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Efficacy of intraoperative dexmedetomidine infusion on emergence agitation and quality of recovery after nasal surgery

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Editor's key points

- Intraoperative continuous dexmedetomidine infusion (0.4 μg kg^{-1} h^{-1}) until extubation was effective in reducing the incidence of emergence agitation after nasal surgery.
- No delay of extubation or increasing incidence of other complications was observed after dexmedetomidine infusion.
- Use of dexmedetomidine produced more stable haemodynamic changes during extubation and enhanced patient-reported global quality of recovery at 24 h after surgery.

Background. Emergence agitation is common after nasal surgery. We investigated the effects of intraoperative dexmedetomidine infusion on emergence agitation and quality of recovery after nasal surgery in adult patients.

Methods. One hundred patients undergoing nasal surgery were randomized into two groups. The dexmedetomidine group (Group D, n=50) received dexmedetomidine infusion at a rate of 0.4 μg kg^{-1} h^{-1} from induction of anaesthesia until extubation, while the control group (Group C, n=50) received volume-matched normal saline infusion as placebo. Propofol (1.5–2 mg kg^{-1}) and fentanyl (1 μg kg^{-1}) were used for induction of anaesthesia, and desflurane was used for maintenance of anaesthesia. The incidence of agitation, haemodynamic parameters, and recovery characteristics were evaluated during emergence. A 40-item quality-of-recovery questionnaire (QoR-40) was provided to patients 24 h after surgery.

Results. The incidence of agitation was lower in Group D than Group C (28 *vs* 52%, P=0.014). Mean arterial pressure and heart rate were more stable in Group D than in Group C during emergence (P<0.05). Time to extubation, bispectral index, and respiratory rate at extubation were similar between the groups. Global QoR-40 score at 24 h after surgery was higher in Group D (median [range], 183 [146 –198]) compared with Group C (178 [133–196]) (P=0.041).

Conclusions. Intraoperative infusion of dexmedetomidine provided smooth and haemodynamically stable emergence. It also improved quality of recovery after nasal surgery.

Keywords: anaesthesia, general; complications, extubation trachea; pharmacology, dexmedetomidine; recovery, postoperative

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Emergence agitation from general anaesthesia may lead to self-extubation or removal of catheters, which can cause serious complications such as hypoxia, aspiration pneumonia, bleeding or reoperation.[1] Ear, nose, and throat (ENT) surgery is associated with a higher incidence of emergence agitation.[2] After nasal surgery, awake extubation is preferred because the airway is contaminated by blood, and the nasal airway is blocked with surgical packs.[3] However, awake extubation may intensify emergence agitation.

Dexmedetomidine is a selective α_2-receptor agonist and has sympatholytic, analgesic, and sedative properties.[4] Infusion of dexmedetomidine reduces agitation from general anaesthesia in children[5 6] and from ventilator weaning in ICU patients.[7 8] However, the data related to the effects of dexmedetomidine on reducing agitation from general anaesthesia in adults are limited. Perioperative use of dexmedetomidine also decreases postoperative opioid consumption, pain intensity, and antiemetic therapy.[9–12] In addition, it has been revealed that intraoperative dexmedetomidine infusion reduces stress response and therefore improves quality of recovery after major spinal surgery.[13]

In this randomized, double blind, placebo-controlled study, we hypothesized that intraoperative use of dexmedetomidine until extubation would reduce emergence agitation in adult patients undergoing nasal surgery. Furthermore, we evaluated the effects of dexmedetomidine on quality of recovery after nasal surgery.

Methods

This study was approved by the Internal Review Board of Yonsei University Medical Center and was registered at

http://clinicaltrials.gov (registration number NCT01513772). Between February 2012 and August 2012, we enrolled 100 consecutive patients, aged 20–58 yr and ASA class I–II, who underwent general anaesthesia for elective nasal surgery in which nasal packing on each side was used until 24 h after surgery. Written informed consent was obtained from all patients before randomization. Patients were not admitted to the study if any of the following criteria were present: known or suspected allergy to α_2-adrenergic agonist or non-steroidal anti-inflammatory drugs; use of monoamine oxidase inhibitors or adrenergic blocking drugs; history of uncontrolled hypertension; heart block greater than first degree; cognitive impairment; chronic use of antipsychotic medications; kidney or liver disease; and body mass index $\geq$30 kg m^{-2}.

Patients were randomly assigned into two groups by computer-generated random numbers. The dexmedetomidine group (Group D, n=50) received dexmedetomidine (Precedex® 100 μg ml^{-1}, Hospira, Inc., Rocky Mount, IL, USA) at a rate of 0.4 μg kg^{-1} h^{-1} from induction of anaesthesia until extubation, while the control group (Group C, n=50) received volume-matched normal saline infusion as placebo. Dexmedetomidine was diluted with normal saline to a concentration of 4 μg ml^{-1} in 50 ml. Dexmedetomidine or normal saline was prepared by an anaesthetist who did not participate in data collection. The investigator, attending anaesthetist, surgeons, recovery, ward nurses, and patients were blinded to group assignment.

All patients were premedicated with i.m. midazolam 0.04 mg kg^{-1} 30 min before induction of anaesthesia. Just before induction of anaesthesia, patients were given i.v. glycopyrrolate 0.1 mg. Routine monitors, including electrocardiogram, pulse oxygen saturation (Sp_{O_2}), non-invasive arterial pressure, and end-tidal CO_2 (E'_{CO_2}) were applied and monitored at 5-min intervals. General anaesthesia was induced by combined use of fentanyl 1 μg kg^{-1} and propofol 1.5–2 mg kg^{-1}, after loading 4 ml kg^{-1} of crystalloid solution. After the administration of rocuronium bromide 0.6–0.8 mg kg^{-1}, orotracheal intubation was performed using a 6.5- and 7.5-mm tracheal tube for women and men, respectively. Mechanical ventilation was maintained with an 8 ml kg^{-1} tidal volume, and ventilation frequency was adjusted to maintain E'_{CO_2} between 4.6–5.3 kPa in 50% O_2/air. Maintenance of anaesthesia was done with desflurane, which was regulated 0.6–1.4 age-adjusted minimal alveolar concentration (MAC) in order to maintain either bispectral index (BIS; A-2000™ SP, Aspect Medical System, Norwood, MA, USA) value of 40–60 or minimum bleeding in the operation field. Bradycardia [heart rate (HR) <40 beats min^{-1}] was treated with i.v. atropine 0.5 mg. Tachycardia (HR>110 beats min^{-1}) was treated with i.v. esmolol in 10 mg increments. Hypotension [mean arterial pressure (MAP) <60 mm Hg] was treated with i.v. ephedrine at 6 mg increments. At the time of nasal packing, i.v. ketorolac 30 mg was administered to both groups.

Once the surgery was complete, oral suction was performed, and reversal agents (glycopyrrolate 0.004 mg kg^{-1} and neostigmine 0.02 mg kg^{-1}) were given after confirming the return of neuromuscular function using train-of-four peripheral nerve stimulation. Following these steps, desflurane was turned off (defined as 'time zero' in the emergence process) in both groups, and mechanical ventilation was then converted to manual ventilation with 100% oxygen at 8 litre min^{-1}. The patients were not disturbed, except by continual verbal requests to open their eyes. All other stimuli were prevented. Extubation was performed when patients began breathing spontaneously and were able to respond to verbal requests with a BIS value of >70. After extubation, dexmedetomidine, or saline was stopped.

Emergence is defined as the time interval from 'time zero' to 2 min after extubation. During emergence, the level of agitation was evaluated using the Ricker sedation-agitation scale,[14] and each patient's maximum agitation score was recorded: 1=minimal or no response to noxious stimuli; 2=arouse to physical stimuli but dose not communicate; 3=difficult to arouse but awakens to verbal stimuli or gentle shaking; 4=calm and follows commands; 5=anxious or physically agitated and calms to verbal instructions; 6=requiring restraint and frequent verbal reminding of limits; and 7=pulling at tracheal tube, trying to remove catheters or striking at staff. Emergence agitation was defined as any score on the sedation-agitation scale ≥5. Dangerous agitation was defined as a sedation-agitation scale score=7.[1 14]

Grade of cough during emergence was assessed using a four-point scale (0=no cough; 1=single cough; 2=persistent cough lasting <5 s; and 3=persistent cough lasting ≥5 s or bucking). The length of the period from 'time zero' to first verbal response and extubation were recorded. Respiratory rate and BIS at the time of extubation were measured. HR and MAP were recorded before induction of anaesthesia, 10 min after the start of operation, 30 min after the start of operation, at the end of operation, at extubation, and 2 min after extubation. Desaturation (Sp_{O_2}<90%), laryngospasm and other complications were recorded during emergence.

In the post-anaesthetic care unit (PACU), residual sedation (sedation-agitation scale score ≤3 at arrival in PACU), score on an 11-point numerical rating scale (NRS) for pain (0=no pain and 10=worst pain imaginable), and score on a four-point nausea and vomiting scale (0=no nausea; 1=mild nausea; 2=severe nausea requiring antiemetics; and 3=retching, vomiting, or both) were evaluated. When NRS was ≥5 or if patients requested analgesics, additional injections of fentanyl 1 μg kg^{-1} were given. If a patient's score on the nausea and vomiting scale was ≥2, i.v. ondansetron 4 mg was given. Patients were discharged from the PACU when their Aldrete score was ≥9.[15]

The quality of recovery was assessed 24 h after surgery using a 40-item quality-of-recovery questionnaire (QoR-40).[16] Five dimensions of recovery are included within the QoR-40: emotional state (9 items), physical comfort (12 items), psychological support (7 items), physical independence (5 items), and pain (7 items). Each item is graded on a five-point score, and global scores range from 40 (extremely poor quality of recovery) to 200 (excellent quality of recovery).