Comparative Study Between Dexmedetomidine And Fentanyl As An Adjuvant To Bupivacaine In Ultrasound-guided Interscalene Brachial Plexus Block in Arthroscopic Shoulder Surgeries

Thesis

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Sara Hossam Eldin Taha Mohammed

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List of Abbreviations

Abb.	Full term
BP	*Brachial plexus*
CBC	*Complete blood count*
CNS	*Central nervous system*
CXR	*Chest x-ray*
DOA	*Duration of analgesia*
ECG	*Electrocardiogram*
GABA	*Gamma Amino Butyric Acid*
HR	*Heart rate*
IV	*Intravenous*
KFT	*Kidney function tests*
LA	*Local anaesthetics*
LC	*Locus coeruleus*
LFT	*Liver function tests*
MAP	*Mean arterial blood pressure*
MEAV50	*Minimum effective anesthetic volume*
MS	*Middle scalene*
NRS	*Numerical rating scale*
PAG	*Peri-aqueductal grey area*
PNB	*Peripheral nerve blockade*
PNS	*Peripheral nerve stimulation*
PT	*Prothrombin time*
PTT	*Partial thromboplastin time*

List of Abbreviations (Cont...)

Abb.	Full term

RBS .....*Random blood sugar*

SG .....*Substantia gelatinosa*

SpO2 .....*Peripheral oxygen saturation*

VAS .....*Visual analogue scale*

INTRODUCTION

Shoulder surgeries include hemiarthroplasty, total shoulder arthroplasty, shoulder arthroscopy, subacromial decompression, and rotator cuff repair. Anesthesia and analgesia for these surgeries can be provided by either general anesthesia, regional anesthesia, or both general and regional anesthesia together ***(Borgeat and Ekatodramis, 2002).***

Postoperative pain after orthopedic surgery can be intense. In particular, pain management after shoulder procedures poses a challenge to both anesthesiologists and orthopedic surgeons. In an effort to improve analgesia and facilitate mobilization, regional anesthesia in the form of an interscalene approach to the brachial plexus is often used either as an adjunct to general anesthesia or as the primary anesthetic ***(Van Geffen et al., 2009).***

The duration of sensory nerve blockade, and therefore analgesia with single shot regional anesthesia is relatively short lived. Prolonging blockade time and thus analgesia could potentially benefit both patients and the healthcare system ***(Christiansson, 2009).***

Ultrasound-guided peripheral nerve block has gained a wide recognition in reducing the complications associated with blind techniques in regional blocks, thus limiting the number of needle attempts for nerve localization, with better visualization

for the local anesthetic deposited in the vicinity of nerves ***(Chan et al., 2003).***

Following arthroscopic shoulder surgery, patients report severe pain on the first postoperative day after the wear off of local anesthetics' effect. Therefore, prolonging the duration of local anesthetics is desirable for decreasing postoperative pain and improving patients' satisfaction. A number of local anesthetic adjuvants, such as alpha-2 adrenergic agonists, ketamine, and corticosteroids, have been evaluated for their abilities to prolong the analgesic duration of brachial plexus blocks, and results have varied ***(Esmaoglu et al., 2010).***

Dexmedetomidine is a potent and highly selective α-2 adrenoceptor agonist with sympatholytic, sedative, amnestic, and analgesic properties, which has been described as a useful and safe adjunct in many clinical applications ***(Carollo et al., 2008).***

There have been clinical studies evaluating the effect of mixing Dexmedetomidine with local anesthetics during peripheral nerve blockade. Peripheral analgesic effects of Dexmedetomidine have enabled an overall improved blockade quality when added to local anesthetics in a peripheral nerve block model which is thought to be mediated by α2 receptor binding. Dexmedetomidine also causes local vasoconstriction resulting in delay of absorption of local anesthetics, thus prolonging its action ***(Yoshitomi et al., 2008).***

Fentanyl is a potent synthetic opioid that produces sedation and analgesia when administered intravenously; also many authors believe that it also prolongs the effect of local anesthetics in peripheral nerve blocks ***(Gormley et al., 1996).***

AIM OF THE WORK

The aim of this work is to compare the effects of adding either Dexmedetomidine or Fentanyl to Bupivacaine in Ultrasound-guided Interscalene Brachial plexus nerve block as regard the block characteristics (onset and duration of the sensory and motor block, and the duration of post-operative analgesia).

SHOULDER ANATOMY AND INNERVATION

There is a dynamic interaction between bones, joints, muscles, and ligaments of the shoulder, which is the foundation for the unique functions of the human shoulder. Shoulder girdle bones include the humerus, scapula, and clavicle. Three joints and one articulation are found in the shoulder girdle: sternoclavicular joint, acromioclavicular joint, glenohumeral joint (shoulder joint), and scapulothoracic articulation ***(Boezaart, 2006).***

The brachial plexus supplies all the motor and most of sensory functions of the shoulder, except the cephalad cutaneous areas of the shoulder, which are innervated by the supraclavicular nerves, originating from the superficial cervical plexus (C3-C4) ***(Borgeat & Ekatodramis, 2002)***.

Effective control of postoperative shoulder pain generally requires local anesthetic blockade of the nerve supply to the synovium, capsule, articular surfaces, periosteum, ligaments, and muscles of the shoulder ***(Price, 2007)***.

The terminal branches of the brachial plexus that supply the majority of the shoulder innervation are the suprascapular and axillary nerves (Figure 1).

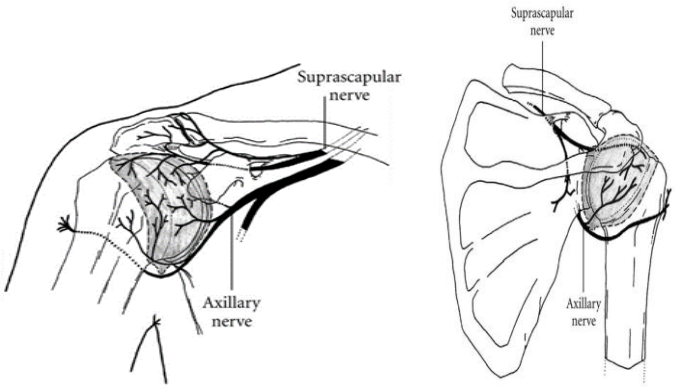

Figure (1): Anterior and posterior innervation of the shoulder joint ***(Borgeat & Ekatodramis 2002)***.

Anatomical consideration of the brachial plexus:

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

Formation of the brachial plexus begins just beyond to the scalene muscles. In the neck, the brachial plexus lies in the posterior triangle, where it's covered by skin, platysma and deep fascia. At this point, it is crossed by many structures such as, the supraclavicular nerves, the nerve to the subclavius, the inferior belly of omohyoid, the external jugular vein, the superficial ramus of the transverse cervical artery (Figure 2). Then the plexus emerges between the scalenus anterior and medius ***(Aszmann et al., 2000).***

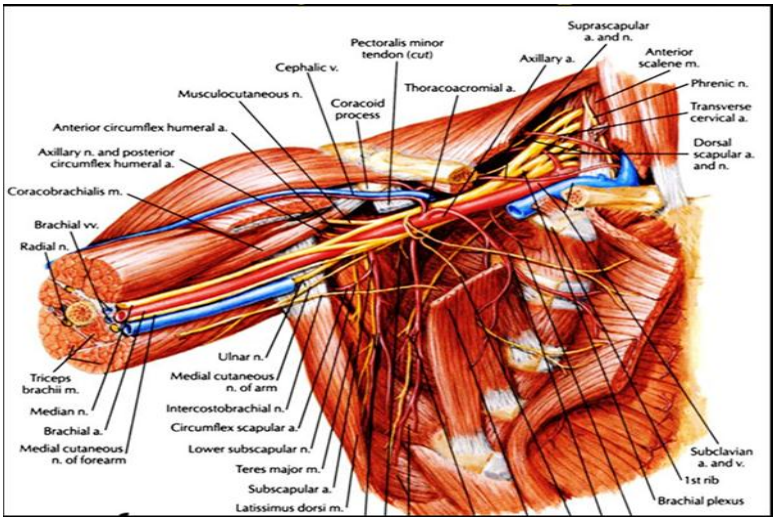

Figure (2): Anatomical relation of the brachial plexus ***(Netter, 2014)***

The brachial plexus is composed of 5 roots, 3 trunks, 6 divisions, 3 cords, and terminal branches as seen in (Figure 3) ***(Andres & Sala, 2001).***

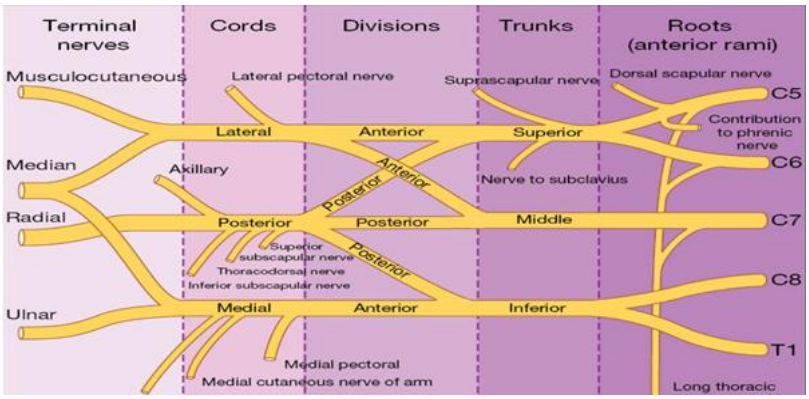

Figure (3): Brachial plexus with terminal branches
(Andres and Sala, 2001)