The effect of adding Magnesium sulfate to Bupivcaine in Supraclavicular Brachial Plexus Block in Upper Limb Surgeries

Thesis

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List of Contents

List of Tables

List of Figures

List of Figures Cont...

List of Abbreviations

Abb.	Full term
Ca	Calcium
CNS	Central nervous system
DNA	Deoxy Ribo-Nucleic Acid
ECF	Extracellular fluid
ECG	Electrocardiogram
IV	Intravenous
K^+	Potassium
LAs	Local anesthetics
MgSO4	Magnesium Sulphate
Na^+	Sodium
NMDA	N-methyl-D-aspartate
Ns	Nerve stimulator
OR	Operating rooms
OTSB	Onset time of the sensory block
PNB	Peripheral nerve block
RNA	Ribonucleic Acid
SCM	Sternocleidomastoid
TCSB	Time for the complete sensory block
TDSB	Total duration of the Sensory Block
USG	Ultrasound guided
VAS	Visual analogue scale

Peripheral nerve block has a reproducible important role in modern anesthesia practice. This technique became common in day case and in patient anesthesia due to its safety and significant success rate ***(Mukherjee et al., 2014).***

Regional nerve block decreases the stress response accompanied with surgery and allows the minimal use of anesthetic drugs ***(Amiri and Espandar, 2011).***

Upper limb surgeries beneath the level of shoulder joint are most commonly performed under peripheral blocks such as the brachial plexus nerve block. These nerve blocks provide intra operative anesthesia as well as an extended highly effective postoperative analgesia along with avoiding the side effects of general anesthesia ***(Bruce et al., 2012).***

Supraclavicular approach is the easiest and the most consistent method for surgery below the level of shoulder joint. The compactness of the brachial plexus in this site provides a rapid onset of action and complete block of the brachial plexus nerves ***(Amiri and Espandar, 2011).***

Ultrasound guidance in supraclavicular brachial plexus block permits better visualization and identification of underlying deep structures, movement of the needle and the direct spread of local anesthetic make procedure safer and more effective as compared to nerve stimulator-guided technique ***(Duncan et al., 2013)***.

Several benefits are obtained using the ultrasound guided peripheral nerve block including accuracy, faster onset of action, decreasing the dose of local anesthetic drugs and decreasing the risk of complications ***(Hopkins, 2007).***

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

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

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

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 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 influx blocking drugs ***(Sirvinskas and Laurinaitis, 2002).***

Magnesium sulfate proved to have antinociceptive effects via blocking the N-methyl-D-aspartate receptors and regulation of associated calcium channels preventing the central sensitization caused by peripheral nociceptive stimulation ***(Soave et al., 2009; Fahmy et al., 2015).***

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

The aim of this work is to study the effect of magnesium sulfate as an adjuvant to bupivacaine in supraclavicular brachial plexus block.

The brachial plexus is a somatic nerve plexus formed by union of ventral rami (roots) of the lower 4 cervical nerves (C5-C8) and the first thoracic nerve (T1). The plexus is responsible for the motor supply of all of the muscles of the upper limb, with the exception of the trapezius and levator scapula **(Figure 1)** ***(Match and Leffert, 1987).***

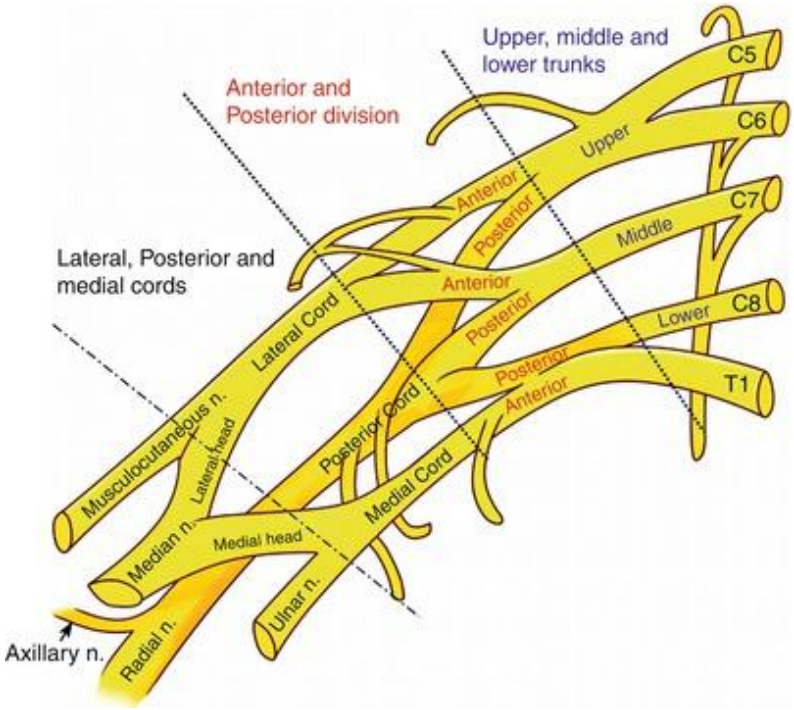

Figure (1): Roots, trunks, divisios, cords and branches of brachial plexuses ***(Strichartz and Berde, 2005).***

Divisions of the brachial plexus:

Roots:

The ventral rami of the C5-C8 and T1 nerve roots unite to form the brachial plexus, between the anterior and middle scalene muscles. C4 and T2 nerve roots may give an additional contributions. The dorsal scapular nerve (C5) and long thoracic nerve (C5-C7) to the serratus anterior muscle arise directly from the nerve roots ***(Auguste et al., 2010).***

Trunks:

Between the two scalene muscles the nerve roots joined together to form three trunks, which emerge from the interscalene space to lay superioposterior to the subclavian artery as it courses along the upper surface of the first rib ***(Wedel, 2004).***

The area of the trunks corresponds to the point where the brachial plexus is confined to its smallest surface area, three nerve structures, closely related to each other. This great reduction in surface area allow the plexus to get through the narrow passage between the clavicle and the first rib at the apex of the axilla **(Figure 2)** ***(Singhal et al., 2007).***

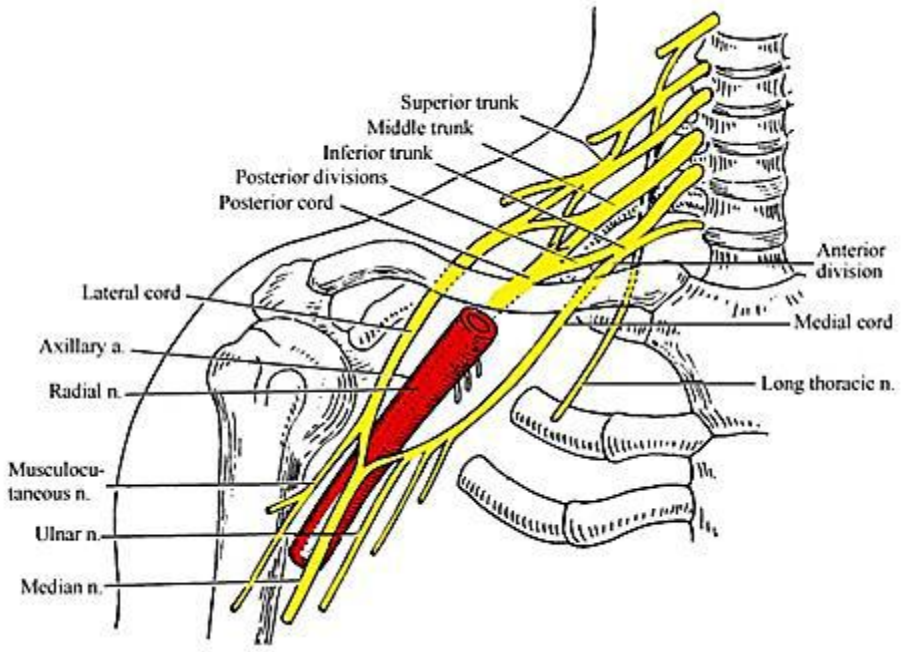

Figure (2): Basic relationships of the brachial plexus to the axillary artery, which is a continuation of the subclavian artery ***(Gloss et al., 2006).***

Divisions:

Each trunk divides into anterior division and posterior division, just above or little behind the clavicle. These separate the innervation of the anterior and posterior aspect of the upper limb. The anterior divisions usually supply the flexor muscles while the posterior divisions usually supply the extensor muscles ***(Franco et al., 2004).***

Cords:

There are Lateral, posterior, and medial cord, according to their relationship with the axillary artery. The cords run