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Research Article

Intravenous dexmedetomidine infusion in adult patients undergoing open nephrolithotomy: Effects on intraoperative hemodynamics and blood loss; a randomized controlled trial

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KEYWORDS

Dexmedetomidine;
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Abstract *Objective:* The aim of this study was to evaluate the effect of intravenous infusion of dexmedetomidine on intraoperative hemodynamics and blood loss during open nephrolithotomy under general anesthesia in adult patients.
Method: 50 male and female patients, ASA physical status I and II aged 20–60 years old scheduled for open nephrolithotomy under general anesthesia were randomly allocated into two equal groups:
Group D (n = 25): received a bolus dose of IV dexmedetomidine.
1 μg/kg over 10 min before induction of anesthesia and then IV infusion of 0.1–0.5 μg/kg/h guided by the hemodynamics.
Group P (n = 25): received a bolus dose of 10 ml Ringer lactate solution before induction of anesthesia, and infusion was continued during surgery.
General anesthesia was induced in all patients using fentanyl, propofol and atracurium. The following parameters were recorded: heart rate and systolic and diastolic arterial blood pressure: before and after induction of anesthesia and then every 15 min intraoperatively, volume of blood loss (ml), laboratory hemoglobin % and hematocrit concentration: preoperative, intraoperative and immediate postoperative and number of the transfused units of PRBCs.
Results: Intraoperative heart rate and systolic and diastolic arterial blood pressure were statistically significantly lower in group D than in group P. The intraoperative blood volume lost was statistically significantly higher in group P than in group D. A number of the transfused units of PRBCs, intraoperative and postoperative hemoglobin % and hematocrit concentration were statistically significantly lower in group P than in group D.

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Conclusion: Dexmedetomidine infusion in patients undergoing open nephrolithotomy under general anesthesia was associated with intraoperative hemodynamic stability, which decreases intraoperative blood loss and the need for intraoperative blood transfusion.

1. Introduction

Dexmedetomidine is an selective α-2 agonist with sedative, analgesic, sympatholytic cardiovascular effects, and it provided hemodynamic stability without causing respiratory depression [1,2].

Previous studies showed that dexmedetomidine decreases skin bleeding in animals, as it causes peripheral vasoconstriction, which resulted in minimal bleeding with skin incision and intraoperatively [3].

Renal stones is a common disease [4], and open surgery for renal stones is associated with blood loss which may be in large amount due to the high vascularity of the kidneys as it received 20% of the cardiac output or due to prolonged surgical time if the stone is large, thus increasing the blood loss [5] and the need for blood transfusion. A study by Khalaf et al. [6] showed that primary or secondary hemorrhage occurred in 186 patients (35%).

The decision to intraoperative blood transfusion must balance the known risks of blood transfusion with the need to provide adequate tissue oxygenation [7].

We hypothesized that intravenous infusion of dexmedetomidine in adult patients undergoing open nephrolithotomy under general anesthesia may provide better intraoperative hemodynamics, reducing bleeding and the need for blood transfusion.

The aim of this prospective randomized double-blinded controlled study was to evaluate the effect of intravenous dexmedetomidine infusion on intraoperative hemodynamics and blood loss in adult patients undergoing open nephrolithotomy under general anesthesia.

2. Patients and methods

After the approval of the ethical committee of Faculty of Medicine, Beni Suef University (FMBUS REC, Egypt), the study was registered at www.AZNCTR clinical trial registry, with registration number ACTRN12614000389606, and written informed consents were obtained from 50 patients' ASA physical status I and II, males and females aged 20–60 years old, scheduled for elective open nephrolithotomy under general anesthesia from April 2014 to November 2014.

Patients were excluded if they were ASA more than II, had a known cardiac arrhythmias, significant coagulopathy defined as (INR > 1.5), use of antiplatelet or anticoagulants, anemic patients with Hb% less than 10 g/dl.

In the operating room, two wide bore peripheral intravenous cannulae were inserted, and monitors were connected including electrocardiogram, pulse oximetry, noninvasive arterial blood pressure cuff at 5 min intervals and BIS monitor strip (BIS Sensor®; Aspect Medical Systems, USA, Toll free 1-888-BIS Index).

The study drugs were prepared by a senior anesthesia resident unaware of the study protocol.

When patients arrived to the operating theater, they were randomly assigned to one of two equally divided groups using a closed envelop technique ($n = 25$ each):

Group D: received in a separate cannula a bolus dose of dexmedetomidine (*Precedex*, *dexmedetomidine HCl injection*, 200 μg/2 ml), 1 μg/kg over 10 min before induction of anesthesia and then IV infusion of 0.1–0.5 μg/kg/h guided by the hemodynamics.

Group P: received a bolus dose of 10 ml Ringer lactate solution before induction of anesthesia and then continuous infusion till the end of the operation.

General anesthesia was induced, after preoxygenation for 3–5 min with 100% oxygen by face mask, using IV fentanyl 2 μg/kg, propofol 2 mg/kg, atracurium (0.5 mg/kg) and ventilated manually with sevoflurane 2%, oxygen 100% via a face mask, intubation with oral cuffed endotracheal tube when the BIS value reached (40–60) which indicate optimal hypnotic state [8], anesthesia was maintained with oxygen 100%, sevoflurane (according to the depth of anesthesia guided by BIS to be between 40% and 60%), muscle relaxation was maintained by additional doses of atracurium, guided by peripheral nerve stimulator (Life-Tech EZ stim II), mechanical ventilation with maintenance of end tidal carbon dioxide 36–40 mmHg. Hypotension is defined as systolic blood pressure less than 90 mmHg and it was treated by decreasing the dexmedetomidine infusion rate and/or sevoflurane concentration and ephedrine in 3 mg IV increments if needed, and bradycardia is defined as heart rate less than 60 beats per minute and was managed by decreasing the dexmedetomidine dose in D group or atropine 0.5 mg IV if needed.

At the end of surgery, 0.25% bupivacaine was injected by the surgeon at the surgical wound, neuromuscular blockade was reversed with IV neostigmine 0.04 mg/kg and atropine 0.02 mg/kg, the trachea was extubated when the patient responds to commands, and all patients were transferred to PACU, where they received oxygen via face mask for 3–4 L/min and were monitored.

The following parameters were evaluated and recorded by senior anesthesia resident unaware of the study protocol:

1. *Patient's characteristics*: age, sex, height, weight, ASA physical status and duration of surgery.
2. *Heart rate and systolic and diastolic arterial blood pressure (primary outcomes)*: before and after induction of anesthesia and then every 15 min intraoperatively.

Secondary outcomes:

3. *Volume of blood loss (ml)*: in the surgical swabs and suction bottle.
4. *Hemoglobin % and hematocrit concentration*: preoperative, intraoperative and immediate postoperative.
5. Number of the transfused units of PRBCs.