



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

# **Comparison between intravenous and perineural dexamethasone in prolonging the analgesic effect of supraclavicular plexus nerve block.**

**Thesis**

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By

**Mohamed Yousef Saad**  
M.B.,B.Ch (Ain Shams University)

Supervised By

**Prof.Dr. Hany Mohamed Mohamed El-Zahaby**

Professor of Anesthesia, Intensive Care and Pain Management  
Faculty of Medicine, Ain Shams University

**Ass. Prof. Dr. Karim Yousef Kamal**

Assistant Professor of Anesthesia, Intensive Care and Pain Management  
Faculty of Medicine, Ain Shams University

**Dr. Dalia FahmyEmam**

Lecturer of Anesthesia, Intensive Care and Pain Management  
Faculty of Medicine, Ain Shams University

**Faculty of Medicine,  
Ain Shams University  
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## **List of Abbreviations**

5-HT	: 5-Hydroxy tyramine (serotonin)
AXI	: Axillary nerve
BP	: Brachial plexus
CNS	: Central nervous system
COX	: Cyclooxygenase
DBP	: Diastolic blood pressure
DC	: Direct current
GABA	: Gamma amino butyric acid
HR	: Heart rate
Hz	: Hertz
LAs	: Local anesthetics
LC	: Locus ceruleus
MAOI	: Monoamine oxidase inhibitors
MC	: Musculocutaneous nerve
MEAV	: Minimum effective anesthetic volume
MED	: Median nerve
MSM	: Middle scalene muscle
NO	: Nitric oxide
NSAIDs	: Non-steroidal anti-inflammatory drugs
PAG	: Peri-aqueductal grey area
PNB	: Peripheral nerve blockade
PNS	: Peripheral nerve stimulation

## List of Abbreviations (Cont.)

RAD	:	Radial nerve
SA	:	Subclavian artery
SBP	:	Systolic blood pressure
SD	:	Standard deviation
SG	:	Substantia gelatinosa
ULN	:	Ulnar nerve
US	:	Ultrasound

## List of symbols

$\lambda$	:	Wave length
$F$	:	Frequency
$C$	:	Velocity
$\Sigma$	:	Sum
$n$	:	Number of observations
$\bar{X}_d$	:	Mean's difference between preand post
$SE_d$	:	Standard error of the difference between pre and post

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## **Introduction**

Brachial plexus block is a popular and widely employed regional nerve block technique for peri-operative anesthesia and analgesia for surgery of the upper extremity. Supraclavicular approach is the easiest and most consistent method for surgery below the shoulder joint. Regional nerve block minimizes the stress response to surgery and allows using minimal anesthetic drugs which is always beneficial for the patients with various cardio-respiratory co-morbidities (*Shrestha et al., 2007*).

Ultrasound guidance is a reliable and safe technique in peripheral nerve blocks. It also plays a crucial and an increasing role in medicine nowadays due its low cost, the absence of ionizing radiation and its high temporal resolution (*Jerrold et al., 2010*).

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 (*Gowala et al., 2009*).

Bupivacaine is a widely used local anesthetic which is related chemically and pharmacologically to the amide local anesthetics available. Using 0.5% bupivacaine in supraclavicular

brachial plexus block, the onset time may be up to 20 min with surgical anaesthesia taking up to 40 min. The duration of block ranges from 4-12h with residual anaesthesia still being present at 24h(*Berde and Strichartz, 2015*).

Perineural dexamethasone was first explored clinically more than 12yr ago, followed by a myriad of clinical trials. Recently, a meta-analysis concluded that perineural dexamethasone, compared with placebo, prolonged the duration of analgesia by >8h, when combined with long-acting local anesthetics, suggesting that patients could benefit from a pain-free postoperative night. The mechanism of action for this prolongation of block is not fully understood, but suggested possibilities include decreased nociceptive C-fiber activity via a direct effect on glucocorticoid receptors (**Johansson et al., 1990**), a direct effect on inhibitory potassium channels, a local vasoconstrictive effect or systemic anti-inflammatory effect.

However, perineural route of dexamethasone administration remains off label. An alternative choice of intravenous dexamethasone intravenous has likewise been explored, which at moderate doses offers the potential for a systemic anti-inflammatory effect. (**De Olivera et al., 2011**).

## **Aim of Work:**

The aim of this work is to study the effect of dexamethasone as an adjuvant to bupivacaine either intravenous or perineural in ultrasound guided supraclavicular brachial plexus block.

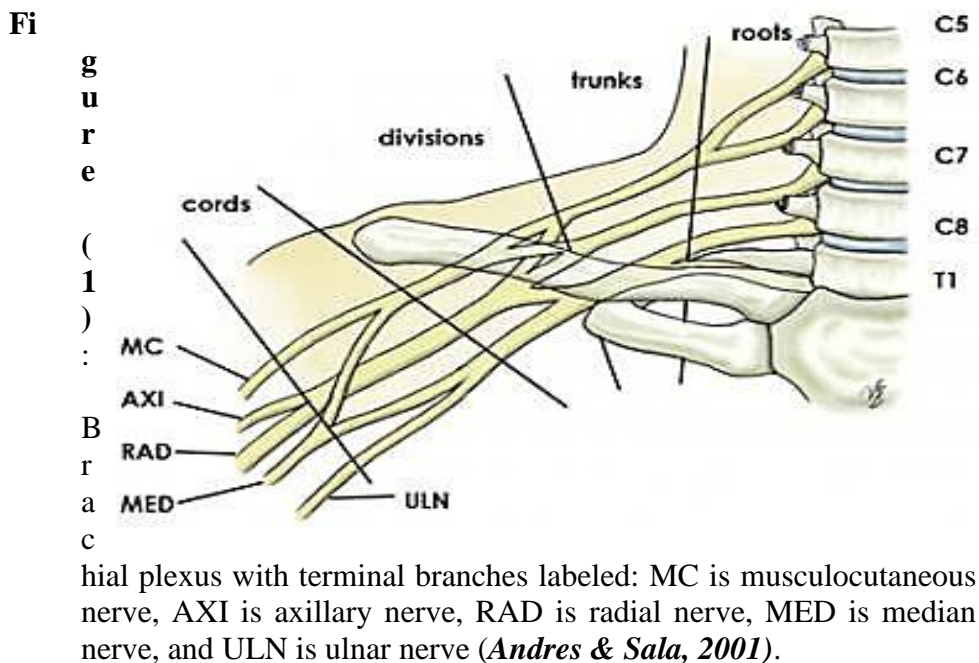
## Anatomy of the Brachial Plexus.

Brachial plexus is a complex network of nerves supplying the whole upper limb, including its motor and sensory supply, arising from the neck and passing through the axilla to the upper limb.

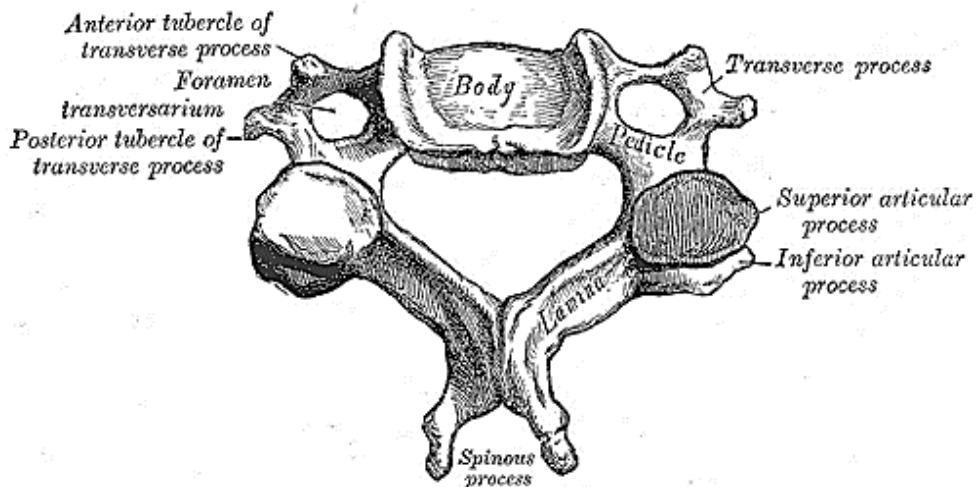
It is composed of 5 roots, 3 trunks, 6 divisions, 3 cords, and terminal branches (**Figure 1**) (*Andres and Sala, 2001*).

### 1-Roots:

The ventral rami of spinal nerves from C5 to T1 are referred to as the roots of the brachial plexus. The typical spinal nerve root results from the union of the ventral nerve rootlets originating in the anterior horn cells of the spinal cord and the dorsal nerve rootlets (*Andres and Sala, 2001*).



The roots then get exit through the transverse processes of the cervical vertebrae just posterior to the vertebral artery, which runs in a cephalic direction through the transverse foraminae. Each transverse process consists of a posterior and anterior tubercle, which meet laterally to form the costotransverse bar (**Figure 2**). The transverse foramen lies medial to the costotransverse bar and between the posterior and anterior tubercles. The spinal nerves that form the brachial plexus run in an inferior and anterior direction within the sulci which is formed by these structures. (*Gloss et al., 2006*)



**Figure (2):** Typical cervical vertebra (*Gloss et al., 2006*).

## 2-Trunks:

Shortly after emerging from the intervertebral foraminae, the 5 roots (C5-T1) unite to form 3 trunks. One on top of the other, as they traverse the triangular interscalene space formed between the anterior and the middle scalene muscles. This space

becomes wider in the anteroposterior plane as the muscles approach their insertion on the first rib. Although the roots of the plexus are long, the trunks are short (approximately 1cm) as they are wide, which shortly give rise to a total of six divisions (three anterior and three posterior), as they reach the clavicle (*Franco and Vieira, 2000*).

The area of the trunks corresponds to the point where the brachial plexus is confined to its smallest surface area, 3 nerve structures, closely related to each other, carrying the entire sensory, motor and sympathetic innervation of the upper extremity, with the exception of a small area in the axilla and upper middle arm, which is innervated by the intercosto-brachial nerve, a branch of the 2<sup>nd</sup> intercostal nerve. This great reduction in surface area allows the plexus to negotiate the narrow passage between the clavicle and the first rib at the apex of the axilla (*Singhal et al., 2007*).

The ventral rami of C5 and C6 unite to form the upper (superior) trunk, from which the suprascapular nerve and the nerve to the subclavius arise. The suprascapular nerve carries sensory fibers to the shoulder joint and provides motor innervation to the supraspinatus and infraspinatus muscles. The ventral ramus of C7 continues as the middle trunk. The ventral