THE EFFECT OF ADDING MAGNESIUM SULPHATE, DEXMEDETOMIDINE AND KETAMINE TO EPIDURAL ANESTHESIA FOR LOWER URINARY TRACT SURGERIES

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Contents

List Of Abbreviations

ACTH ……..…… Adrenocorticotropic Hormone

ADH …….……..…….. Antidiuretic Hormone

ASA ……..…… American Society of Anesthesiologists

C2……..……..…..Second Cervical vertebra

C7…….....……Seventh Cervical vertebra

CSF …….……..…… Cerebro Spinal Fluid

CNS ……... Central Nervous System

CV ……. Closing Volume

ECG ……. Electrocardiogram

FRC……Functional Residual Capacity

GABA…… Gamma-aminobutyric Acid

ICP…….....Increase intracranial pressure

ICU ……..…….. Intensive Care Unit

IM……..…….…….. Intramuscular

INR ……..…. International Normalized Ratio

IV……..…….. Intravenous

LMWH……..……Low-Molecular-Weight Heparin

Mg2+ …… Magnesium ion

$MgSO_4$ ……. Magnesium Sulphate

MPQ……..…… McGill Pain Questionnaire

NMDA…….…… N-Methyl-D-aspartate

NSAIDS …… Non Steroidal Anti-inflammatory Drugs

PONV…….Postoprative nausea & vomiting

PCA …… Patient Controlled Analgesia

PT …… Prothrombin Time

PTT ……Partial Thromboplastin Time

VAS ……..…… Visual Analogue Scale

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Abstract

Epidural anesthesia is a safe and inexpensive technique with the advantage of providing surgical anesthesia and prolonged postoperative pain relief. It is also an effective treatment of operative pain as it blunts autonomic, somatic and endocrine responses. This study showed the effect of adding magnesium sulphate, dexmedetomidine and ketamine to epidural bupivacaine in anesthesia for lower urinary tract surgeries, with respect to onset of action, potency, duration of the block and the total dose of bupivacaine consumption during surgery as well hemodynamic changes.

Methods: 80 patients, ASA I/II were enrolled into the study. All patients had epidural anesthesia and randomly allocated into one of four groups .**Group C**: (20 patients)The patient received 10 ml of bupivacaine 0.5%, **Group M**: (20 patients): The patient received 10 ml of bupivacaine 0.5% plus 1.0 ml of magnesium sulphate 10% (100 mg) , **Group D**: (20 patients):The patient received 10 ml of bupivacaine 0.5% plus dexmedetomidine in a dose of 1 μg/kg diluted in 1 ml normal saline and **Group K**: (20 patients) The patient received 10 ml of bupivacaine 0.5% plus ketamine in a dose of 0.3 mg/kg diluted in 1 ml normal saline. In all groups assessment was done after 10 minutes aiming to achieve T10 sensory level and G3 motor block. Otherwise incremental doses of 5 ml bupivacaine 0.5% were given without additives.

Results: This study demonstrated that a more rapid onset of action of the epidural block was achieved in the magnesium group, while in the ketamine and dexmedetomidine groups, a more prolonged duration of action was recorded. In all groups, total dose consumption of the local anesthetic was lower than that of the control group. Hemodynamic variables were stable and there were no significant differences beween groups.

Conclusion: Magnesium, ketamine and dexmedetomidine are effective as useful adjuvants to local anesthetic for epidural anesthesia. Magnesium sulphate is associated with a shorter onset of action of the epidural block. While both ketamine and dexmedetomidine have a prolonged duration and an increased potency of the block. All the studied drugs effectively decreased the total dose requirements of local anesthetic drugs. No significant side effects were observed throughout the study period.

Keyword: **ADH**, **GABA**, **DEXMEDETOMIDINE**, **KETAMINE**

INTRODUCTION

Epidural anesthesia is a safe and inexpensive technique with the advantage of providing surgical anesthesia and prolonged postoperative pain relief. It is also an effective treatment of operative pain as it blunts autonomic, somatic and endocrine responses. It has become a common practice to use polypharmacy approach for treatment of intra and postoperative pain, because no drug has yet been identified that specifically inhibits nociception without associated side effects. [(1)] Research continues concerning different techniques and drugs that could provide better surgical anesthesia and postoperative pain relief.

Magnesium is the fourth most plentiful cation in our body. It has antinociceptive effects in animal and human models of pain. [(2)] It has been mentioned in a systematic review that it may be worthwhile to further study the role of supplemental magnesium in providing perioperative analgesia, because this is a relatively harmless molecule, is not expensive and also because the biological basis for its potential antinociceptive effect is promising. [(3)] These effects are primarily based on physiological calcium antagonism, that is voltage-dependent regulation of calcium influx into the cell, and noncompetitive antagonism of N-methyl-D-aspartate (NMDA) receptors. [(1)]

The addition of magnesium to epidural bupivacaine and fentanyl in women undergoing elective caesarean section with combined spinal-epidural anesthesia improved intraoperative conditions and the quality of postoperative analgesia.[(4)] In patients undergoing orthopedic surgery, supplementation of spinal anesthesia with combined intrathecal and epidural magnesium sulfate significantly reduced patients' post-operative analgesic requirements.[(5)]

Dexmedetomidine is a new addition to the class of alpha-2 agonist which has got numerous beneficial effects when used through epidural route. [6] It acts on both pre and post synaptic sympathetic nerve terminal and central nervous system thereby decreasing the sympathetic outflow and nor-epinephrine release causing sedative, anti-anxiety, analgesic, sympatholytic and hemodynamic effects. [7] Dexmedetomidine does cause a manageable hypotension and bradycardia but the striking feature of this drug is the lack of opioid-related side effects like respiratory depression, pruritis, nausea, and vomiting. [8]

Ketamine, a non-competitive NMDA receptor antagonist, inhibits central sensitization, thus potentiating the analgesic effect of epidural bupivacaine. [9]

Aim of work

The main goal of our study is to compare the efficacy of magnesium sulphate, dexmedetomidine or ketamine when added to 0.5% bupivacaine in epidural anesthesia for lower urinary tract surgery.

The comparison will include onset time, duration, quality and dermatomal spread of epidural anesthesia

ANATOMICAL CONSIDERATIONS IN NEURAXIAL BLOCKADE

The vertebral column:

The spine is one of the most important parts of our body. The main functions of the spine are: Protecting the spinal cord, nerve roots and several of the body's internal organs, providing structural support and balance to maintain an upright posture and enabling flexible motion.[10]

Regions of the spine:

The spine is divided into 4 main regions; cervical, thoracic, lumbar and sacral. Each region has specific characteristics and functions

- Cervical spine:

This region consists of 7 vertebrae. These vertebrae protect the brain stem and the spinal cord, support the skull and allow for a wide range of head movement .[11]

- Thoracic spine:

Beneath the last cervical vertebra are the 12 vertebrae of the thoracic spine. The first thoracic vertebra (T_1) is the smallest and the last thoracic vertebra (T_{12}) is the largest. The thoracic vertebrae are larger than the cervical bones and have longer spinous processes. In addition, rib attachments add to the thoracic spine's strength. These structures make the thoracic spine more stable than the cervical or lumbar regions. In addition, the rib cage and ligament systems limit the thoracic spine's range of motion and protect many vital organs.[12]

- Lumbar spine:

The lumbar spine has 5 vertebrae. The size and shape of each lumbar vertebra is designed to carry most of the body's weight. Each structural element of a lumbar vertebra is bigger, wider and broader than similar components in the cervical and thoracic regions. The lumbar spine has more range of motion than the thoracic spine, but less than the cervical spine.[13]

The lumbar facet joints allow for significant flexion and extension movement as they are oriented somewhat parasagittally but limit rotation. Lumbar vertebrae also contain small mammillary and accessory processes on their bodies. These bony protuberances are sites of attachment of deep back muscles .[14]

The nearly perpendicular orientation of the spinous process in the lumbar area and the downward angular orientation in the thoracic area define the angle required for placement and advancement of a needle intended to access the vertebral canal. [15]

- Sacral spine:

The sacrum is located behind the pelvis. 5 bones fused into a triangular shape. The sacrum fits between the two hip bones connecting the spine to the pelvis. The last lumbar vertebra (L5) articulates with the sacrum. Immediately below the sacrum are 5 additional bones, fused together to form the coccyx (Fig. 1). [10]

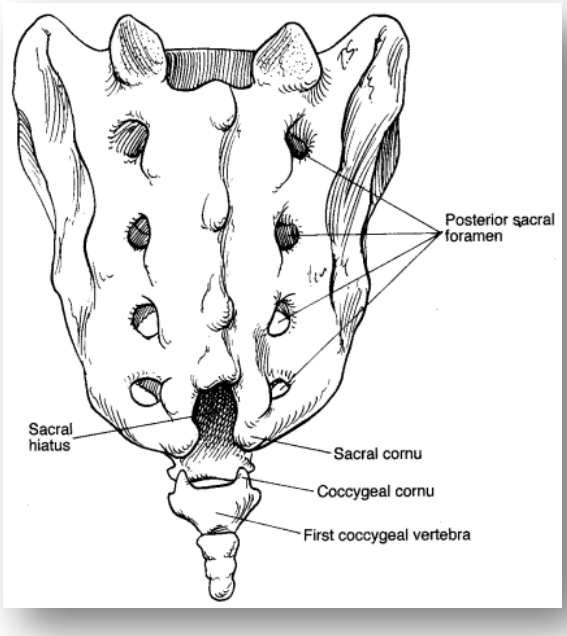

Fig. (1): Anatomy of the sacral hiatus and dorsum of the sacrum.[10]

Spinal curves:

The normal spine has S like curve when looking at it from the sagittal plane. This allows for an even distribution of weight. The cervical and the lumbar spines curve slightly inward, the thoracic and the sacral spines curve outward. Even though the lower portion of the spine holds most of the body's weight, each segment relies upon the strength of the others to function properly. **(16)**

The thoracic convexity (kyphosis) and the lumbar concavity (lordosis) are of major importance to the distribution of local anesthetic (LA) solution in the subarachnoid space (Fig. 2). **(15)**