The effect of intrathecal and epidural supplementation of magnesium sulphate combined with spinal anesthesia on intra-operative and postoperative pain relief in lower abdominal surgeries

Thesis

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By

Ahmed Abdelfattah Abdelfattah Elsayed
M.B.B.Ch., M.Sc. anesthesia
Ain Shams University

Under supervision of

Prof. Dr. Mostafa Kamel Fouad Saleh
Professor of Anesthesia and Intensive Care
Faculty of Medicine - Ain Shams University

Dr. Alfred Maurice Said
Assistant Professor of Anesthesia and Intensive Care
Faculty of medicine - Ain Shams University

Dr. Amal Hamed Rabie
Lecturer of Anesthesia and Intensive Care
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain Shams University
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بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ ①
الْحَمْدُ لِلَّهِ رَبِّ الْعَالَمِينَ ② الرَّحْمَٰنِ الرَّحِيمِ ③
مَالِكِ يَوْمِ الدِّينِ ④ إِيَّاكَ نَعْبُدُ وَإِيَّاكَ نَسْتَعِينُ ⑤
اهْدِنَا الصِّرَاطَ الْمُسْتَقِيمَ ⑥ صِرَاطَ الَّذِينَ
أَنْعَمْتَ عَلَيْهِمْ غَيْرِ الْمَغْضُوبِ
عَلَيْهِمْ وَلَا الضَّالِّينَ ⑦

Aim of the study

The aim of the this study is to evaluate the effect of intrathecal and epidural supplementation of magnesium sulphate combined with spinal anesthesia on improving the quality of intra-operative anesthesia and reduction of post-operative pain and narcotic requirements.

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List of Abbreviations

Abbrev.	Meaning
ASA	American society of anesthesiologist
CNS	Central nervous system
COPD	Chronic Obstructive Pulmonary Disease
COX	Cyclooxygenase
CSEA	Combined Spinal Epidural Anesthesia
CSF	Cerebrospinal fluid
CT	Computerized tomography
DST	Double Segment Technique
EA	Epidural Abscess
FRC	Functional Residual Capacity
GABA	Gama amino butyric acid
HR	Heart Rate
I.N.R	International Normalization Ratio
IVRA	Intravenous Regional Anesthesia
MAP	Mean Arterial Pressure
$MgSO_4$	Magnesium sulfate
NIBP	Non-invasive Blood Pressure
NMDA	N-methyl-d-aspartate
NMDARs	N-methyl-d-aspartate Receptor
NSAIDs	Non-Steroidal Anti-inflammatory Drugs
P.T	Prothrombin Time
P.T.T	Partial Throbmoplastin Time
PABA	Para Aminobezoic Acid
PDPH	Post Dural Puncture Headache
PNS	Peripheral nervous system
PSPS	Post spinal pain syndrome
SpO_2	Peripheral Oxygen Saturation
SST	Single Segment Technique
TNS	Transient Neurologic Symptoms
TRI	Transient Radicular Irritation
VAS	Visual analogue scales
μ	Mu Receptor
δ	Delta receptor
κ	Kappa receptor

Introduction

Magnesium (Mg^{2+}) is a non-competitive NMDA receptor antagonist that blocks ion channels in a voltage-dependent fashion. Numerous clinical studies investigating the effects of intravenously injected magnesium sulphate ($MgSo_4$) on intra-operative and post-operative pain perception have shown that $MgSo_4$ reduces the intra-operative consumption of hypnotic agents and analgesics ***(Kara et al., 2002)***.

NMDA receptor antagonists prevent central sensitization induced by peripheral nociceptive stimulation. They abolish hypersensitization once it is established by blocking dorsal horn NMDA receptor activation induced by excitatory amino acid transmitters, such as glutamate and aspartate ***(Woolf and Thompson, 1991)***.

Adding magnesium to spinal anesthesia should improve the quality, and prolong the duration of spinal anesthesia and reduce the incidence of side effects observed when local anesthetics are used in high doses or combined with opioids, such as respiratory depression, hemodynamic instability, pruritus, urinary retention, and severe nausea and vomiting ***(Özalevli et al., 2005)***.

Intrathecal administration of magnesium sulphate has been shown to be more effective than intravenous administration due to the limitation of magnesium transfer across the blood brain barrier ***(De Kock and Lavand'homme, 2007)***.

Patients and Methods

This study was conducted in the obstetric department, general surgery department and urology department of Ain Shams University hospitals on one hundred and twenty patients undergoing elective lower abdominal surgeries after approval of Ain Shams University medical ethics committee in 2010. A written consent was taken from all patients who were either class I or II according to the classification of the American Society of Anesthesiologists (ASA I or II). The age of the patients ranged between 21-50 years old and they were of both sexes. The expected duration of surgery was not more than 2 hours.

This study was a prospective double blind randomized controlled study where the patients were allocated into four equal groups, thirty patients each, according to magnesium sulphate supplementation as an adjunct to spinal anesthesia:

A. Group (I): [S]

30 patients received intrathecal injection of 0.5% hyperbaric bupivacaine 15 mg (3 ml bupivacaine 5 mg/ ml in hyperbaric solution) combined with 25 µg fentanyl (0.5 ml) and 1 ml saline 0.9%. Total volume of intrathecal injection was 4.5 ml.

B. Group(II):[IM]

30 patients received intrathecal injection of 0.5% hyperbaric bupivacaine 15 mg (3 ml bupivacaine 5 mg/ ml in hyperbaric solution) combined with 25 µg fentanyl (0.5 ml) and 100 mg of 10% magnesium sulphate (1 ml). Total volume of intrathecal injection was 4.5 ml.

C. Group (III): [EM]

30 patients received intrathecal injection of 0.5% hyperbaric bupivacaine 15 mg (3 ml bupivacaine 5 mg/ ml in hyperbaric solution) combined with 25 µg fentanyl (0.5 ml) and 1 ml saline0.9%. In addition, to an epidural dose of magnesium sulphate 100 mg of 2% solution (5 ml) was given to be repeated hourly including the first 24 hours of the postoperative period. Total volume of intrathecal injection was 4.5 ml in addition to an epiduaral dose of magnesium.

D. Group (IV): [IEM]

30 patients received intrathecal injection of 0.5% hyperbaric bupivacaine 15 mg (3 ml bupivacaine 5 mg/ ml in hyperbaric solution) combined with 25 µg fentanyl (0.5 ml) solution) and 100 mg of 10% magnesium sulphate (1 ml). In addition, to an epidural dose of magnesium sulphate 100 mg of 2% solution (5 ml) was given to be repeated hourly including the first postoperative period of the 24 hours. Total volume of