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Studying the effect of increasing the doses of Magnesium Sulphate as an adjuvant to Bupivacaine in Supraclavicular Brachial plexus block

Thesis

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قسم التخدير والرعاية المركزة وعلاج الألم

دراسة تأثير الجرعات المتزايدة من كبريتات المغنيسيوم كمساعد لبوبيفاكين في إغلاق الضفيرة الكتفية فوق الترقوه

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List of Abbreviations

| | |
|-------------------|---|
| AAGBI | : Association of Anaesthetists of Great Britain and Ireland |
| BP | : Brachial plexus |
| C | : Cervical |
| CNS | : Central nervous system |
| CVS | : Cardiovascular system |
| DBP | : Diastolic blood pressure |
| DC | : Direct current |
| DNA | : Deoxy Ribo-Nucleic Acid |
| EAA | : Excitatory amino acids |
| GABA | : Gamma amino butyric acid |
| HR | : Heart rate |
| IV | : Intravenous |
| LAs | : Local anesthetics |
| LAST | : Local Anesthetics Systemic Toxicity |
| MEAV50 | : Minimum effective anesthetic volume |
| MgSO ₄ | : Magnesium Sulphate |
| MHz | : Mega Hertz |
| MSM | : Middle scalene muscle |
| NMDA | : N-methyl-D-aspartate |
| NPRS | : Numeric Pain Rating Scale |
| PNB | : Peripheral nerve blockade |
| PNBs | : Peripheral nerve blocks |
| PNS | : Peripheral nerve stimulation |
| RNA | : Ribonucleic Acid |
| SA | : Subclavian artery |

| | |
|------------------|--------------------------------|
| SBP | : Systolic blood pressure |
| SCM | : Sternocleidomastoid |
| SD | : Standard deviation |
| SPO ₂ | : Peripheral oxygen saturation |
| US | : Ultrasound |
| USG | : Ultrasound guided |

List of symbols

Σ : Sum

N : Number of observations

% : Percentage

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Introduction

Peripheral nerve block has a significant contributory role in modern anesthesia practice. This technique became very popular in ambulatory and inpatient anesthesia due to its safety and significant success rate (**Mukherjee *et al.*, 2014**).

Upper limb surgeries below the shoulder joint are mostly performed under peripheral blocks such as the brachial plexus block. These nerve blocks not only provide intra operative anesthesia but also extended postoperative analgesia without major systemic side effects by minimizing stress response and using minimal anesthetic drugs (**Bruce *et al.*, 2012**).

Regional nerve block decreases the stress response to surgery and allows using minimal anesthetic drugs. Supraclavicular approach is the easiest and the most consistent method for surgery below the shoulder joint. The compactness of the brachial plexus in this site provides a rapid onset and complete block of the brachial plexus (**Amiri & Espander, 2011**).

Ultrasound guidance is a reliable and safe technique in peripheral nerve blocks. Several benefits obtained using the ultrasound including accuracy, faster onset and decreasing the

dose of local anesthetic drugs. Ultrasound guided needle placement decreases the risk of complications and increases the accuracy of the block **(Hopkins, 2007)**.

Ultrasound guided supraclavicular brachial plexus block allows better visualization of underlying structures, movement of needle and direct spread of local anesthetic and thereby making procedure safe and effective as compared to nerve stimulator-guided technique **(Duncan *et al.*, 2013)**.

Complications of supraclavicular block include pneumothorax, vascular puncture, intravascular injection, Horner's syndrome, recurrent laryngeal nerve blockade, nerve injury, and phrenic nerve blockade with transient hemidiaphragmatic paresis **(Bhatia *et al.*, 2010; Perlas *et al.*, 2009)**.

Local anesthetics alone for supraclavicular brachial plexus block provide good operative conditions, but they have short duration of postoperative analgesia. Therefore, various adjuvants such as opioids, clonidine, neostigmine and midazolam were added to local anesthetics in brachial plexus block to achieve quick, dense and prolonged block **(Golwala *et al.*, 2009)**.

Bupivacaine is a widely used local anesthetic that is related chemically and pharmacologically to the amide local anesthetics available in isotonic solution. Various pharmacokinetic parameters of the local anesthetics can be significantly altered by the presence of hepatic or renal disease, factors affecting urinary pH, renal blood flow, the route of drug administration, and the age of the patient **(Balakrishnan, 2015)**.

Better knowledge of pain mechanisms has highlighted the role of central sensitization and N-methyl-D-aspartate (NMDA) receptors in postoperative pain **(Woolf 2011; Verma *et al.*, 2017)**.

Magnesium is the fourth most plentiful cation in the body and the second most plentiful intracellular cation after potassium. It is necessary for the presynaptic release of acetylcholine from nerve endings and may produce effects similar to calcium - entry - blocking drugs **(Sirvinskas & Laurinaitis, 2002)**.

Magnesium sulfate has been proved to have antinociceptive effects by blocking the N-methyl-D-aspartate receptor and associated calcium channels preventing the central

sensitization caused by peripheral nociceptive stimulation (**Soave *et al.*, 2009; Fahmy *et al.*, 2015**).

Anti - nociceptive effects of magnesium are due to regulation of calcium influx into the cell and antagonism of the N - methyl D - aspartate (NMDA) receptors (**Agrawal *et al.*, 2014**).

Though magnesium has an analgesic property, it has not been studied well as an adjuvant to the local anesthetic agents during supraclavicular brachial plexus block (**Mukherjee *et al.*, 2014**).