

Research Article

The effect of adding different doses of Magnesium Sulphate to Bupivacaine in the ultrasound-guided supraclavicular brachial plexus block anesthesia.

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Abstract

Introduction: Pain is characterized as an unpleasant experience linked to the damage to the tissues. Perioperative pain management can provide short-term and long-term benefits that may pose a challenge to providers of anesthetics. **Aim of the work:** Aim of this study is to evaluate the effect of adding different doses of magnesium sulphate to bupivacaine for supraclavicular brachial plexus block anesthesia. **Patients and methods:** After approval of the university ethical committee and obtaining informed consent from all patients, this prospective, randomized, double blinded, and placebo controlled study was conducted in Minia University hospital during the period from October 2019 to May 2020. A total of 60 patients aged between 18 and 40 years with ASA I and II patients scheduled to undergo supraclavicular brachial plexus block for upper limb surgeries were included in the study. Patients were randomly allocated into 3 equal study groups each contains 20 patients. **Group (A)** received 80mg of .5% bupivacaine. **Group (B)** received 80mg of 0.5% bupivacaine + Magnesium Sulphate 100 mg (2ml). **Group (C)** received 80mg of 0.5% bupivacaine + Magnesium Sulphate 50 mg (1ml). Anesthetic technique was standardized in all the 3 groups. Heart rate (beats/min), mean arterial blood pressure (mmHg) and oxygen saturation (%) were assessed just before the block as: a baseline value, immediately after the block, every 10 (min) during the operative time till the end of operation and every 2 hours till 12 hours after the operation. Pain intensity was assessed using VAS 2, 4, 6, 8, 10 and 12 hours postoperatively. Also, quality of the sensory and motor block was assessed using different tests. Adverse effects such as hypotension, nausea, vomiting and hypoxemia (SpO₂ <90%) were recorded during the operation and for 12 hours postoperatively. **Results:** Magnesium sulphate as an adjuvant to bupivacaine in supraclavicular brachial plexus blocks reduces the time to reach complete sensory and motor block and therefore shortens the time before operation. Also, using magnesium sulphate with doses of 100mg and 50mg as an adjuvant to bupivacaine in supraclavicular brachial plexus blocks could give satisfactory results that could compete vigorously with the high doses used in previous studies.

Key words: supraclavicular block, magnesium sulphate, upper limb surgeries, regional anathesia.

Introduction

Pain is characterized as an unpleasant emotional experience linked to real or potential damage to the tissues. Active perioperative pain management can provide both short-term and long-term benefits that may pose a challenge to providers of anesthetics (Scott Urigel CRNA, 2014).

Balanced or multimodal analgesia uses a combination of opioid and non-opioid analgesics to improve pain control. These include the use of NSAIDs, local anesthetics and regional blocks. Any combination of these therapies can reduce the response to surgical stress and

improve patient outcomes such as pain control, patient satisfaction and discharge time. One of methods used in this multimodal approach is the supraclavicular brachial plexus block anesthesia (Scott Urigel CRNA, 2014).

Ultrasound guidance is fast becoming the gold standard for regional anesthesia. The improved safety and effectiveness of ultrasound in regional anesthesia will promote its use and recognize the benefits of regional anesthesia over general anesthesia, such as reduced morbidity and mortality (Griffin and Nicholls, 2010).

The peripheral nerve block has a major role in current anesthesia practice. Safety and impressive success rate made this anesthetic technique very common in anesthesia. Upper limb surgery is often conducted under peripheral blocks such as the brachial plexus block. In addition to intraoperative anesthesia, peripheral blocks also give postoperative analgesia. (Bruce et al., 2012).

Magnesium sulphate plays an essential role in many cellular functions and therefore its importance in clinical medicine is becoming increasingly important. Well-designed large-scale clinical trials are required to assess its efficacy in pain management (Mousavi et al., 2020; Rao et al., 2020).

Aim of the work

Primary aim of the work is postoperative visual analogue pain score and secondary aim is calculation of the time to first postoperative analgesic requirement, time of discharge from hospital, incidence of any side effect and cumulative intra operative and post-operative analgesic requirement.

Patients and methods

After approval of the university ethical committee and obtaining informed consent from all patients, this prospective, randomized, double blinded, and placebo controlled study was conducted in Minia University hospital during the period from October 2019 to May 2020. A total of 60 patients aged between 18 and 40 years with ASA I and II patients scheduled to undergo supraclavicular brachial plexus block for upper limb surgeries were included in the study.

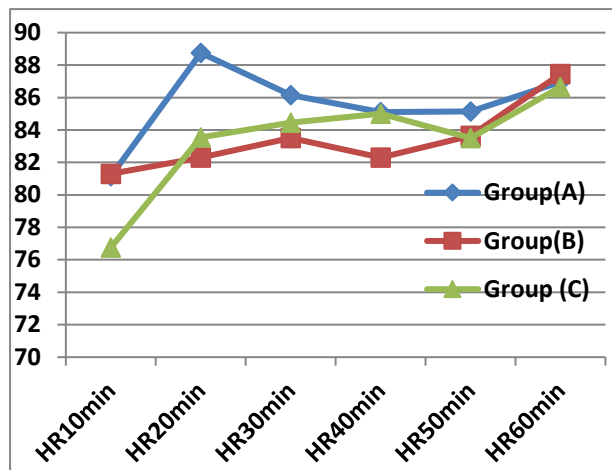
Patients were randomly allocated into three equal study groups each contains 20 patients. Group (A) received 80mg of .5% bupivacaine. Group (B) received 80mg of 0.5% bupivacaine + Magnesium Sulphate 100 mg (2ml). Group (C) received 80mg of 0.5% bupivacaine + Magnesium Sulphate 50 mg (1ml). Anesthetic technique was standardized in all the 3 groups. On arrival, ECG, pulse oximetry, and non-invasive arterial blood pressure were applied.

Vital signs were obtained then an intravenous 18G cannula was inserted. Under sterile conditions, the identified area was prepared with anti-septic solution and infiltrated with 1-2 ml of LA subcutaneously. Patient lies down supine with head turned 45 degrees to the contralateral side and ipsilateral arm adducted gently by the assistant and the shoulder kept down with flexed elbow.

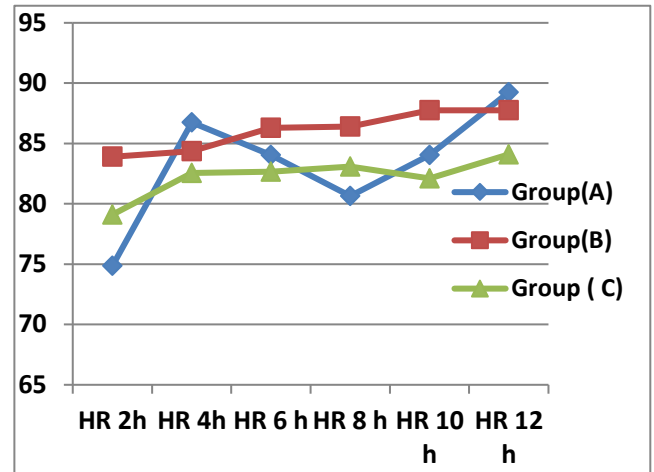
The ultrasound probe (12 MHz probe) was used; the brachial plexus was visualized by placing the transducer in the sagittal plane in the supraclavicular fossa behind the middle-third of the clavicle. Then, the pre-determined volume of study drug solution was administered around the brachial plexus after negative aspiration to a void accidental subclavian artery needle puncture and spread of local anesthetic drug was observed in tissue planes. HR, MAP and SPO₂(%) were assessed just before the block as a baseline value, immediately after the block, every 10 (min) during the operative time till the end of operation and every 2 hours till 12 hours after the end of operation. Pain intensity was assessed using VAS 2, 4, 6,8,10 and 12 hours postoperatively. Adverse effects such as hypotension, nausea, vomiting, hypoxemia (SpO₂ <90%), local hematoma, haemothorax and pneumothorax were recorded during the operation and for 12 hours postoperatively. Sample size was estimated using pain scores as the primary variable. Assuming a standard deviation of 10 mm, the minimum needed sample size to detect a difference of 10 mm on the VAS of 10 cm, with type I error of (0.05) and power of (80%). Minimum needed sample was 54.

Results

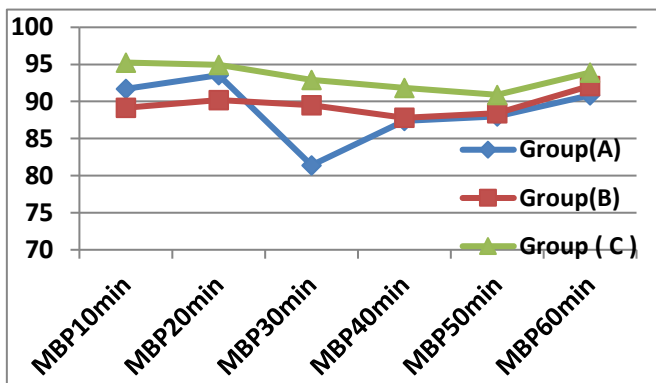
One way anova test was used to compare means, Qui square test was used to compare proportions. The 3 groups were comparable with respect to age, gender, weight, ASA grade, and duration of surgery with no clinical significance between the 3 groups. There was a state of hemodynamic stability in the three groups throughout the study period although there were some statistical significant differences inside or in-between all groups observed in some times that didn't affect clinical stability and didn't need any interference.



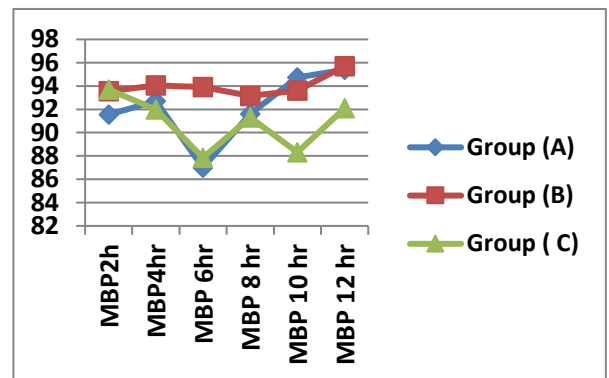
HR among three groups intraoperatively.



HR among three groups postoperatively.

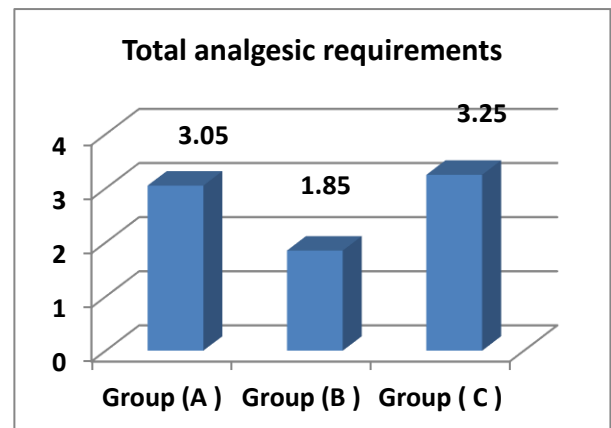
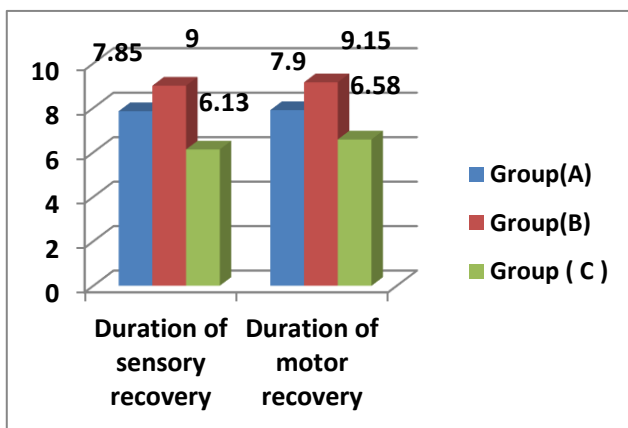


MAP among three groups intraoperatively.



MAP among three groups postoperatively.

Group (B): significantly had longer duration of sensory and motor recovery than other groups, with highest first analgesic request and lowest total analgesic requirements.



Regarding (VAS) after surgery, most patients had satisfactory analgesia as indicated by VAS, Group (B) was significantly less than (A) and (C) at 2, 4, 8, 12 hours. (15%) of patients in group (A) had nausea and vomiting as well as (5%) had self-limited pneumothorax that didn't occur in group (B) or (C). This was an operator dependent false that has no relation to the comparisons between the three groups.

Discussion

It is always the interest of the anesthetist to increase the quality of local anesthetics, so several studies have been done to evaluate the efficacy of adding different adjuvants to local anesthetics to prolong the block duration and reduce the toxicity, like opioids, magnesium sulphate, dexamethasone, hyaluronidase and neostigmine.

In partial agreement with our study, Abdelfatah et al., Egypt, in 2013, demonstrated that, the addition of Mgso₄ to lidocaine in interscalene brachial plexus block significantly increased the analgesic duration and reduced postoperative pain and opioid requirements.

To our knowledge, our study is the only one done to find the optimum lowest dose of magnesium sulphate as an adjuvant to bupivacaine in supraclavicular brachial plexus blocks giving the nearly same results as the large ones and the impact of that study on the economic factor up till now.

Our study shows that the use of magnesium sulphate as an adjuvant to bupivacaine in supraclavicular brachial plexus blocks reduces the time to reach complete sensory and motor block and therefore shortens the total time before operation. Also, increases the duration of motor and sensory block as well as increases the analgesic duration and reduces the postoperative analgesic consumption which leads to more satisfactory analgesia for the patients as indicated by VAS.

Last conclusion was that using magnesium sulphate with doses of 100mg and 50mg as an adjuvant to bupivacaine in supraclavicular brachial plexus blocks could give satisfactory results that could compete vigorously with the high doses used in previous studies. Also, those two doses of sulphate gave nearly similar results with preference for group (B) over group (C).

This may give us an idea of that the lowest dose of sulphate used as an adjuvant in regional blocks to achieve the nearly same results as the large doses is 100mg. This makes the costs are getting lower and one ampoule of magnesium sulphate can be used for 10 patients instead of

only one. New future studies could be done to prove this conclusion in other fields of regional blocks.

Recommendations

1. Conducting several studies for comparison to follow up on patients for a longer period after surgery and the use of different types of drugs as adjuvant agents for bupivacaine.
2. Carrying out several studies to compare the ultrasound-guided supraclavicular brachial plexus block with various other techniques such as infraclavicular brachial plexus block, interscalene brachial plexus block and the use of electrical neural vibrations.

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