Egyptian Journal of Anaesthesia (2015) **31**, 309–314

HOSTED BY

ELSEVIER

Egyptian Society of Anesthesiologists

Egyptian Journal of Anaesthesia

www.elsevier.com/locate/egja
www.sciencedirect.com

Research Article

Comparative study of intra-articular dexmedetomidine versus ketamine as adjuvant analgesics after knee arthroscopy

Ahmed M. ELbadawy *, **Atef K. Salama, Molham M. Mohammad**

Cairo University, Egypt

Received 5 February 2015; revised 24 April 2015; accepted 9 May 2015
Available online 30 July 2015

KEYWORDS

Knee arthroscopy;
Dexmedetomidine;
Ketamine;
Postoperative pain;
Intra-articular

Abstract *Background:* Knee arthroscopy is one of the day case procedures which may be diagnostic or therapeutic. Postoperative analgesia is important for early ambulation and short hospital stay. This prospective randomized study was designed to compare the analgesic effect of intra-articular dexmedetomidine versus ketamine as adjuvant to bupivacaine following knee arthroscopy.
Method: 75 patients ASA physical status I and II undergoing knee arthroscopy under general anesthesia were included in this study. Patients were divided into three groups according to intra-articular injected combination at the end of the arthroscopy. Group B/D received 25 ml 0.25% bupivacaine and dexmedetomidine 1 μg/kg, group B/K received 25 ml 0.25% bupivacaine and ketamine 1 mg/kg, and control group B received 25 ml 0.25% bupivacaine only. Postoperative pain using visual analogue score (VAS), the time to the first postoperative analgesic request, the total dose of postoperative analgesia during the first 24 h, and possible side effects were recorded.
Results: Visual analogue score (VAS) was significantly less in B/D group in comparison with B/K group after the 1st hour and thereafter. Also VAS was higher in B group compared to the other two groups ($P < 0.05$). Time to first postoperative analgesic request was longer in the B/D group (479.2 ± 34.9 min) than in B/K group (356.7 ± 39.2 min), but in both groups it was longer than in B group (312.4 ± 18.8 min), ($P < 0.05$).
The total dose of postoperative analgesia (paracetamol consumption) during the first 24 h was significantly low in B/D group (758.0 ± 153.0 mg) compared to both B/K and B groups (1041.2 ± 178.6 mg and 1368.0 ± 227.2 mg) respectively ($P < 0.05$).
Conclusion: Intra-articular bupivacaine/dexmedetomidine provides better analgesia compared to bupivacaine/ketamine and both are superior to bupivacaine alone following knee arthroscopy.

* Corresponding author at: Faculty of medicine, Cairo university, 5 Heliopolis rock compound-Sheraton Heliopolis, Cairo, Egypt. Tel.: +20 1064249076.

Peer review under responsibility of Egyptian Society of Anesthesiologists.

http://dx.doi.org/10.1016/j.egja.2015.05.003

1. Introduction

Knee arthroscopy is a minimally invasive day case procedure which may be done for diagnosis, meniscectomy or debridement. Arthroscopic surgery is associated with a variable degree of postoperative pain, which is caused by an irritation of free nerve endings of the synovial tissue, anterior fat pad, and joint capsule due to surgical excision and resection [1]. Postoperative pain control is very important for early rehabilitation and short hospital stay. Several postoperative analgesic modalities were tried such as systemic drugs, central or peripheral nerve blocks and intra-articular injections aiming at reaching the ideal technique for postoperative pain control [2]. Many studies were done using different intra-articular agents as local anesthetics, opioids, ketamine, NSAIDS and α2-adrenergic agonists for prevention and treatment of pain after knee surgeries [3]. Dexmedetomidine is a potent and highly selective α2-adrenoreceptor agonist. It has sedative-hypnotic, anxiolytic, analgesic, anesthetic and sympatholytic effects [4].

Intra-articular dexmedetomidine was used in several studies to enhance postoperative analgesia after knee arthroscopy with an increased time to first analgesic request and a decreased need for postoperative analgesia [2]. Ketamine has been introduced into clinical practice for nearly 46 years, with the objective to act as an anesthetic substance with analgesia, amnesia, unconsciousness, and immobility properties. Ketamine has been found to interact with a number of receptors such as opioids, muscarinic and N-methyl-D-aspartate receptors (NMDAr) [5].

Although central NMDAr, especially when located in the spinal cord have received a great deal of attention, recent evidence suggests that NMDAr located in peripheral somatic and visceral pain pathways play an important role in nociception [6]. NMDAr have been found to exist in joints, as demonstrated in the rat model by Yu et al. [7].

The intra-articular application of ketamine after arthroscopic knee surgery leads to a significant decrease of postoperative analgesic demand and decreases patients' subjective level of pain compared to intra-articular application of bupivacaine or placebo [8]. However, there is no study comparing the effect of intra-articular dexmedetomidine versus ketamine. The aim of this prospective randomized study was to evaluate the effect of adding dexmedetomidine versus ketamine as adjuvant to intra-articular bupivacaine for postoperative analgesia after knee arthroscopy.

2. Patients and methods

2.1. Study design

This is a randomized parallel-group controlled study with allocation ratio (1:1:1) was done in orthopedic theater in Kasr Alaini hospital in the period between October 2013 and August 2014 after approval of ethics committee and obtaining written informed consent from all patients. Patients recruited in this study were scheduled to knee arthroscopy under general anesthesia to evaluate the postoperative analgesic effect of intra-articular dexmedetomidine versus ketamine as adjuvant to bupivacaine in comparison with bupivacaine alone.

2.2. Patient

75 patients aged 20–50 years of both sexes, ASA physical status I–II were enrolled in this study. Fig. 1 shows a flowchart of participants in the study. Patients with history of cardiac, hepatic, renal diseases, and hypertension treated with ß-adrenergic blockers, α-2-adrenergic agonists, α-methyldopa, or known allergy to the used drugs were excluded.

In the preparation room under local anesthesia intravenous cannula was inserted, midazolam 2 mg and ranitidine 50 mg were given to all patients. Then patient was transferred to the operating room, standard monitors were applied (noninvasive blood pressure, pulse oximetry, electrocardiogram) and capnography after induction of anesthesia.

General anesthesia was induced with Propofol 2 mg/kg and fentanyl 2 μg/kg, endotracheal intubation was facilitated with atracurium 0.5 mg/kg, mechanical ventilation was adjusted to keep the end tidal carbon dioxide between 30–35 mmHg and anesthesia was maintained with 50% O2, 50% Air and isoflurane 1–1.5% with topup doses of atracurium 0.15 mg/kg every 20 min. Surgical pneumatic tourniquet was applied to the thigh during the procedure till 15 min after intra-articular injection. Patients were randomly assigned into one of three groups (25 patients each). Randomization was done using Computer-generated random numbers inserted into opaque concealed envelopes; inside these envelopes was a number, which indicates the group to which the patient was allocated. Group (B) received intra-articular injection of 25 ml 0.25% bupivacaine only and considered as the control group, group (B/D) received intra-articular injection of combination of 25 ml 0.25% bupivacaine and dexmedetomidine 1 mcg/kg, and group (B/K) received intra-articular injection of combination of 25 ml 0.25% bupivacaine and ketamine 1 mg/kg. The study drugs were injected by the surgeon through the arthroscopy port at the end of the procedure (Neither the surgeon and the anesthesiologist nor the nurse looking after the patient postoperatively was aware of the randomization sequence or the content of the injected drugs), and if a drain was inserted it was closed for one hour. At the end of the surgery isoflurane inhalation was stopped and 100% O2 was inhaled. The neuromuscular block was reversed with neostigmine (0.05 mg/kg) and atropine (0.02 mg/kg), and then tracheal extubation was done after complete recovery of the patient with sufficient muscle power.

The use of the 10 cm Visual Analogue Scale (VAS) for pain was explained to all patients preoperatively (0 = no pain to 10 = the worst pain). The primary outcome of the study was the duration of postoperative analgesia guided by the pain score. Secondary outcome variables were the total paracetamol consumption and the requirement of meperidine rescue analgesia between the study groups.

VAS scores were recorded at 30 min, 1, 2, 4, 6 and 12 h after the intra-articular injection. Scoring was conducted postoperatively by an observer who was blinded to the study drugs. For postoperative pain control paracetamol intravenous infusion was given if the recorded VAS was 4 or more (with minimum 4 h time interval between successive doses of paracetamol and rescue analgesia with meperidine 50 mg intravenous if the VAS score was 4 or more within this time interval). The time to first analgesic request and the total dose of paracetamol during the first 24 h as well as the total dose of