Ain Shams University
Faculty of Medicine
Department of Anesthesiology,
Intensive Care and Pain Management

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

Thesis

Submitted for Partial Fulfillment of Master Degree in Anesthesia

By
Mohammed Waheed Mahmoud Emam
M.B.B.CH (Ain Shams University)

Supervised By

Prof. Dr.Mohammed AbdElgaleel Ahmed Salaam
Professor of Anesthesia, Intensive Care and Pain Management
Faculty of Medicine, Ain Shams University

Dr. Adel Mohammed Muselhy Alansary
Assistant Professor of Anesthesia, Intensive Care and Pain Management
Faculty of Medicine, Ain Shams University

Dr. Walid Youssef Youssef Kamel
Lecturer of Anesthesia, Intensive Care and Pain Management
Faculty of Medicine, Ain Shams University

Faculty of Medicine,
Ain Shams University
2018

جامعة عين شمس
كلية الطب
قسم التخدير والرعاية المركزة وعلاج الألم

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

رسالة توطئة للحصول على درجة الماجستير في علم التخدير

مقدمة من

الطبيب/ محمد وحيد محمود إمام

بكالوريوس الطب والجراحة العامة (جامعة عين شمس)

تحت إشراف

أ.د / محمد عبد الجليل أحمد سلام

أستاذ التخدير والرعاية المركزة وعلاج الألم
كلية الطب- جامعة عين شمس

أ.م.د / عادل محمد مصيلحى الأنصارى

أستاذ مساعد التخدير والرعاية المركزة وعلاج الألم
كلية الطب- جامعة عين شمس

د/ وليد يوسف يوسف كامل

مدرس التخدير والرعاية المركزة وعلاج الألم
كلية الطب- جامعة عين شمس

كلية الطب
جامعة عين شمس
٢٠١٨

Acknowledgement

*First of all, all gratitude is due to **Allah** almighty for blessing this work, until it has reached its end, as a part of his generous help throughout my life.*

*Really, I can hardly find the words to express my gratitude to **Prof. Dr. Mohammed Abdelgaleel Ahmed Sallam,** Professor of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University, for his supervision, continuous help, encouragement throughout this work .It is a great honor to work under his guidance and supervision.*

*I cannot forget the great help of **Assistant Prof. Dr. Adel Mohammed Muselhy Alansary ,** Assistant Professor of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University, for his invaluable efforts, tireless guidance and for his patience and support to get this work into light.*

*I would like to express special thanks to **Dr.Walid Youssef Youssef Kamel,** Lecturer of Anesthesia, Intensive Care and Pain Management, Faculty in Medicine, Ain Shams University for his faithful supervision, precious help and continuous support throughout this work.*

Last but not least, I dedicate this work to my father, my family, my future wife and my friends, whom without their sincere emotional support pushing me forwards, this work would not have ever been completed.

Mohammed Waheed Emam

Contents

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

List of Tables

List of Figures

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 hemi diaphragmatic 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)**.