. Hoffman BA, Ranga C. Ananda MD

Department of Anesthesiology, University of Illinois at Chicago, Chicago, IL 60612, USA

Received 9 December 2004; accepted 16 May 2005

Keywords:
Obesity;
Fentanyl;
Dexmedetomidine;
Desflurane;
Pain, postoperative;
Morphine

Abstract

Study Objective: Because fentanyl has ventilatory depressing effects, alternative methods for analgesia may be beneficial for management of bariatric surgery. We evaluated whether dexmedetomidine infusion could replace fentanyl for facilitation of open gastric bypass surgery.

Design: Randomized, single blinded, open label.

Setting: University teaching hospital.

Patients: Twenty bariatric patients with an average body mass index of 54 to 61 kg/m^2 undergoing surgery for open gastric bypass.

Interventions: Patients were randomized to receive either fentanyl (0.5-μg/kg bolus, 0.5 $\mu g \cdot kg^{-1} \cdot h^{-1}$, n = 10) or dexmedetomidine (0.5-μg/kg bolus, 0.4 $\mu g \cdot kg^{-1} \cdot h^{-1}$, n = 10) for intraoperative analgesia. In both groups, end-tidal desflurane was adjusted to maintain the bispectral index at 45 to 50.

Measurements: In the operating room, blood pressure and heart rate were measured at 5-minute intervals. Bispectral index and end-tidal desflurane concentration were measured every hour. During recovery in the postanesthesia care unit, patient-evaluated pain scores and morphine use by patient-controlled analgesia pump were determined.

Main Results: During surgery, desflurane concentrations necessary to maintain the bispectral index at 45 to 50 were decreased, and blood pressure and heart rate were lower with in the dexmedetomidine compared with fentanyl group. In the postanesthesia care unit, pain scores and morphine use were decreased in the dexmedetomidine group.

Conclusions: Dexmedetomidine, when used to substitute for fentanyl during gastric bypass surgery, attenuates blood pressure and provides postoperative analgesia.

1. Introduction

Bariatric surgery is on the rise. Anesthetic management of morbidly obese patients poses a challenge to the anesthesiologist [1-3]. Prevalence of a difficult airway, risk for

☆ This study was funded by the Anesthesiology Department, University of Illinois, Chicago.

* Corresponding author. Tel.: +1 312 996 4018; fax: +1 312 996 4019.
E-mail address: whoffman@uic.edu (W.E. Hoffman).

0952-8180/$ – see front matter © 2006 Elsevier Inc. All rights reserved.
doi:10.1016/j.jclinane.2005.05.009

aspiration, pulmonary embolus, and consideration of concomitant disease in morbidly obese patients have been previously described [4-7]. The incidence of obstructive sleep apnea and decreased tissue oxygenation is high in morbidly obese patients, increasing the risk of morbidity and mortality due to inadequate postoperative ventilation [8-10]. Opioid narcotics have ventilatory depressing effects, suggesting that alternative analgesics or sedatives may improve the management of morbidly obese patients [11-13].

Dexmedetomidine is a specific α_2-adrenergic receptor agonist with antinociceptive and sedative properties that has been approved by the Federal Drug Administration for 24-hour sedation in the intensive care unit. Reports indicate that dexmedetomidine decreased anesthetic requirements during surgery, provided postoperative analgesia, and decreased morphine use in the postanesthesia care unit (PACU) [14-16]. In addition, dexmedetomidine alone produced minimal respiratory depression [17,18]. The hypothesis of this pilot study was that dexmedetomidine could be used in place of fentanyl for intraoperative control of blood pressure and heart rate without increasing the need for postoperative pain control in the PACU.

2. Methods

Following University of Illinois at Chicago Institutional Review Board approval for the study, 20 patients (ASA physical status II or III) age 26 to 55 years undergoing open gastric bypass surgery were enrolled by informed signed consent. Pregnant patients and patients with clinically significant brain, cardiac, respiratory, or liver disease were excluded. A preoperative evaluation determined whether the patient had sleep apnea or not. Patients were randomized using a computer-generated random number table to receive either fentanyl (n = 10) or dexmedetomidine (n = 10) for facilitation of intraoperative anesthesia. Patients and investigators recording data in the operating room were blinded to the treatment with either fentanyl or dexmedetomidine but the anesthesiologist was aware of the treatment condition. The same surgeon performed all of the surgeries.

All drug doses were determined according to true patient weight. All patients were sedated with midazolam, 2-mg intravenous bolus. In the operating room, monitoring included noninvasive blood pressure, electrocardiography, pulse oximetry, and processed electroencephalography using the bispectral index (BIS). In the fentanyl group, anesthesia was induced with fentanyl (0.5 μg/kg), lidocaine (100 mg), thiopental (1-4 mg/kg), and succinylcholine (0.6 mg/kg). Anesthesia was maintained with fentanyl infusion (0.5 $\mu g \cdot kg^{-1} \cdot h^{-1}$), consistent with previous dosing [19]. End-tidal desflurane concentration was adjusted to maintain the BIS at 45 to 50 during surgery. In the second group, dexmedetomidine (0.5 μg/kg) was given intravenously over 10 minutes to facilitate sedation with midazolam. A dose of up to 1 μg/kg dexmedetomidine is indicated for sedation in the package insert. In the operating room, anesthesia was induced with lidocaine (100 mg), thiopental (1-4 mg/kg), and succinylcholine (0.6 mg/kg); dexmedetomidine was infused at a rate of 0.4 $\mu g \cdot kg^{-1} \cdot h^{-1}$ as indicated in the package insert; and end-tidal desflurane was given to produce a BIS of 45 to 50 for maintenance of anesthesia. The thiopental dose required for anesthesia was determined in each patient. The infusion of both fentanyl and dexmedetomidine was completed at the end of surgery. All patients in both groups were mechanically ventilated with a positive end-expiratory pressure of 10 cm H_2O and all received a total volume infusion of 6 L of Ringer's lactate solution during anesthesia.

An open gastric bypass was performed using a Roux-en-Y procedure [20,21]. The desired volume of the gastric pouch was 30 to 45 mL. At the end of surgery, anesthesia was maintained at a constant level during closing of the laparotomy until the last stitch was completed. Desflurane was then turned off and the time to extubation was recorded. Mean blood pressure, heart rate, and end-tidal desflurane were determined every 5 minutes during surgery and total time of anesthesia was recorded.

In the postoperative care unit, subjective patient pain scores were obtained with a scale from 0 to 10 with 0 = no pain and 10 = worst pain at 1 and 2 hours and blood pressure and heart rate at 1 hour of recovery by a nurse blinded to the treatment procedure. Morphine use by patient-controlled analgesia (PCA) pump was recorded after 120 minutes in the PACU.

2.1. Statistics

Data are reported as mean ± SD for parametric data or median with a 25% and a 75% range for nonparametric data. Blood pressure and heart rate were determined every 5 minutes and compared between the fentanyl and dexmedetomidine groups over the 3-hour anesthetic period using an analysis of variance. Parametric patient data were compared between groups by Student *t* test, with a

Table 1 Patient age, weight, height, body mass index, sex, ASA physical status, mean blood pressure, and heart rate before anesthesia

	Fentanyl (n = 10)	Dexmedetomidine (n = 10)
Age (y)	39 ± 6	40 ± 8
Weight (kg)	159 ± 27	175 ± 49
Height (cm)	152 ± 8	152 ± 13
BMI (kg/m^2)	54.4 ± 6.8	61.0 ± 12.6
Sex (M/F)	3:7	4:6
ASA (PS)	II (6), III (4)	II (6), III (4)
MAP (mm Hg)	94 ± 13	96 ± 13
HR (min^{-1})	87 ± 10	83 ± 13

Data are reported as mean ± SD. ASA (PS) indicates ASA physical status with number of patients in parenthesis; BMI, body mass index; MAP, mean arterial pressure; HR, heart rate.