Dexmedetomidine-fentanyl Compared With Midazolam-fentanyl for Conscious Sedation in Patients Undergoing Lumbar Disc Surgery

Ke Peng, MS; Hua-yue Liu, MS; Si-lan Liu, MD; and Fu-hai Ji, MD

Department of Anesthesiology, First Affiliated Hospital of Soochow University, Suzhou, China

ABSTRACT

Purpose: Patients undergoing awake lumbar disc surgery need adequate sedation and analgesia. This study investigated whether use of a dexmedetomidine-fentanyl (DF) regimen could be superior to midazolam-fentanyl (MF) for these patients.

Methods: Sixty patients scheduled for elective lumbar laminotomy and discectomy were randomly assigned to receive either DF or MF for conscious sedation. Patient-controlled intravenous analgesia with fentanyl was used for postoperative pain management. Hemodynamic and respiratory changes, sedation scores, pain scores, fentanyl consumption, patient satisfaction, postoperative hospital stay, and adverse events were assessed.

Findings: The patient and surgical characteristics, sedation levels, and pain scores were similar in the 2 groups. Compared with the MF group, heart rate was lower in the DF group at six time points from skin incision to 15 minutes in the postanesthesia care unit (PACU), they are skin incision, 15 min after the beginning of surgery, 30 min after the beginning of surgery, skin closure, entering PACU, and 15 min in PACU ($P = 0.016$, 0.002, 0.000, 0.000, 0.000, and 0.001, respectively), whereas pulse oxygen saturation was higher at 3 time points from 15 minutes after the beginning of surgery to skin closure ($P = 0.022$, 0.026, and 0.025, respectively). The intraoperative, postoperative, and total consumption of fentanyl were lower in the DF group (total: mean difference = –69.3 μg; 95% CI, = –114.3 to –24.4; $P = 0.003$). No significant differences were found for adverse events, postoperative hospital stay, or satisfaction between the 2 groups.

Implications: Although awake lumbar disc surgery can be performed successfully under sedation with either MF or DF combination, the latter may be a better alternative because of less consumption of opioid analgesics. ChiCTR.org identifier: ChiCTR-TRC-13003645. (*Clin Ther.* 2016;38:192–201) © 2016 Elsevier HS Journals, Inc. All rights reserved.

Key words: analgesia, dexmedetomidine, discectomy, laminotomy, midazolam, sedation.

INTRODUCTION

Lumbar laminotomy and discectomy are the most common surgical procedures performed for patients with back pain and leg symptoms because of intervertebral disc herniation.[1] Although general, spinal, and epidural anesthesia techniques are all suitable, local anesthesia with conscious sedation is preferred by many practitioners because of the advantages of motor and sensory testing and immediate patient feedback during operation.[2,3] Patients under regional or local anesthesia may also benefit from their ability to position themselves to avoid nerve injury to the brachial plexus and pressure to the face and chest. Conscious sedation is usually provided with the combination of an opioid analgesic and a benzodiazepine.[4] Midazolam is most frequently used as the sedation agent for conscious sedation, but respiratory depression, unexpected paradoxical responses, and occasional cardiopulmonary complications may occur during its administration.[5,6]

Dexmedetomidine, a highly selective α_2 adrenoceptor agonist, provides sedation, anxiolysis, and analgesia with minimal effects on respiratory physiology.[7–9] Previous studies reported that dexmedetomidine was an effective sedative agent in the intensive care unit or during surgery under local anesthesia.[10–12]

Accepted for publication November 21, 2015.
http://dx.doi.org/10.1016/j.clinthera.2015.11.016
0149-2918/$ - see front matter

In addition, recent systematic reviews found that dexmedetomidine could reduce opioid requirements and potentiate analgesia.[13–15] However, few studies have reported the clinical use of dexmedetomidine in conscious sedation for awake lumbar disc surgery.[16] Therefore, the present study aimed to explore whether the combination of dexmedetomidine-fentanyl (DF) would provide better sedation and analgesia for patients undergoing awake lumbar disc surgery than a midazolam-fentanyl (MF) regimen, with the primary outcome of intraoperative and postoperative consumption of opioid analgesics.

METHODS

Patients

The protocol of this randomized, double-blind, controlled study was approved by the institutional review board for human subjects and registered at www.chictr.org as ChiCTR-TRC-13003645. All participants gave their written informed consent. Patients between the ages of 18 and 65 years with an American Society of Anesthesiologists (ASA) classification of I to II, who were scheduled for elective lumbar laminotomy and discectomy under local anesthesia and conscious sedation, were eligible for inclusion in this study. The exclusion criteria were known allergies to medications used, an ASA classification of III or more, body mass index >35 or <15 kg/m^2, asthma, sleep apnea syndrome, evidence of heart block, ischemic heart disease, major renal or liver diseases (known renal or hepatic disease with serum albumin concentration <30 g/L or creatinine >120 μmol/L), long-term use of opioids or benzodiazepine, alcohol abuse, pregnancy, and patient refusal. Patients were informed preoperatively about the use of verbal rating scale for pain (VRS; 0–10, where 0 represented no pain and 10 indicated the worst pain imaginable) and the use of a patient-controlled analgesia (PCA) device for postoperative pain management.

A computer-generated randomization table was used to assign the patients to either the DF group or the MF group. The randomization was performed by a statistician who was unaware of the clinical nature of the study. An independent anesthesiologist who was not involved in the study prepared the study medications according to the random-generated sequence. The dexmedetomidine was diluted with saline to a final concentration of 4 μg/mL, and the midazolam was diluted to 0.4 mg/mL. All patients, anesthesiologists, surgeons, and postoperative observers were blind to the group allocation.

Perioperative Management

No premedication was given. Oxygen was administered at 2 L/min via nasal cannula throughout the procedure. All patients were placed in the right lateral position. Standard monitoring included pulse oximetry (S_pO_2), electrocardiogram, and noninvasive blood pressure. Each patient received an intravenous bolus dose of 1 μg/kg fentanyl combined with either 0.5 μg/kg dexmedetomidine (DF group) or 0.05 mg/kg midazolam (MF group) for 10 minutes, followed by a continuous infusion with either 0.5 μg/kg/h dexmedetomidine (DF group) or 0.05 mg/kg/h midazolam (MF group) until the end of the surgery. Increases or decreases of 0.1 μg/kg/h dexmedetomidine or 0.01 mg/kg/h midazolam could be repeated to maintain a Ramsay Sedation Scale score of 3 to 4 (full sedation).[17] After full sedation was accomplished, local anesthesia was provided with 2% lidocaine by the surgeons. Additional 0.5-μg/kg boluses of fentanyl were available for rescue analgesia intraoperatively. During surgery, motor and sensory testing was performed to get immediate feedback from the patients when needed.

Desaturation (oxygen saturation $<90\%$) or respiratory depression (respiratory rate ≤ 10 breaths/min) was treated with supplemental oxygen (5–10 L/min), verbal stimuli, and jaw extension. Endotracheal intubation and mechanical ventilation were available if necessary. Ephedrine (5 mg) or phenylephrine (50 μg) was administered to treat hypotension (systolic blood pressure [SBP] <90 mm Hg or mean blood pressure <65 mm Hg). Bradycardia (heart rate [HR] <40 beats/min) was treated with 0.5-mg boluses of atropine.

After the operation, all patients were transferred to the postanesthesia care unit (PACU). They were monitored and received nasal oxygen supplementation until the modified Aldrete postanesthesia recovery score reached ≥ 9 (full recovery).[18] The PCA device was set to deliver fentanyl boluses of 10 μg with a lockout interval of 5 minutes for 24 hours (in the PACU and in the ward). Patients were encouraged to push the demand button when they experienced pain and to repeat until they felt pain relief. Flurbiprofen axetil (50 mg) was administered as an additional analgesic if the pain scores remained >4 for