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Research Article

Is this the time for Magnesium sulfate to replace Meperidine as an antishivering agent in spinal anesthesia?

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KEYWORDS

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Abstract *Background & Aim:* Shivering is one of the serious complications during spinal anesthesia. Meperidine is considered the most common drug used for control of shivering. The aim of this study is to detect if Magnesium sulfate can replace Meperidine, in the prevention of shivering in patients undergoing spinal anesthesia during knee arthroscopy.

Methods: The study included 50 patients scheduled for elective knee arthroscopy, aged 20–50 years under spinal anesthesia. The patients were randomly divided into two equal groups. Patients in Group (M) ($n = 25$) received single intravenous bolus dose of Meperidine 0.5 mg/kg while patients in group (Mg) ($n = 25$) received intravenous (IV) $MgSO_4$ in a dose of 50 mg/kg over 20 min followed by 0.5 mg/kg/min both. The both test drugs were administered after establishment of spinal anesthesia. The incidence and severity of shivering were recorded during the operation and in the recovery room.

Results: Shivering occurred in 68% of patients in group (M) when compared to group (Mg) where only 28% suffered from shivering. This difference in % was found to be statistically significant. Regarding the complications, local allergy significantly occurred in group (M) in five patients when compare to one patient in group (Mg). There was no significant difference between group (M) and group (Mg) regarding the body core temperature.

Conclusion: $MgSO_4$ was found to be an effective way for the control shivering and it could replace Meperidine in middle age patients under spinal anesthesia.

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1. Introduction

Shivering is an oscillatory involuntary muscular activity [1] that may occur during knee arthroscopy, which is an unpleasant sensation for all patients [2], surgeons, and anesthetist. It interferes with the proper visualization of the field which resulting in ligament or vascular injury and results in inappropriate ECG and pulse oximeter monitoring as well [3].

The main value of shivering is to increase metabolic heat production [4]. Also it increases the oxygen consumption from

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500% [5,6] up to 600% of the basal level [7], lactic acid, and CO₂ production with consequence increase in the cardiac output and minute ventilation [8].

Shivering during knee arthroscopy occurs due to hypothermia which may be either due to irrigation of fluid at room temperature, or due to the effect of spinal or epidural anesthesia [9] which are the common anesthetic techniques of choice in knee arthroscopy. Regional anesthesia results in sympathetic and somatic neural blockade on both vasomotor tone and shivering below the level of the blockade [10].

Magnesium sulfate is found to be effective in management of post-operative shivering after general anesthesia [11]. In the present study, we compared the antishivering action between Meperidine and Magnesium sulfate in middle age patients under spinal anesthesia.

2. Materials and methods

This study was performed between January 2010 and June 2010 after approval of ethical committee of anesthesia department (Faculty of Medicine Cairo University). The selected patients were scheduled for unilateral knee arthroscopy under spinal anesthesia. Patients included in the study were ASA I and II aged between 20 and 50 years, with no history of allergy to Meperidine or Magnesium sulfate. Exclusion criteria included patients with history of allergy, obese with body mass index (BMI) ≥ 30 generalized infection or localized infection at level of blockade, neurologic disease, coagulation disorder, and patients refusing regional anesthesia.

This double-blinded randomized study included 50 patients who were equally divided into two equal groups: Meperidine group (M) and Magnesium sulfate group (Mg).

All routine investigations were done including complete blood picture, coagulation profile, liver function tests, kidney function tests, blood grouping, and ECG, and written informed consents were obtained.

Demographic data including age, weight, height, (BMI) and ASA, also intra-operative data include (level of sensory blockade, total irrigation fluid, and total surgical time) were recorded.

Preoperative hemodynamic data were recorded namely mean blood pressure (MBP), heart rate (HR), arterial oxygen saturation (SPO₂), skin temperature (Ts), and tympanic temperature (Tc).

No premedication was given to both groups. Peripheral intravenous line was inserted and (15 mL/kg) Ringer's lactate solution warmed up to 37 °C was given to all patients prior to performance of spinal anesthesia, and all subsequent intravenous fluids and irrigation fluids given during the procedure were also warmed.

Oxygen was administered via face mask (5 L/min). All through the procedure and during the recovery time, the operating room temperature was maintained between 22 °C and 25 °C.

Midline Spinal anesthesia approach was performed to all patients in the sitting position at the L3–L4 or L4–L5 interspaces using 25-gauge Quincke needle using 2.5 mL hyperbaric bupivacaine, 5 mg/mL.

After confirming the establishment of the spinal anesthesia level by pinprick, the patients were secured in the supine position and wrapping the other limb in cotton towels and the same standard tourniquet for knee was applied.

In group M [1], patients received single bolus dose of Meperidine 0.5 mg/kg diluted in 10 mL syringe intravenously after establishment of spinal anesthesia.

In group Mg [2], patients received intravenous (IV) infusion of MgSO₄ 50 mg/kg over 20 min followed by 0.5 mg/kg/min infusion after establishment of spinal anesthesia.

The (MBP), (HR), (SPO₂), (Ts), and (Tc) were measured and recorded intermittently intra-operatively and in the recovery room (every 15 min).

The incidence and severity of shivering were recorded during the operation and in the recovery room. Shivering was graded with a scale described by (Bedside Shivering Assessment Score) (BSAS) as follows [12]:

1. *None*: no shivering noted on palpation of the masseter, neck, or chest wall.
2. *Mild*: shivering localized to the neck and/or thorax only.
3. *Moderate*: shivering involves gross movement of the upper extremities (in addition to neck and thorax).
4. *Severe*: shivering involves gross movements of the trunk and upper and lower extremities.

Also any complications were recorded:

Hypotension was defined as a decrease in the (MBP) to less than 20% less than the baseline value, which was treated with 5–10 mg of intravenous ephedrine.

Bradycardia was defined as a decrease in HR less than 50 b/min which was treated with 0.5 mg IV atropine.

2.1. Statistical analysis

The collected data were analyzed by Statistical Package for Social Science (SPSS) version 16. Parametric data were expressed as mean \pm SD. The comparison the mean \pm SD of two groups was done using the paired and unpaired student's *t* test. Nonparametric data was expressed as number and percentage of the total number of patients. Determining the extent of a single observed series of proportions, difference from a theoretical or expected distribution was done using the Chi square test and repeated-measures analysis of variance followed by Bonferroni's post hoc testing. *P*-value < 0.05 was considered statistically significant.

2.2. Outcome measures

The primary outcome measure was the dose of Magnesium sulfate that prevented the shivering and at the same time did not produce hypotension. The second outcome was the use of Magnesium sulfate in avoiding complications secondary to the use of Meperidine.

3. Results

All the demographic data including age, sex, weight, height, body mass index and ASA status (Table 1), operative data surgical time, and total irrigation fluid (Table 2) were comparable between both groups.

As regards the level of sensory blockade in both groups, minimal level was T10 and maximal level was T4 with no significant difference between the two groups.

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