Dissertation on

COMPARISON OF TWO DIFFERENT TECHNIQUES FOR BRACHIAL PLEXUS BLOCK-INFRACLAVICULAR-CORACOID APPROACH AND SUPRACLAVICULAR APPROACH A STUDY OF 60 CASES

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CERTIFICATE

This is to certify that this dissertation entitled **"COMPARISON OF TWO TECHNIQUES OF BRACHIAL PLEXUS BLOCK : INFRACLAVICULAR COROCOID APPROACH AND SUPRACLAVICULAR APPROACH"** is bonafide record work done by **Dr.A.NIRANJAN KUMAR** under my direct supervision and guidance, submitted to the Tamil Nadu Dr. M.G.R. Medical University in partial fulfilment of University regulation for MD, Branch X – Anaesthesiology. Duration of course: April 2008 – March 2010.

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DECLARATION

I **Dr.A.NIRANJAN KUMAR** solemnly declare that this dissertation titled **"COMPARISON OF TWO DIFFERENT TECHNIQUES FOR BRACHIAL PLEXUS BLOCK-INFRACLAVICULAR - CORACOID APPROACH AND SUPRACLAVICULAR APPROACH"** has been done by me. I also declare that this bonafide work or a part of this work was not submitted by me or any other for any award, degree, diploma to any other University board either in India or abroad.

This is submitted to The Tamilnadu Dr. M. G. R. Medical University, Chennai in partial fulfillment of the rules and regulation for the award of Doctor of Medicine degree Branch –X (Anaesthesiology) to be held in March 2010.

Dr. A. Niranjan Kumar

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CONTENTS

INTRODUCTION

Peripheral nerve blocks are gaining widespread popularity for perioperative pain management because of their distinct advantages over general and central neuraxial anesthesia.

Pain relief with peripheral nerve block (PNB) is devoid of side effects such as somnolence, nausea, vomiting, hemodynamic instability and voiding difficulties inherent to general and central neuraxial anesthesia.

Patient who undergoes surgery under PNB can bypass recovery room and be expeditiously discharged following outpatient surgery. A substantial savings on operating room turnover time can occur if PNB are done outside operating rooms. Patient can position themselves on the operating table with little risk to the loss of airway and minimal personnel effort. High degree of patient and surgeon satisfaction results because of superior pain control with minimal side effects. Consent for amputation on table may be obtained if required, from patients undergoing anaesthesia with peripheral nerve block techniques.

Peripheral nerve block of upper limb includes the various techniques of brachial plexus block. Among brachial plexus blocks, interscalene, supraclavicular and axillary blocks have been routinely used

for many years in our institute. Infraclavicular block has gained interest in recent times.

INFRACLAVICULAR BLOCK

Infra clavicular brachial plexus block was first described by Bazy in the early 20th century and was even included in LABAT's text book: regional anesthesia in 1922[1]. In the past few years infraclavicular block has become a method of increased interest.

This block targets the musculocutaneous and axillary nerves at the level of the cords before these nerves leave the brachial plexus "sheath". This block carries no risk of accidental intrathecal, epidural, intravertebral injection, stellate ganglion block or paralysis of hemi diaphragm.

PERIPHERAL NERVE STIMULATORS:

Until recently, elicitation of paraesthesia has been a classical method to locate nerves for peripheral nerve blocks. Peripheral nerve stimulator technology utilizes objective end points for nerve localization and does not depend on patient's subjective feeling for effective nerve localization. An effective use of PNS technology mandates knowledge of anatomy with respect to optimal needle insertion site to achieve needle

tip-target nerve contact muscle innervations scheme of the targeted nerve to identify desired evoked motor response (EMR) ability to differentiate desired EMR from the alternate EMRs elicited by the stimulation of adjacent muscles and collateral nerves and the relationships of the adjacent neuromuscular structures generating these alternate EMRs to the targeted nerve.

Therefore an algorithm can be designed for needle redirection during PNS assisted PNB.

This study attempts to compare the clinical efficacy of infraclavicular and supraclavicular approach of brachial plexus block by using peripheral nerve stimulator.

AIM OF THE STUDY

To compare the ease of technique & efficacy of block between supraclavicular and infraclavicular approaches for brachial plexus block using nerve locator in patients undergoing surgery in elbow, forearm and hand.

HISTORY

Brachial plexus nerve block was performed first by –HALSTED in 1884 When he "freed the cords and nerves of the brachial plexus, after blocking the roots in the neck with cocaine solution".[2]

In 1911 HIRSCHEL and KULENKAMPFF[3], working independently, were the first to inject the brachial plexus percutaneously, (blindly through the skin),without exposure of the nerves. This was the first method of supraclavicular block

More modern modifications of supraclavicular block include WINNIE AND COLLINS'S subclavian perivascular technique[4,5] and the "plumb-bob" technique of BROWN et al 1993[6].

Infraclavicular approach was originally suggested by BAZY and coworkers in 1917.-was included in LABAT's regional anesthesia in 1922.[1]

In 1977, RAJ and associates modified the infraclavicular technique by a lateral direction of the needle; thus avoiding pneumothorax, and using the nerve stimulator to make the technique of locating the plexus more acceptable to the patients.[7,8,9]

In 1998 WILSON et al[10].described an infraclavicular corocoid technique –which was adopted in this study, was undertaken to evaluate the sensory distribution and its clinical efficacy.

ANATOMICAL CONSIDERATIONS[11-19]

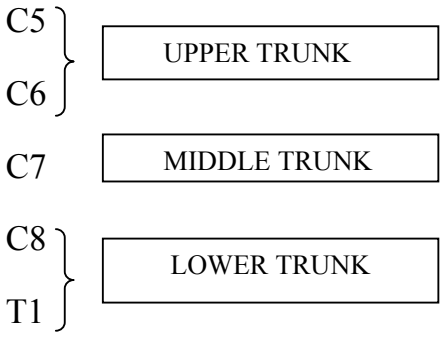
Knowledge of the formation of the brachial plexus and its distribution is essential to the intelligent and effective use of the brachial plexus blockade for the surgeries of the upper limb. Close familiarity with the vascular, muscular and fascial relationship of the plexus throughout the formation and distribution is equally essential to the mastery of various techniques of Brachial plexus Blockade.

Derivation of plexus:

The brachial plexus is derived from the anterior primary rami of the fifth, sixth, seventh, eighth cervical nerves and the first thoracic nerve: with variable contributions from the fourth cervical and second thoracic nerves.

Course:

After leaving their intervertebral foramina, the roots course anterolaterally and inferiorly to lie between the anterior and middle scalene muscles, which arise from anterior and posterior tubercles of cervical vertebrae respectively. Here they unite to form the trunks.



The prevertebral fascia invests both the anterior and middle scalene muscles, fusing laterally to enclose the brachial plexus in a fascial sheath. Trunks emerge from the lower border of the muscle running inferiorly and anterolaterally converging towards the upper border of the first rib, where they lie cephaloposterior to the subclavian artery.

At the lateral edge of the first rib each trunk divides into anterior and posterior divisions passing inferior to mid portion of clavicle. They reunite within the axilla to form the lateral, medial and posterior cord related to the second part of the axillary artery. The posterior divisions from all three trunks unite to form the posterior cord. The anterior divisions from the upper and middle trunk unite to form the lateral cord. The anterior division from the lower trunk continues as the medial cord.

At the lateral border of the pectoralis minor, the three cords divide into the peripheral nerves of the upper extremity.

Lateral cord:

Lateral root of median nerve

Lateral pectoral nerve

Musculocutaneous nerve

Medial cord:

Medial root of median nerve

Medial cutaneous nerve of arm

Medial cutaneous nerve of forearm

Medial pectoral nerve

Ulnar nerve

Posterior cord:

Radial nerve

Axillary nerve

Upper and lower subscapular nerve

Nerve to lattismus dorsi

Branches from roots

Dorsal scapular nerve to Rhomboid muscles (C5)

Nerve to serratus anterior (C5, C6, and C7)

Branches from trunk:

Nerve to subclavius (C5-C6)

Suprascapular nerve (C5-C6)

RELATIONS

Brachial plexus has its roots in between the scalene muscles, trunks in the posterior triangle of the neck, divisions behind the clavicle and cords at the level of the Axilla and nerves beyond the axilla. In its course it lies superior and posterior to the subclavian artery. Dome of pleura is anteromedial to the lower trunk and posteromedial to the subclavian artery. The trunks emerge between the fascia covering the anterior and middle scalene muscles.

ANATOMY OF BRACHIAL PLEXUS ABOVE THE CLAVICLE:

The five roots originating from the ventral divisions of C5 through T1 are sandwiched between the anterior and middle scalene muscles. The five roots converge toward each other to form three trunks -upper, middle and lower-, which are stacked one on top of the other as they traverse the triangular interscalene space formed between the anterior and middle scalene muscles, commonly known as interscalene groove. The subclavian artery accompanies the brachial plexus in the interscalene triangle anterior to the lower trunk.

There are two potential places where the pleura can be injured during a supraclavicular block leading to pneumothorax. Those are the pleural dome and the first intercostal space. The pleural dome is the apex

of the parietal pleura (inside lining of the rib cage), circumscribed by the first rib. Each first rib is short, broad and flattened bone structure with the shape of a letter “C”. They are located on each side of the upper chest with their concavities facing each other. This concavity or medial border forms the outer boundary of the pleural dome. The anterior scalene, by inserting in this border of the first rib, comes in contact medially with the pleural dome. There is no pleural dome lateral to the anterior scalene muscle. The first intercostal space on the other hand, is for the most part infraclavicular and consequently should not be reached when a supraclavicular block is properly performed.

BOUNDARIES OF INFRACLAVICULAR FOSSA:

The pectoralis minor and major muscles anteriorly, ribs medially, clavicle and the coracoids process superiorly, and the humerus laterally. At this location, the brachial plexus is composed of cords. The sheath surrounding the plexus is delicate. It contains the subclavian/axillary artery and vein. Axillary and musculocutaneous nerves leave the sheath at or before the corocoid process in 50% patients.

FUNCTIONAL ANATOMY AND TECHNIQUES

Common techniques of infraclavicular block

- Proximal vertical infraclavicular approaches
- Distal /lateral infraclavicular approaches

These approaches target the plexus either in the close proximity of the clavicle at its midpoint i.e Kilka's point[11] (VIB) or at the apex of the deltopectoral triangle medial to the corocoid process (VIP) approaches.

At this level the 3 cords of brachial plexus are posterior and lateral to the axillary artery, forming a groups of cords, the medial cord being in the most caudal position lying under the lateral cord. The most commonly elicited EMRs at this site are those of the:

Lateral cord-EMR elbow flexion (stimulation of musculocutaneous nerve) or EMR forearm pronation (stimulation of the neural elements of the lateral root of the median)

Posterior cord-EMR deltoid contraction (stimulation of the neural elements of the axillary nerve) or wrist/finger extension (stimulation of the neural elements of the radial nerve).Eliciting a medial cord/median response at the proximal infraclavicular site will require manipulation of the needle in a more distal direction aiming medially or laterlly under the lateral cord.

1. Proximal vertical infraclavicular approaches:

Advantages:

- less painful-bypasses pectoralis muscle
- plexus is superficial

- blocks musculocutaneous and axillary nerve consistently(may be missed in distal approach)

Disadvantage:

There may be difficulty in achieving medial cord response because the medial cord lies under the lateral cord. If there is difficulty then proceed to a more distal approach.

Increased risk of pneumothorax when compared to distal approach.

Patient position:

Supine, head turned contralateral side. Roll under the interscapular and neck area, operated arm abducted, forearm supported for clear view of the hand.

Needle entry site:

It is preferable to mark the deltopectoral triangle of the clavicle(kilka's point-VIB-vertical infraclavicular approach).[11]

1. The midpoint of the line between suprasternal notch and acromian process.To identify acromian process, move the upper arm, the immobile acromian can be distinguished from mobile humeral

head. Mark the needle entry site immediately distal to the clavicle the midpoint of the line joining the sternal notch and the anterior acromian (kilka's point for VIB approach)

2. If the external jugular vein is visible, trace its trajectory down over the clavicle, this point should be in alignment with the above marked needle entry site.

3. Feel the interscalene groove above the clavicle and trace it down the clavicle, this point should also align with the marked needle entry site.

4. To mark the distal needle entry site for the more distal VIP(vertical infraclavicular brachial plexus block) approach, identify the deltropectoral triangle (infraclavicular fossa).Feel the corocoid process by asking the patient to shrug the shoulder, resulting in the anterior movement of the corocoid while the head of humerus is in upward direction. Mark the medial border of the corocoid process, the needle insertion site is at the distal angle of the deltopectoral triangle (infraclavicular fossa) 1cm medial to the corocoid process.

Procedure:

The operator stands near head of the patient on the ipsilateral side. One can start with the proximal puncture site (kilka's point), moving to a

distal site if no response is obtained or start at the distal paracorocoid site in the deltopectoral triangle. After disinfection and local anaesthetic infiltration, advance the insulated 22G, 5cm block needle in strictly perpendicular direction in the saggital plane. Set the stimulating current set at 1.0mA, 2Hz, 0.1ms.The most common initial response at the depth of 2-3cm is lateral cord response (flexion of the elbow from biceps contraction or forearm pronation). Advance the needle 1-2cm for a posterior or medial cord response. If a EMR of medial/posterior cord is not elicited, withdraw the needle drop the angle by 15-20^{o} so as to advance the needle in a more caudad direction to seek the medial cord response. If no response is elicited on the initial needle insertion site more the needle to a lateral location for 1-2cm.If lateral search fails to elicit a motor response move the needle site 1cm medially. Keep in mind that a more medial needle insertion site from kilka's point increases the risk of pneumothorax.

Gauging the depth of brachial plexus for infraclavicular block:

CORNISH et al[12] in a recent MRI study examined the anatomy of the infraclavicular region to assess the possibility of estimating brachial plexus depth before performing an infraclavicular block by using identifiable anatomical landmarks such as corocoid process and clavicle.The depth of the plexus can be most reliably gauged when the

needle is inserted in the parasagittal plane,1cm medial to the corocoid process directly below the clavicle.

The depth of the plexus from the needle insertion point in the parasagittal plane is equivalent to the vertical distance between the horizontal plane of the needle insertion point and the middle of the clavicle.

2.Distal/Lateral infraclavicular approaches(distal corocoid approaches);

(Klaastaad,Borgeat,Kapral,Wilson et al[16,17,18,19]

This approach blocks the brachial plexus distal to the pectoralis minor tendon around the second portion of axillary artery.

Advantages:

Carries a relatively **lower risk** of pneumothorax compared to proximal VIP approach especially that performed in the close proximity of the clavicle. It is technically easier to elicit the desired EMR responses.

Disadvantages:

1. Patient discomfort-requires the needle to traverse the pectoralis major so it is more painful than the proximal VIP approaches.

2. Due to the variable take off of the axillary and musculocutaneous nerves, there is a possibility of them getting spared.

Technique

Patient position- same as proximal VIP approaches

Needle entry site

Kapral et al[18] (Lateral infraclavicular) : the operator stands on the ipsilateral side to be blocked. The coracoids process is identified by asking the patient to shrug the shoulder, the coracoid process is felt when the head of humerus is positioned in the upward direction. The needle is inserted directly posteriorly in the sagittal plane until it contacts the coracoids process. The needle is then withdrawn 2-3 mm and reinserted under the coracoid process till it contacts the brachial plexus. Kapral et al has reported that in a lateral infraclavicular approach, a pronounce sensory and motor blockade of musculocutanoeus nerve was observed and an addition spectrum of nerves (thoracodorsal, axillary and medial brachial cutaneous nerve) were also onvolved

WILSON et al[10] ,Klaastad et al[19](distal coracoid) : the coracoid process is identified as described above. The needle entry site is 2cm medial and 2cm inferior to the tip of the coracoid process. The needle is

inserted directly posteriorly in the sagittal plane. The distance of plexus from skin ranges from 3-6cm.

SUPRACLAVICULAR APPROACH[4,5]

Supraclavicular block is one of the most widely used techniques of brachial plexus block. At the lateral border of the anterior scalene muscles the brachial plexus passes down between the first rib and clavicle to ener the axilla. The trunks are tightly oriented vertically on top of the first rib just posterior to the subclavian artery. As the plexus is so compact here blockade achieves excellent anaesthesia of the entire arm including the hand.

Positon:

Patient placed in supine position with head turned 30° to the opposite side to be injected. The arms are placed at the patient's side with hands pointing towards the knee. A rolled towel is placed lenghthwise between the shoulders along the spine to give the best exposure of the area.

Procedure;

The procedure is done by eliciting paraesthesia of fore arm or hands or by using a nerve locator. If used the initial setting of a nerve

locator is to deliver 0.9 mA current at 2 Hz frequenzy and 0.1 m sec pulse width and its functional status assessed. Positive pole of the cable is connected to the patient's arm on the side of the block. Negative pole of the cable is connected to the stimulating block needle. In this procedure the desired evoked motor response (EMR) is elbow flexion or finger flexion & extension of hand.

The lateral border of sternocleidomastoid is palpated and the interscalene groove is palpated by rolling the finger laterally. The subclavian pulsations is palpated as the finger is move inferiorly down the groove. The above land marks and clavicle are marked.

Needle entry:

The pulsation of the subclavian artery against the palpating finger is a guide to supraclavicular block. The needle enters at the level of C 7 in the interscalene groove. The stimulating needle is inserted just above the palpating finger and advanced in a direction which is directly caudal running parallel to sagittal axis. The needle is advanced behind the palpating finger until EMR of elbow or hand is obtained. If contraction is observed with a stimulated voltage reduced to 0.5 mA, 25- 40 ml of local anaesthetic is injected.

Clinical pearls:

- With the shoulder pulled down the three trunks of the brachial plexus are located above the clavicle; therefore the block needle during a supraclavicular block should never need to reach below the clavicle.
- The first intercostal space is located below the clavicle, thus its penetration is unlikely during a supraclavicular block properly performed.
- The needle should never cross the parasagital plane medial to the anterior scalene muscle because of risk of pneumothorax.
- The pulsatile effect of the subclavian artery exerted mainly against the lower trunk could explain why the C8-T1 dermatome can be spared if the injection is not performed in the vicinity of the lower trunk.
- The SCM muscle inserts on the medial third of the clavicle, the trapezius muscle on the lateral third of it, leaving the middle third for the neurovascular bundle. These proportions are maintained regardless of patient's size. Bigger muscle bulk through exercise does not influence the size of the muscle insertion area.
- A cough by the patient is a warning that the pleura is being irritated by the needle.

PHYSIOLOGICAL BASIS OF PERIPHERAL NERVE STIMULATOR TECHNOLOGY [20- 22]

The ability of a nerve stimulator to evoke a motor response depends on the intensity, duration, and polarity of the stimulating current used and the needle (stimulus)-nerve distance. To propagate a nerve impulse, a threshold current must be applied to the nerve fibre. Peripheral nerve stimulation is typically performed using a rectangular pulse of current. When a square pulse of the current is used to stimulate a nerve, the total charge delivered is the product of the current strength and the duration of pulse.

RHEOBASE-is the minimal threshold current required to stimulate a nerve with a long pulse width.

CHRONAXIE- is the duration of the stimulus required to stimulate at twice the rheobase. Chronaxie is used to express the relative excitabilities of different tissues. It is possible to stimulate A-α (motor) fibres without stimulating A-δ and C fibres that transmit pain. Moreover, mixed nerves can be located by evoking a motor response without causing patient discomfort. Stimulation intensity will be variable as determined by coulomb's law. A very high stimulus current is required to stimulate the nerve when the needle tip is far away from the nerve. If the

distance is great, the strength of the stimulus required to stimulate the nerve may produce significant pain and systemic effects. An EMR at a stimulating current of <0.5mA is associated with high rates of success of PNS assisted PNB.

Characteristics of an ideal PNS:

1. Constant current output-A particular current not the voltage stimulates the nerve. Therfore, the current delivered by the device should not vary with changes in the resistance of the external circuits.
2. Digital display of the delivered current
3. Variable output control
4. Clearly identifiable polarity
5. Option for different pulses
6. A wide range of current output 0.1-5.0mA
7. Battery indicator

Peripheral nerve stimulator settings:

MIXED NERVE(most PNB)

Current(dial)-> 1mA

Current duration-0.1ms

Frequency-> 1-2Hz

SENSORY NERVE(eg-Lateral femoral cutaneous and saphenous nerves)

Current (dial)->2-5mA

Current duration-1ms , Frequency-1Hz

DIABETIC NEUROPATHY(PNB)

Current(dial)->2mA

Current duration->0.3ms

Frequency->1-2HZ

PHARMACOLOGY [23.24.25]

BUPIVACAINE

It is a widely used amide local analgesic. Structure is similar to lignocaine except that the amine containing group is butylpiperidine. Levobupivacaine the s-enantiomer of bupivacaine is also available with less cardio toxicity

Mechanism of action:

Binds to specific sites located on the inner portion of sodium channels (interior gate or H gate) as well as obstructing sodium channels near their external openings to maintain these channels in inactivated closed states.

Pharmacokinetics :

Pka 8.1

Bound in plasma 95%

Clearance 7.1 - 2.8 ml/min/kg

Volume of distribution 0.9 - 0.4 litres/kg

Half life 2.4-1.2 hours

Peak time 0.17-0.5 hours

Peak concentration 0.8 microgram/ml

Toxic plasma concentration > 1.5micro gram /ml

Most important plasma protein binding site is alpha1 acid glycoprotein

Metabolism:

Metabolised by enzymes in the liver by aromatic hydroxylation, N-dealkylation, amide hydrolysis and conjugation

Metabolite is N-dealkylated desbutyl bupivacaine

DOSE 3mg/kg

Used in epidural and spinal anaesthesia

For peripheral nerve blocks

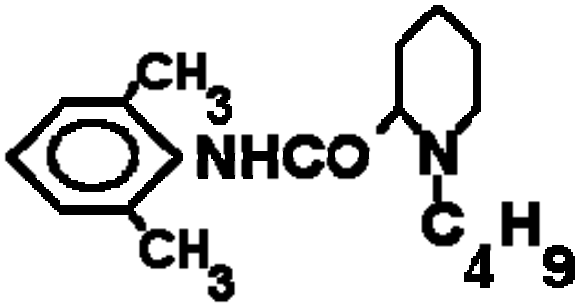
For infiltration analgesia

Toxicity

More cardio toxic than equieffective dose of lidocaine. Manifested clinically as ventricular and myocardial depression after inadvertant intra vascular administration of Bupivacaine

Mechanism of toxicity:

Although both lignocaine and Bupivacaine block cardiac sodium channels during systole, Bupivacaine dissociates more slowly than lignocaine and therefore significant fraction of sodium channels remain blocked during diastole. Thus the block is cumulative and substantively more than would be predicted by its local anaesthetic potency. A percentage of its cardiac toxicity is centrally mediated. Toxicity is enhanced by acidosis, hypoxemia, hypercarbia.



BUPIVACAINE MOLECULAR STRUCTURE

LIGNOCAINE HYDROCHOLORIDE

Lignocaine was synthesised in 1943 in Sweden by Loffgren of AB Astra. It is chemically a tertiary amide, diethyl aminoacetyl, 2,6 xylidine hydrochloride monohydrate. It is a local anaesthetic of moderate potency and duration but of good penetrative powers and rapid onset of action.

Mechanism of action:

Blocks the sodium channel in the inactivated closed state and hence prevent the initiation of conduction of action potential.

It is a stable compound at room temperature. Adrenaline prolongs the action of lignocaine and reduces the rate of systemic absorption by producing vasoconstriction and also reduces the systemic toxicity. Tachyphylaxis can occur with repeated injections. Concentration of adrenaline added is kept at 5 μgm /ml (1:200,000 dilution) of Local anesthetic.

Pharmacokinetics:

Molecular weight 271

Pka 7.8

Protein binding 70%

Lipid solubility 2.9

Volume of distribution 91 litres

Clearance 0.95 litres /minute

Elimination half life 96 minutes

Toxic plasma concentration: >5microgram/ml

Metabolism

The principle metabolic pathway of Lidocaine is oxidative dealkylation in Liver to monoethylglycine xylilide followed by hydrolysis of this metabolite to xylidide. Hepatic disease can decrease the rate of metabolism of Lidocaine

Dose

Safe dose 3mg/kg without adrenaline

7mg/kg with adrenaline

Adrenaline upto 5ugm/ml (1 in 200,000) does not give rise to systemic effects

Blood concentration of local anaesthetic drug is highest following intercostal block followed in order of decreasing concentration, epidural, Brachial plexus block and subcutaneous infiltration

Toxicity

Allergic reactions : Due to the methyl paraben or similar preservatives , are structurally similar to paraaminobenzoic and allergic reactions are due to antibody stimulation by the preservative

Central nervous system: numbness of tongue and circumoral tissues restlessness, vertigo, tinnitus slurred speech skeletal muscle twitching ,Tonic clonic seizures, CNS depression, hypotension, apnea. Seizures are produced by selective inhibition of the inhibitory neurons of CNS leaving unopposed excitatory neuron activity.

Transient radicular irritation (with 5% hyperbaric lignocaine)

Cauda equina syndrome

Cardiovascular System

Plasma concentrations 5-10 µgm /ml can produce profound hypotension due to relaxation of arteriolar smooth muscle and direct myocardial depression

Therapeutic uses:

Topical anaesthesic (2-4%)

EMLA cream (lignocaine 2.5% prilocaine 2.5%)

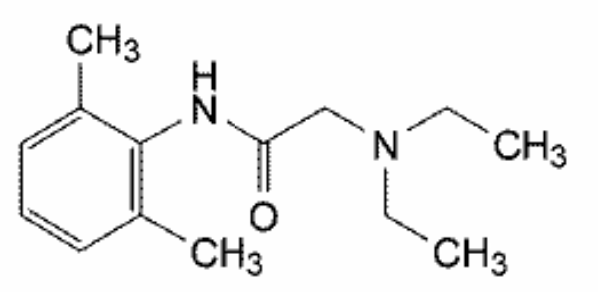
Local infiltration and peripheral nerve block

Intravenous regional anaesthetic (Biers block)

Regional anaesthetic (spinal / epidural)

Stress attenuation and prevention of rise in intra cranial tension

Suppression of the ventricular cardiac dysrythmias



LIGNOCAINE MOLECULAR STRUCTURE

VASOCONSTRICTORS

When used with a local anaesthetic, adrenaline, a commonly used vasoconstrictor is found to prolong the duration of block by delaying the absorption and also by lowering the peak blood level, to reduce the incidence of systemic toxicity of the local anaesthetic.Though its use is controversial in microvascular re-implantation and reconstructive surgeries of the hand, due to possible adverse consequences of decreased overall arm blood flow, it was used in the present study,with the aim of reducing the incidence of toxicity due to lignocaine since it is the drug of choice for the initial blockade because of its shorter onset of action.

Adrenaline

Epinephrine (adrenaline) is the prototype drug among the sympathomimetics.

Functions

- Regulation of myocardial contractility, heart rate, vascular and bronchial smooth muscle tone.
- Potentiates glandular secretions and metabolic processes.
- Agonist of α- adrenergic, β 1 and β2 receptors.
- Poorly lipid soluble hence lack of cerebral effects.

Uses

- Addition to local anaesthetic solution in order to decrease systemic absorption and to prolong duration of action.
- Treatment of life threatening allergic reaction.
- During CPR as a very important theraupetic drug.
- Continuous infusion to increase myocardial contractility.

REVIEW OF LITERATURE

1. Infraclavicular brachial plexus block for regional anaesthesia of the lower arm [26] KJ Chin, VTW Chee, B Lee Cochrane Database of Systematic Reviews 2008 Issue 4.

More recently, another approach, the infraclavicular block (where the skin is pierced in the area below the collarbone), has enjoyed a resurgence.

The touted advantages of the infraclavicular approach are as follows. Firstly, it provides comprehensive anaesthesia of the upper limb, equalled only by the supraclavicular approach. The axillary approach often fails to block the axillary nerve and musculocutaneous nerves (which branch off at a higher level), whilst the interscalene and supraclavicular approaches often may fail to provide anaesthesia in the distribution of the ulnar nerve (Cousins 1998). Secondly, unlike the interscalene and supraclavicular approaches, the risk of inadvertent lung or pleural puncture is minimal (Cousins 1998). Thirdly, by piercing the skin below the collarbone, injury to the neurovascular structures in the neck are avoided (unlike the interscalene approach). Finally, it is an ideal site for long-term brachial plexus blockade. The bulk of the pectoralis muscle firmly anchors the catheter, arm movement is not impaired, and hygiene is easily maintained (Brown 1993).

2. **Infraclavicular block vs axillary and humeral canal blocks (HCB)** *Canadian Journal of Anesthesia* 54:662-674 (2007) [27] **Quang Hieu De Tran, MD FRCPC, Antonio Clemente, MD, Julian Doan, MD and Roderick J. Finlayson, MD FRCPC**

Eight RCTs comparing ICB to AXB were identified. Despite differences in infraclavicular surface landmarks and varying definitions of success rate, the findings were remarkably consistent.

Interpretation

Most studies suggest that ICB is more reliable than a single-stimulation AXB. When compared to a multiple-stimulation AXB or HCB, ICB provides similar efficacy. However it may be associated with a shorter performance time and less procedure-related pain for the patient.

3. **Genevieve arcand, Stephen Williams, CHUM Hospital, Montreal Canada Anaesth Analg 2005; 101: 886 -90 Ultrasound guided Infraclavicular vs Supraclavicular Block.** [28]

USG Infraclavicular block is at least as rapidly performed as USG Supraclavicular Block and produces similar degree of surgical anaesthesia without supplementation.

Single-injection brachial plexus anesthesia for arteriovenous fistula surgery of the forearm: a comparison of infraclavicular coracoid and

axillary approach.[29] Niemi TT, Salmela L, Aromaa U, Pöyhiä R, Rosenberg PH.Reg Anesth Pain Med. 2005 Jan-Feb; 32(1):55-9

Conclusions:

Blockade of the musculocutaneous nerve developed faster with the infraclavicular coracoid approach than with the axillary approach. The infraclavicular coracoid approach may be preferable in patients scheduled for the creation of an arteriovenous fistula at the forearm.

4. **Acta Anaesthesiol Scand. 2005 May;49(5):677-82** [30]

Efficacy of vertical infraclavicular plexus block vs. modified axillary plexus block: a prospective, randomized, observer-blinded study.

Heid FM**,** ***Jage J*****,** ***Guth M*****,** ***Bauwe N*****,** ***Brambrink AM*****.**

Clinics of Anesthesiology, Johannes Gutenberg-University Hospital, Langenbeckstrasse 1, 55131 Mainz, Germany. heid@uni-mainz.de

Conclusions:

While both techniques provide sufficient surgical anesthesia, vertical infraclavicular plexus block demonstrated a partially higher success rate and a faster onset than high axillary plexus block.

5. Brachial plexus block: "Best" approach and "Best" evoked response-where are we? [31] Top of Form Robert S. Weller, M.D.a, J.C. Gerancher, M.D. Bottom of Form Accepted 30 August 2004.

Practitioners and investigators alike continue the search for one of the "Holy Grails" of regional anesthesia: the ideal brachial plexus block. Such a block would be ideal if it produced rapid, complete, and consistent anesthesia of the arm, forearm, and hand; led to secure catheter placement; and was nearly free of side effects or complications. The approach could be performed with the arm and head in any position and could be performed by a single injection of local anesthetic (LA). Of all approaches to brachial plexus block, infraclavicular block (ICB) is a strong contender

6. Continuous infraclavicular block for acute pain management in children-C dadure et al Anaesth analg 2003 97(3) 691-693 [32]

Corocoid approach are still being evaluated in children but seem particularly useful when catheter placement is mandatory to provide long-lasting pain relief. This approach facilitates immobilization, and dressing is easier to achieve and more comfortable than with axillary techniques.

7. **Canadian journal of anesthesia- 2003-Infraclavicular block by corocoid approach- clinically effective- Dr. Jean Desroaches, Dept. of anesthesia, Quebec, 2003.**[33]

Conclusion-Infraclavicular block by corocoid approach provides highly consistent brachial plexus anaesthesia for upper extremity surgery Contrary to axillary block positioning is not mandatory. Identification of corocoid-bony landmark-easy even in obese patients Single injection block is time efficient.

8. **Acta Anaesthesiol Scand. 1999 Nov;43(10):1047-52. Acta Anaesthesiol Scand. 2000 May;44(5):633.** [34]

Lateral infraclavicular plexus block vs. axillary block for hand and forearm surgery.

Kapral S, Jandrasits O, Schabernig C, Likar R, Reddy B, Mayer N, Weinstabl C.

Department of Anesthesia and General Intensive Care, University of Vienna, Austria.

Conclusion:

Based on the safe landmark and feasibility of this procedure and the additional spectrum of nerve block achieved (musculocutaneous,

thoraco dorsal and medial brachial cutaneous nerves), the application of lateral infraclavicular technique has to be reconsidered in clinical practice.

Given these advantages, the infraclavicular block would appear to be the regional anaesthetic technique of choice for surgery of the lower arm.

9. UPPER EXTREMITY: somatic block-David L.Brown & Donald Bridenbaugh-NEURAL BLOCKADE-COUSINS III Edition 1988[35]

Injection of local anaesthetic in the sheath above the level where the musculocutaneous and axillary nerves are formed would block these nerves frequently missed on the axillary approach.

Blocking lower than first rib would eliminate the potential for pnemothorax or for missing the ulnar segment of the medial cord.

It also blocks intercostbrachial nerve,which is not blocked on any of the other approaches.

It does not require positioning of arm as does the axillary approaches.

10. **Coracoid** block-**a safe and easy technique** [36] **British Journal of Anaesthesia, 1981, Vol. 53, No. 8 845-848 M.ROUSSO, M.D. and K.WHIFFLER, M.B., B.CH, D.A.(RAND), F.F.A.(S.A.)**

Department of Anaesthesia, University of the Witwatersrand, and Rand Mutual Hospital P.O. Box 62171, Marshalltown, 2107, Republic of South Africa.

A method of **block**ing the **brachial plexus** using an infraclavicular **approach** is described. Compared with the supraclavicular **approach**, pulmonary complications do not occur and compared with the axillary **approach** a higher level of analgesia can be obtained and a potentially septic area is not traversed. However, the level of anaesthesia is at a lower level than that obtained from the supraclavicular **approach.**

Nerve locators

11. **The supraclavicular block with a nerve stimulator: To decrease or not to decrease. That is the question. Carlo D Franco et al Anesth Analg 2004;98:1167-1171** [37]

When nerve blocks are performed with a nerve stimulator it is customary to reduce the nerve stimulator output to <= 0.5 mA before injecting. Apparently this is not necessary with a supraclavicular block.

12. **In 1990 Zaharai DT et al [38]described the use of nerve stimulator which allows accurate nerve blocks without causing paraesthesia and decreasing the possibility of nerve injury.**

13. **In 1985 Smith DC et al[39] described an inexpensive portable nerve stimulator which is used to enhance the ease and effectiveness of peripheral nerve locator.**

15. **In 1984 Bashein G et al and Ford et al [40] in their independent studies concluded that in nerve stimulator assisted nerve blocks, insulated needles more precisely located the peripheral nerves than uninsulated ones.**

16. **In 1980 Yasuda I et al[41] described the use of nerve stimulator with insulated needle in Supraclavicular brachial plexus block. They identified the plexus at the mean depth of 27 mm below the skin and the block was successful in 98% of patients when the stimulation of index, middle or ring finger was obtained.**

MATERIALS AND METHODS

This is a prospective randomized study conducted at Government Stanley Hospital, attached to Stanley Medical College, Chennai .Sixty patients of ASA grade I or II of either sex undergoing surgery on the elbow, forearm or hand (mostly orthopedic plastic surgeries) were randomly allocated into two groups S and I. Each group comprises of 30 patients. Surgery was done under Infraclavicular- corocoid approach of Brachial plexus Block in group I and under Supraclavicular –subclavian perivascular approach of Brachial plexus block in group S.

PROCEDURE

After ethical committee approval informed consent was obtained from the patients. Intravenous access was obtained. Anaesthesia machine checked resuscitative equipments and drugs were kept ready.

Inclusion criteria:

Age 18 - 60 yrs

Both sex

PS I & II undergoing surgery for both elective/emergency

Hand , wrist , Fore arm and elbow

Exclusion criteria

Infection at the puncture site

Coagulopathy

Allergy to amide local anaesthetics

Pregnancy

Severe pulmonary pathology

Mental incapacity or language barrier

BMI more than 35

Anatomical variations

Drugs and Equipment:

Group I and S-15ml of 2% lignocaine

15ml of 0.5% bupivacaine

5mic/ml of adrenaline /ml

Standard monitoring-BP/pulse/SpO2/ECG

Sterile towels and 4*4 gauge packs

20ml syringe with local anaesthetics

Sterile gloves,marking pens,and surface electrodes

One 25G needle for skin infiltration

A 10cm long,short bevel,insulated nerve stimulating needle

Peripheral nerve stimulator

Standard monitoring was applied,an IV line was secured and sedation (midazolam 1-2mg iv) and analgesia (fentanyl 50-100mic iv) were given.(The dose titrated depending on the patient"s age,weight and degree of anxiety.

TECHNIQUE

INFRACLAVICULAR BLOCK

The block was performed with the patient lying in supine position with his head turned in the direction opposite the limb to be anesthetized. The arm to be blocked is abducted to 110°. The procedure can be done with the arm in neutral position also. We identified by palpation the coracoids process and marked, with the help of a ruler, the point of entry of the needle – 2cm caudad and 2cm medial to the corocoid process, as previously described by Wilson et al[10]. Using a sterile technique, a 100mm 22 gauge insulated short bevel stimulating needle was inserted perpendicular to the skin and connected to a nerve stimulator that was

programmed with the following variables:current 2.0mA and frequency 2HZ.In the absence of an upper extremity motor response, the needle was redirected either cephalad or caudal but never medially to avoid the pleura. In the presence of an upper extremity motor response, the intensity of the current was then progressively reduced to 0.5mA and 0.5 ml/ kg of LA mixture containing 0.25 % bupivacaine and 1 % Lignocaine with 5µg/ml of adrenaline is injected (not exceeding 30 ml) after a negative aspiration for blood.[42]

GOAL: Is to achieve a hand twitch (preferably "medianus")using a current of 0.2-0.3mA.

SUPRACLAVICULAR BLOCK:

Patient was placed in supine position with head turned 30° to the opposite side to be injected. The arms were placed at the patient's side with hands pointing towards the knee. A rolled towel was placed lenghthwise between the shoulders along the spine to give the best exposure of the area. The interscalene groove and subclavian pulsations were marked. The pulsation of the subclavian artery against the palpating finger was used as a guide and the stimulating needle was inserted just above the palpating finger (i.e. the inferior most point of interscalene groove) and advanced in a direction which is directly caudal running parallel to sagittal axis. The needle was advanced behind the palpating

finger until EMR of elbow or hand is obtained. If contraction was observed with a stimulated voltage reduced to 0.5 mA, 0.5 ml/ kg of LA mixture containing 0.25 % bupivacaine and 1 % Lignocaine with 5µg/ml of adrenaline is injected (not exceeding 30 ml) after a negative aspiration for blood.

GOAL: Is to achieve a hand twitch (preferably flexion of finger and thumb) using a current of 0.2-0.3mA

Care was taken so that the toxic dose of the local anaesthetics were not exceeded according to the weight of the patients.

PARAMETERS OBSERVED

1. **Time to perform block-** from the time of skin disinfection to the end of injection. If adequate response was not obtained within 20 minutes the procedure was taken as a failure with performance time of 20 minutes.

2. **Successful block-** defined as a blockade in the four nerves to the elbow (musculocutaneous, median, ulnar and radial). If a nerve territory was spared a rescue block was administered. If the patient still experiences pain or discomfort general anaesthesia was administered.

3. **Onset of sensory block -** Onset of sensory block was taken as abolition of temperature sensation using ice over the distribution of musculocutanoeus, radial, ulnar and median nerves compared to the contralateral side was assessed every minute after the performance of the block. Surgery was allowed after all the four nerves were completely blocked.

4. **Onset of motor blockade -** Onset of motor blockade was assessed every 2 minute after the block using four point scale

   Normal power

   Weakness but able to move arm

   Not able to move arm but the fingers

   Complete motor Blockade

   Attaining a score of 2 was considered as the onset of motor Block

5. **Duration of motor Blockade -** When (3) in the four point scale changes to (2) the motor blockade is said to be reversed. The duration of motor block is noted from the time from scale (3) to scale (2).

6. **Post op analgesia -** The time interval between the onset of sensory block to the first requirement of post op analgesia was recorded in every patient.

The patient was observed every 30 minutes after the surgery is over till the motor block reverses and thereafter hourly for 6 hrs; second hourly for next 6 hrs and then at 24 hours.

7. **Vital parameters**

Pulse rate

Blood pressure

Respiratory rate monitored periodically
oxygen saturation

ECG

8. **Complications:**

Pneumothorax,

Accidental vessel puncture,

Haematoma

Paraesthesia in the post operative period.

OBSERVATION AND RESULTS

This study comprised of two groups. The patients were randomly selected.

group-I: 30 patients were received an infraclavicular block by corocoid approach and in

group-S: 30 patients were received a Supraclavicular block

Table 1:Age distribution

Age distribution in Supraclavicular group varies from 18 years to maximum of 60years ,with a mean value of 29.8 years, and standard deviation 0f 12.8. distribution in Infraclavicular group varies from 18 years to maximum of 60 years, with the mean value of 34.9years, and standard deviation of 13.4.(As shown in table.1 & fig.1)

TABLE - 1

Age group	Group S		Group I	
	No.	**%**	**No.**	**%**
Less than 20 years	7	23.3	10	33.3
21-30 years	6	20	10	33.3
31-40 years	6	20	4	13.3
40 and above years	11	36.7	6	20
Total	30	100	30	100
Range Mean S.D.	18-60 years 29.8 years 12.41 years		18-60 years 34.9 years 12.48 year	
'p'	0.117992 Not significant			

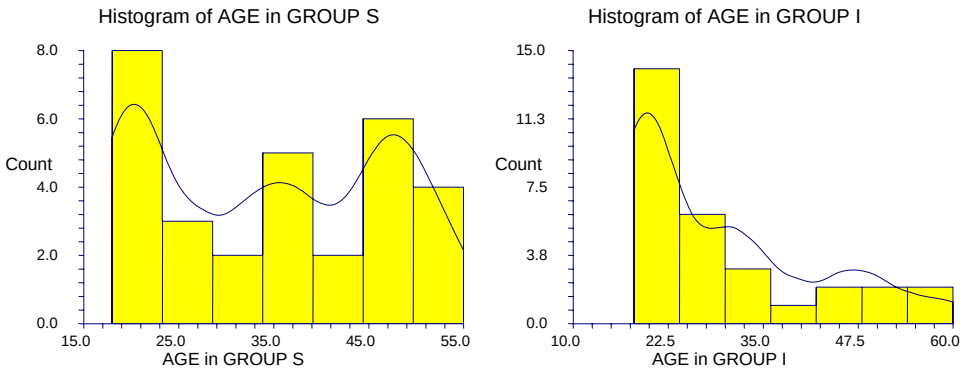


FIGURE - 1

SEX DISTRIBUTION

Sex	Group S		Group I	
	No.	%	No.	%
Males	24	80	21	70
Females	6	20	9	30
Chi square value	0.800 Not significant			
'p'	0.371 not significant			

TABLE - 2

Sex distribution in infraclavicular group-males were 21, and the rest were females and in supraclavicular group – males were 24, and the rest were females . (As shown in table.2 & Fig.2)

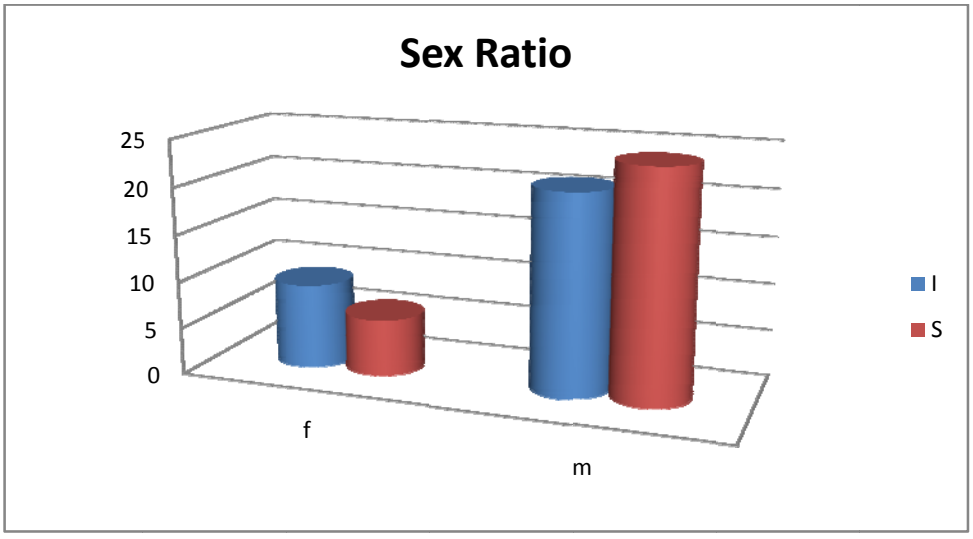


FIGURE - 2

WEIGHT

Weight distribution in Group-S range from minimum of 40kg to maximum of 70 kg, with a mean of 54.96,and the standard deviation of 6.69 , and in Group-I weight of the patients ranges from 30-70kg,with a mean of 55.46, and the standard deviation of 10.39. P value insignificant as shown in table:3 and figure: 3

TABLE - 3

Weight(in kgs)	Group S	Group I
Range	40-70	30-70
Mean	54.96	55.46
S.D.	6.69	10.39
'p'	0.825001 Not significant	

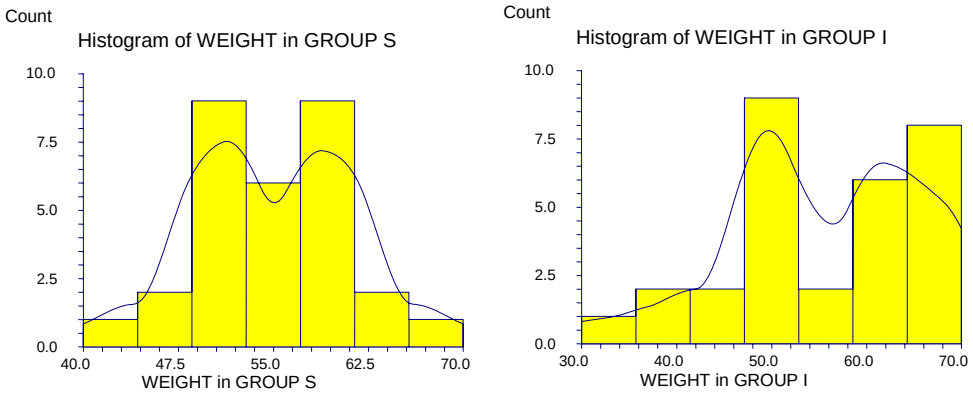


FIGURE - 3

TIME TO PERFORM BLOCK

Time to perform block in Group-S ranges from minimum of 3 minutes to the maximum of 6 minutes, with the mean of 4.61,and the standard deviation of 0.959, and in Group-I, the time to perform the block ranges from 3min,to the maximum of 7 min, with the mean of 3.9min,and the standard deviation of 1.028. The 'p' value was not significant. (Table: 4, figure:4)

TABLE - 4

Time to perform block (in minutes)	**Group S**	**Group I**
Range	3-6	3-7
Mean	4.1	3.9
S.D.	0.959	1.028
'p'	**0.4393 Not Significant**	

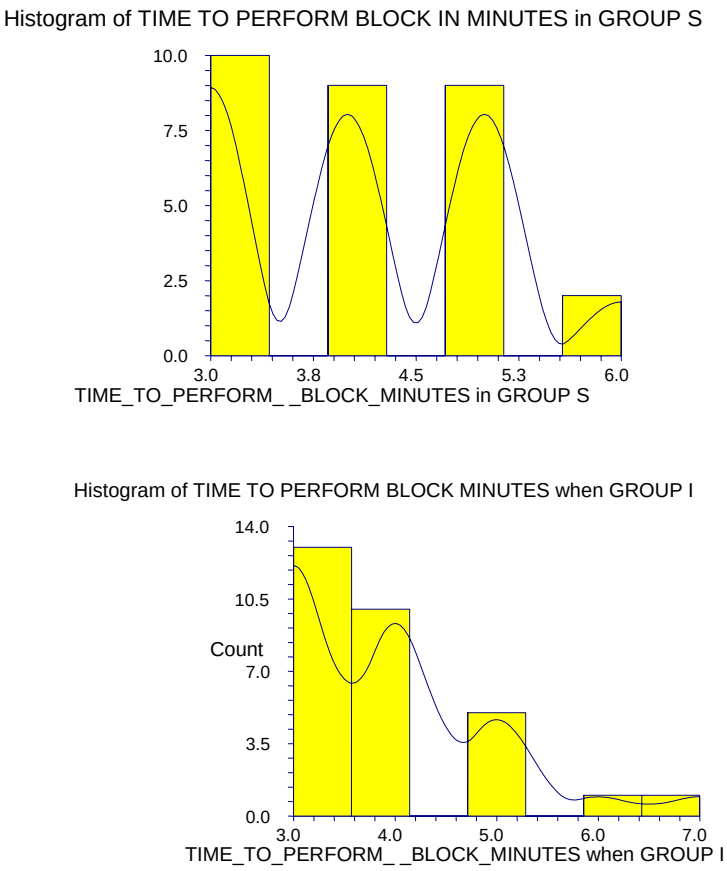


FIGURE - 4

Time for onset of motor block

Time for onset of motor block (in minutes)	Group S	Group I
Range	4- 8	3-10
Mean	5.33	5.53
S.D.	1.093	1.907
'p'	**0.6201 Not Significant**	

Time of onset of motor block in Group_S ranges from 4 min,to the maximum of 8 min, with the mean of 5.33min and the standard deviation of 1.093 and in Group-I, it ranges from 3min to the maximum of 10 min, with the mean of 5.53min,and the standard deviation of 1-907 min. P value insignificant (Table: 5 & figure: 5)

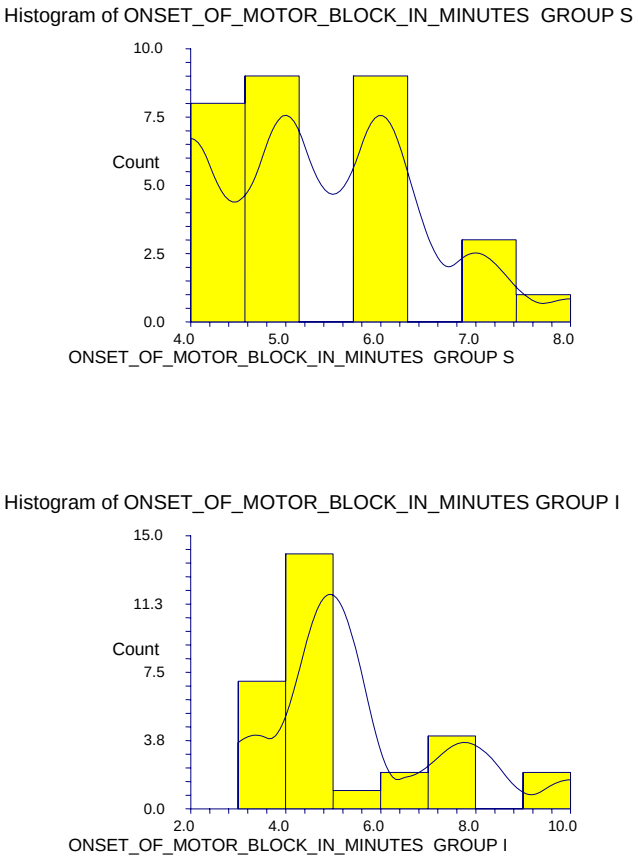


FIGURE - 5

Time for onset of sensory block

Time for onset of sensory block in Group-S ranges from the minimum of 7min, to the maximum of 10 min, with the mean value of 8.2 min, and the standard deviation of 0.846,and in group_I, it ranges from minimum of 5min, to the maximum of 15 min, with the mean of 8.03min,and the standard deviation of 2.189. P value insignificant (table: 6 & Figure: 6)

Time for onset of sensory block (in minutes)	**Group S**	**Group I**
Range	7- 10	5-15
Mean	8.2	8.03
S.D.	0.846	2.189
'p'	**0.6987 Not Significant**	

TABLE - 6

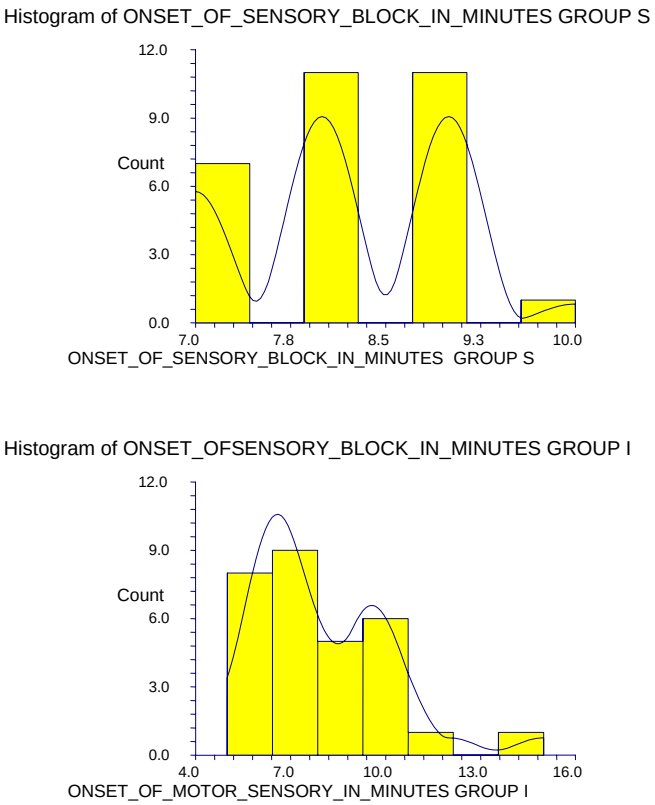


FIGURE - 6

Motor block time

Total duration of motor blockade in Group-S,ranges from 100min,to the maximum of 150 min, with the mean of 130.66min,and the standard deviation of 11.79, and in Group-I, the motor blockade duration ranges from 90min, to the maximum of 180 min, with the mean of 130.83min, and the standard deviation of 21.21 .P value insignificant (table: 7 & Figure: 7)

TABLE - 7

Duration of motor block (in minutes)	**Group S**	**Group I**
Range	100- 150	90-180
Mean	130.66	130.83
S.D.	11.79	21-21
'p'	**0.970133 Not Significant**	

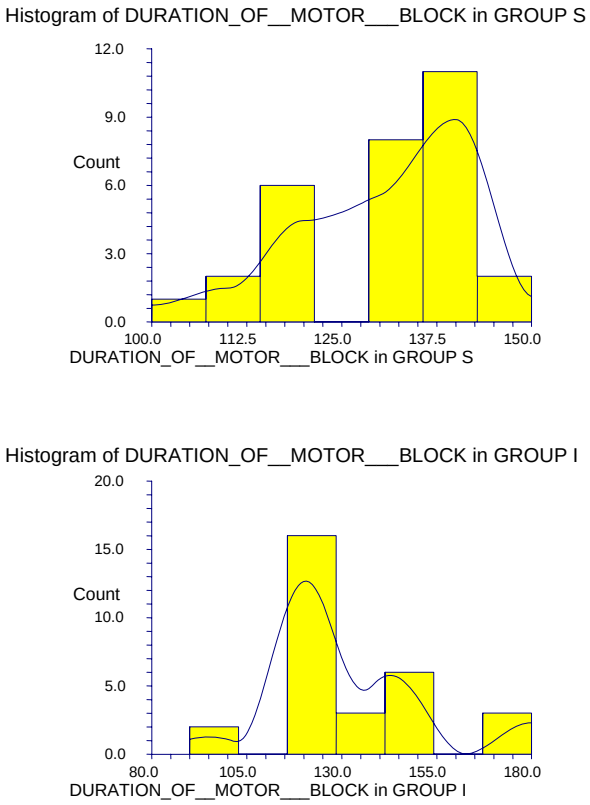


FIGURE - 7

Post Operative Analgesia time

Total duration of post operative analgesia in Group-S, ranges from minimum of 10 hrs, to the maximum of 15 hours, with the mean of 11.42 hours, and the standard deviation of 1.42,and in Group-I, it was ranges from the minimum of 9 hrs, to the maximum of 20 hrs, with the mean of 10.93 hours, and the standard deviation of 2.31. P value insignificant **(table:8 & Figure: 8)**

TABLE - 8

Duration of Post op analgesia (in hours)	**Group S**	**Group I**
Range	10 -15	9 -20
Mean	11.1	10.93
S.D.	1.42	2.31
'p'	**0.738380 Not Significant**	

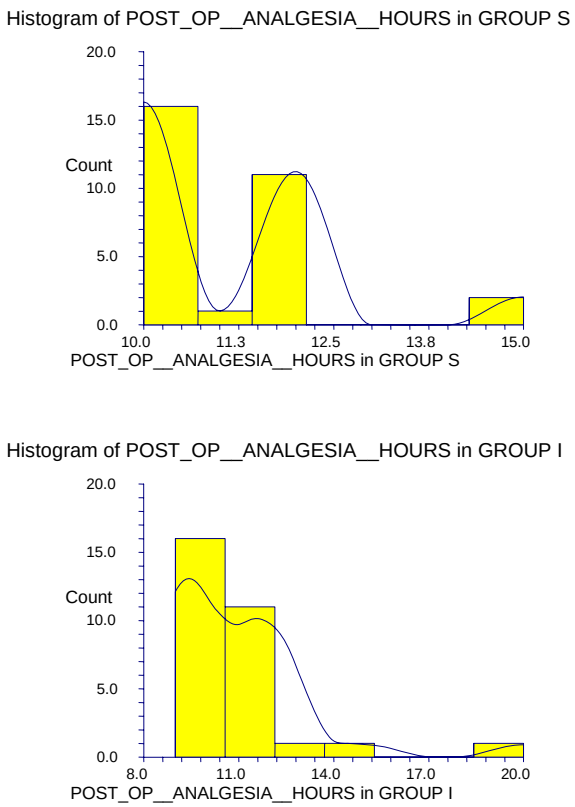


FIGURE - 8

Successful Block

Successful block, that is involvement of four terminal nerves : In Group-S, 3 out of four nerves were blocked in 1 patient (3-3 %) and all four nerves were blocked in 29 patients (96.7 %). In group I 3 out of four nerves were blocked in 3 patients (10 %) and all four nerves were blocked in 27 patients (90 %). Applying Chi square tests, it was found to be statistically insignificant. The 'p' value of 0.554 was statistically insignificant. P value insignificant (table:9 & Figure: 9)

TABLE - 9

Number of nerves	Group S		Group I	
	No.	%	No.	%
3	1	3.3	3	10
4	29	96.7	27	90
Chi square value	0.353 Not significant			
'p'	0.554 Not significant			

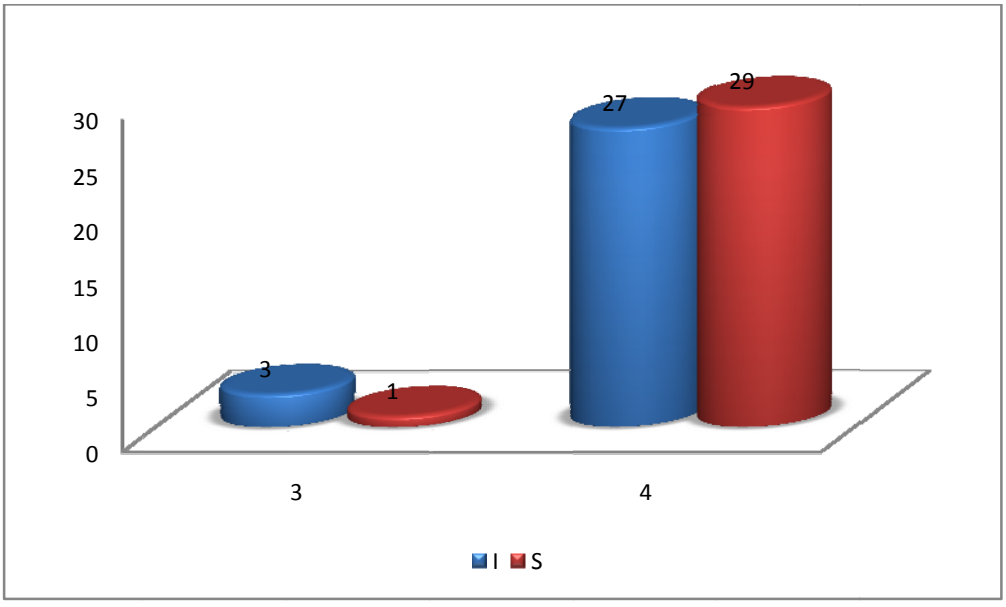


FIGURE - 9

Complications

The number of vessel punctures in Group S was 2 (6.7%). There were no vessel puncres in Group I was nil (0%).Applying Chi square tests, the 'p' value was 0.150 which is statistically insignificant. No other complication was recorded in both the group S and groupI. P value insignificant (table:10 & Figure: 10)

TABLE – 10

Complications	Group S		Group I	
	No.	%	No.	%
Vessel puncture	2	6.7	0	0
No complications	30	93.3	30	100
Chi square value	2.069 Not significant			
'p' value	0.150 Not significant			

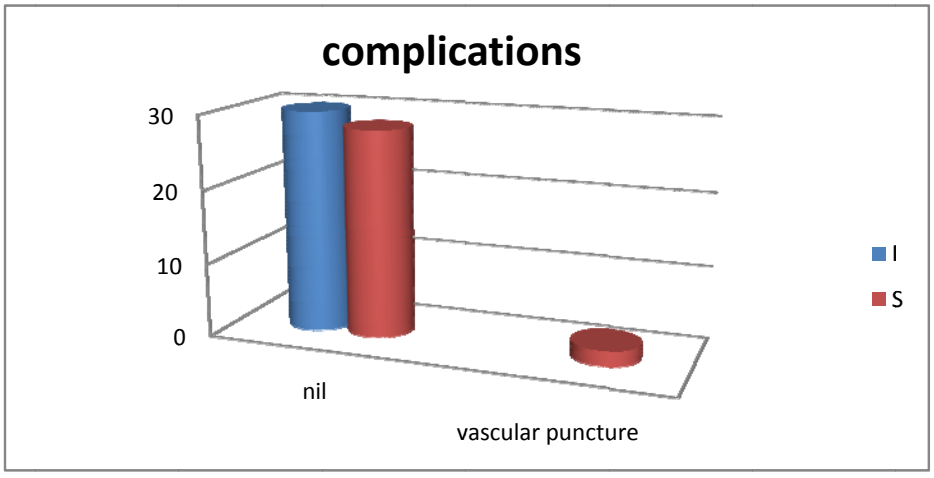


FIGURE - 10

Statistical Tools

The information collected regarding all the selected cases were recorded in a Master Chart. Data analysis was done with the help of computer using SPSS software.

Data was expressed as mean +/- of Standard deviation. Quantitative Analysis was compared with Student's 't' test and the Fisher's exact test for 2 x 2 contingency tables were used. A 'p' value < 0.05 was considered significant.

Patients in whom the block was unsuccessful due to total failure or missed dermatomes which needed intravenous supplementation or general anaesthesia were excluded from the study.

DISCUSSION

Brachial plexus block, like other regional anesthetics, offers specific advantage to the patient, surgeon, anesthesiologist, and surgical facility, which may not be true for use of general anesthesia.

The anesthesia is limited to a restricted portion of the body on which the surgery will be performed, leaving the other vital centers unaffected.

It is possible and desirable for the patient to remain ambulatory.

The use of brachial block may minimize development of central nervous system hyper excitability during a surgical procedure carried out during general anesthesia.

Whenever fluoroscopy is a necessary adjunct to the surgical procedure, brachial plexus block eliminates the potential general anesthetic dangers of explosions, respiratory depression, or airway obstruction in a dark room.

Patients who present for surgery with an upper extremity at risk of vascular compromise may improve as soon as the pain has been relieved and vasodilatation has been produced by the block.

Among the various approaches to brachial plexus blockade, Supraclavicular block (subclavian perivascular) as described by Winne and Collins in1980, has been a very widely used approach due its rapid onset, dense blockade and high success rate. The risks of complication are rare with experienced hands, especially when a nerve locator is used.

Several modifications of the original infraclavicular approach to the brachial plexus –Raj et al, Sims, and whiffler suggest that the perivascular sheath may be injected in this area as an alternative to other approaches.

The infraclavicular approach was developed in the hope to overcome these limitations, but widespread use of Raj's infraclavicular brachial approach has not gained popularity, since most believe it requires the use of a nerve stimulator and a long needle able to penetrate both the pectoralis major and minor muscles, which can cause greater patient discomfort. It has recently gained favour for use with patients in whom the continuous block technique is desired, because maintaining an aseptic dressing at this site is more practical than at one in the axilla.

There have been numerous descriptions of the new infraclavicular approaches varying in their site of the needle insertion, success and complication rate.

Wilson et al. described in 1998 an infraclavicular corocoid technique that is adopted in this study, which was undertaken to evaluate the sensory distribution of the infraclavicular brachial plexus block by the corocoid approach and its clinical efficacy.

Genevieve Arcand, Stephen Williams, et al in 2005 compared Ultrasound guided Infraclavicular vs Supraclavicular Block in a prospective randomized study of 60 patients compared the performance time and quality of blockade. Sensory block, motor block and supplementation rates were evaluated for musculocutaneous, ulnar, median and radial nerves were evaluated.Volume of anaesthetic mixture used was 0.5 ml/ kg. Students t test & Fischer's exact test were used for statistical analysis.

Our study was similar to the above study but used nerve stimulator and the technique of infraclavicular block was corocoid approach. Similar parameters were recorded and the statistical tools were similar.

By statistical analysis of two groups the age distribution in both groups was statistically not significant with a p value of 0.117992 ($p > 0.05$).

When comparing the weight of the patients in two groups it was statistically not significant with a p value of 0.825001 ($p > 0.05$). Both the groups were comparable in relation to Age and Weight.

Time to perform block:

Time to perform blockin Group-S ranges from minimum of 3 minutes to the maximum of 6 minutes, with the mean of 4.61,and the standard deviation of 0.959, and in Group-I, the time to perform the block ranges from 3min,to the maximum of 7 min, with the mean of 3.9min,and the standard deviation of 1.028, with a p value of 0.04393, which is not significant. (p> 0.05)- comparable with the study of *Genevieve Arcand, Stephen Williams,* ***et al***

Onset of sensory Blockade:

Mean onset of sensory block in group S was 5.33 min mean and in group I it was 5.53min. The difference between the two groups was not statistically significant with a p value of 0.6201 (p>0.05), again comparable with the study of *Genevieve Arcand, Stephen Williams,* ***et al***

Onset of motor blockade:

Mean onset of motor blockade in group S was 8.2 min and in group I it was 8.03min. The difference between the two groups was statistically not significant with a p value of 0.6987 (p>0.05).

Successful block:

Successful block, that is involvement of four terminal nerves, :

In Group-S, 3 out of four nerves were blocked in 1 patient (3-3 %) and all four nerves were blocked in 29 patients (96.7 %). In group I 3 out of four nerves were blocked in 3 patients (10 %) and all four nerves were blocked in 27 patients (90 %). No patient in either group underwent general anaesthesia. Applying Chi square tests, it was found to be statistically insignificant.('p'vaule 0.554)- similar to study of *Genevieve Arcand, Stephen Williams,* ***et al.*** The increased incidence of sparing can be explained by the fact that although the cords of the brachial plexus are compactly arranged around the axillary artery, the posterior cord is deeper from the point of needle entry which may explain the sparing of the radial nerve in the infraclavicular group.

Duration of Motor Block:

Mean duration of motor block from scale 3-2 in group S was 130.66 minutes and in group I 130.83 minutes . The difference between the two groups was statistically not significant with a p value of 0.970133 ($p>0.05$).

Duration of post operative analgesia:

The mean duration of post operative analgesia till the requirement of first dose of post op analgesia in group S was 11.42 hours and in group I it was 10.93 hours. The difference between the two groups was not statistically significant with a p value of 0.738380 ($p>0.05$).

Thus the quality of blockade was not statistically significant between the two groups which is comparable with the study of Genevieve et al.

Complications

The number of vessel punctures in Group S was 2 (6.7%). There were no vessel punctures in Group I was nil (0%). Though seemingly significant clinically, applying Chi square tests, the 'p' value was 0.150 which is statistically insignificant. No other complications were noted in either groups. Although the incidence of pneumothorax is often feared in infraclavicular block, it is an extremely rare as the needle is directed away from the chest cavity.

SUMMARY

60 patients of ASA grade I and II undergoing upper limb surgeries were randomly assigned into two groups, Group I and Group S

In this randomized prospective study, 30 patients received an infraclavicular block by coracoid approach in group I, and other 30 patients received a Supraclavicular block in group S.

Surgeries below the level of elbow were selected for this study.

Parameters observed were – block performance time, sensory and motor blockade, and its quality, duration of post op analgesia, and block related complications like pneumothorax, vessel puncture.

Study shows that:

1. Time to perform block was not different in infraclavicular block by coracoid approach when compared to supaclavicular approach.

2. Onset of both motor and sensory blockade were not different in group I and Group S.

3. Success rate of blocking four nerves to the elbow (musculocutaneous, ulnar, radial, median,) was not different in group I, when compared to group S.

4. Duration of post op analgesia was not different in group I, when compared to the groupS.

5. The incidence of complications in the form of vascular puncture was not different in both group I and Group S.

CONCLUSION

From our study it is inferred that nerve locator guided Infraclavicular block of brachial plexus by coracoid approach is at least as rapidly executed as nerve locator guided Supraclavicular approach and produces a similar degree of surgical anaesthesia with similar complication rates.

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PROFORMA

Name: Age: Sex: Date:

Address: IP no: Case No: Ht: Wt:

Diagnosis:

Surgery:

Pre op Status

Monitoring:

Anaesthetic Technique:

Concentration & Volume of local anaesthetic :

Parameters observed:

- Time to perform block:
- Block onset time:
  Sensory
  Motor
- Successful block of four nerves:

  1. Musculocutaneous N.
  2. Radial nerve
  3. ulnar nerve
  4. median nerve

- Need for supplementation/ GA
- Duration of surgical analgesia
- Duration of Post op analgesia
- Complications:
  1. Pneumothorax
  2. Accidental vessel puncture
  3. Paraesthesia in post op period
  4. Any other complication

- Remarks

Intra op Monitoring:

TIME	HR min	BP mm Hg	SPO_2
0 min			
1 min			
2 min			
3 min			
4 min			
5 min			
10 min			
15 min			
20 min			
25 min			
30 min			
35 min			
40 min			
45 min			
50 min			
55 min			
60 min			

TIME	Sensory Blovk	Motor Block
5min		
10 min		
15 min		
20 min		
25 min		
30 min		
Post op		
6 hour		
12 hour		
25 hour		
24 hour		

Post op:

Stanley Medical College, Chennai – 1

Ethical Committee

CERTIFICATE FOR APPROVAL OF ETHICAL COMMITTEE

To

Dr.A. Niranjan Kumar, PG in MD(Anaes)

Dear **Dr.A. Niranjan Kumar, PG in MD(Anaes)**

The Institutional Ethics Committee reviewed and discussed your application for approval of the project entitled

"Comparison of Infraclavicular vensus supraclavicular Brachial Plexus Block"

The following members of the ethics committee were present at the meeting held on 25.06.2009 at the Modernised Seminar Hall, Stanley Medical College, Chennai-1 at 12.00Noon

Dr.C.B.Tharani, Director of Pharmacology,
Madras Medical College, Chennai-3 Chairman of the Ethics Committee
Dr.A.Sundaram, Vice-Principal,
Stanley Medical College, Chennai – 1 Member Secretary of the Ethics Committee

Members

Dr. Jayanthi
Prof. of Medical Gastroenterology
Dr. Usha Sadasivam
Prof. of Pharmacology
Dr. Lalitha
Prof. of Biochemistry
Dr. Madhan
Prof. of Aneasthesiology
Dr.Thenmozhivalli
Prof. of Microbiology
Dr.S. Ramasamy
Prof.of Medicine
Thiru.G. Karuppasamy
Administrative Officer
Thiru. A. Senthil Manoharan
Advocate

We approve the project to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study, any SAE occurring in the course of the study, any changes in the protocol and patient information/informed consent and asks to be provided a copy of the final report.

Yours sincerely,

Member Secretary,
Ethical Committee.

MEMBER SECRETARY
ETHICAL COMMITTEE,
STANLEY MEDICAL COLLEGE
CHENNAI-600 001.

s.no	Group	name	age	sex	IP Nunber	wt	diagnosis	surgery	time to perform block	onset of motor block	onset of sensory block	successful block	duration of motor block	post op analgesia	complication
1	S	Rajesh	18	m	10186	50	Flap division Rt hand done	Flap thinning	4	5	7	4	120	12	nil
2	S	Balaji	20	m	11387	45	Raw area stump lt hand	Shortening closure	4	5	7	4	140	10	nil
3	S	Andavar	50	m	10284	55	#olecrenon ORIF done	metal exit	4	6	8	4	135	10	nil
4	S	Selvakumar	30	m	12478	60	#prox.PX and distal shortening	Repair	4	6	8	4	140	12	nil
5	S	Velmurugan	24	m	15748	60	PBC forearm Rt	Release SSG	4	6	8	4	145	12	nil
6	S	Janani	20	f	18345	55	Injury rt hand	SSG	3	5	9	4	120	10	vascular puncture
7	S	Velu	39	m	11398	65	PEB raw area lt hand	wound debridement&SSG	4	6	8	4	140	10	nil
8	S	Basker	30	m	15619	60	Groin flap done	Flap division	5	6	9	4	100	15	nil
9	S	Bose	55	m	14361	65	# rt radial shaft	ORIF	5	5	8	4	130	10	nil
10	S	Selvakumar	19	m	13761	50	# rt olecranon-TBWdone	metal exit	5	7	9	4	140	12	nil
11	S	Nandakumar	18	m	10765	50	raw area rt hand	SSG	6	6	8	4	150	12	nil
12	S	Thangachelvan	40	m	13645	50	PBCLt hand	Release	3	4	9	4	130	11	nil
13	S	Natarajan	35	m	14365	70	crush injury rt handF 3-4	wound debridement&K'wire	3	4	8	4	140	12	nil
14	S	Latha	20	f	18762	50	lt finger flap done	flap division	4	4	9	4	140	10	nil
15	S	Periasamy	55	m	15236	60	# head of I MCP rt	K"stabilization	5	5	8	4	140	15	nil
16	S	Sivakumar	23	m	18731	60	PT raw area Rt hand	SSG	3	5	7	4	130	10	Nil
17	S	Arumugam	49	M	19538	50	E.T injury lt finger 3	tendon repair	5	6	9	4	120	10	Nil
18	S	Baskar	45	m	13762	50	FA-cut injury rt	wound debridement	3	7	9	4	130	10	nil

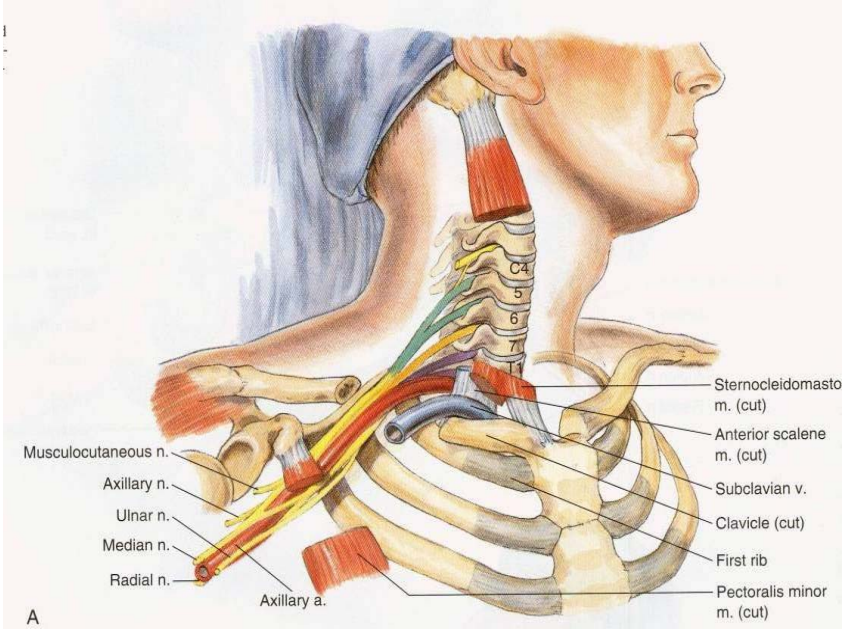
s.no	Group	name	age	sex	IP Nunber	wt	Diagnosis	surgery	time to perform block	onset of motor block	onset of sensory block	successful block	duration of motor block	post op analgesia	complication
19	S	Dinesh	19	m	14674	50	PT raw area rt fore arm	Free flap	3	5	7	4	140	10	nil
20	S	Sundaram	42	m	14723	60	# distal PX II IP jt`	K"stabilization	3	4	7	4	140	10	nil
21	S	Pradhaban	27	m	10832	55	Raw area Rt hand	SSG	3	4	7	4	120	12	vascular puncture
22	S	Marisamy	49	m	15763	50	crush injury lt hand	wound debridement	4	4	8	4	110	12	nil
23	S	Arul	48	m	13452	55	FA-cut injury rt	wound debridement	3	4	8	4	120	10	nil
24	S	Sarath Babu	25	m	14359	40	PTS ulnar nerve	Exploration	5	4	9	4	130	10	nil
25	S	Santhoshammal	50	f	15639	60	Dermoid Rt hand	Excision	5	6	9	4	140	12	nil
26	S	Veerammal	46	f	13563	60	Diabetic hand	Debridement	4	5	8	3	110	10	nil
27	S	Manickam	35	m	15763	60	#head of Ist MCB rt	K"stabilization	6	6	9	4	120	12	nil
28	S	Usha	36	f	14572	54	#shaft of DPX F3-5	wound debridement &k'wire	5	7	10	4	130	10	nil
29	S	Saraswathy	45	m	14893	55	PBSC palm	Realease	3	5	7	4	140	12	nil
30	S	Radha	34	f	14556	45	crush injury LF3&4	wound debridement&K'wire	5	8	9	4	130	10	nil
31	i	Nagoor	60	m	18237	58	crush injury lt hand	tendon repair	4	5	7	4	120	9	nil
32	i	Sundaraswari	19	f	11243	50	hamartoma lt forearm	serial excision	3	5	7	4	120	15	nil
33	i	Munirathnam	30	f	14892	60	zone IV ext.tendon injury	tendon repair	4	8	10	4	180	12	nil
34	i	Karthick	18	m	16032	30	PBC lt.F5	contrature release&SSG	3	5	7	4	180	20	nil
35	i	Mahendran	35	m	12897	60	blast injury rt.hand	wound debridement&K'wiring	5	7	10	4	120	12	nil
36	i	Rajan	29	f	14572	60	PBSC B/L hands	Release Rt hand	5	5	7	4	130	11	nil

s.no	Group	name	age	sex	IP Nunber	wt	diagnosis	surgery	time to perform block	onset of motor block	onset of sensory block	successful block	duration of motor block	post op analgesia	complication
37	i	Karupaiah	40	m	14006	64	cut injury-rt. Hand	wound debridement&K'wiring	4	8	10	4	120	12	nil
38	i	Murugan	36	m	15820	55	PTC Lt.Finger	contrature release&SSG	5	10	12	3	145	10	nil
39	i	Dinesh kumar	21	m	11768	50	Raw area rt fore arm	Dbridement	5	8	10	4	100	9	nil
40	i	Sambasivam	27	m	14174	50	PT raw area finger done	Flap thinning	6	8	10	4	180	12	nil
41	i	Panna	20	m	18125	65	PT raw area rt.FA	wound debridement&K'wiring	5	6	8	4	145	9	nil
42	i	Velan	34	m	14357	65	zone II FDP cut injury F4,5	tendon repair	3	5	9	4	120	10	nil
43	i	Muthalagan	30	m	14982	70	Bulky flap Lt hand	Flap thinning	4	5	7	4	120	11	nil
44	i	Perumal	49	m	13667	70	crush injury-rt.hand	SSG	4	3	6	4	120	9	nil
45	i	Rose Weldi	19	f	13862	45	Syndactyly Rt hand	Realease	4	3	6	4	120	10	nil
46	i	Chitradevi	22	f	12784	50	olecrenon frac.Lt	ORIF &TBW	3	5	7	4	145	9	nil
47	i	Krishnan	25	m	12654	70	Post surgical palsy P in Rt	Tendon transfer	4	3	6	3	90	9	nil
48	i	Devapitchai	55	m	13557	70	#lat.condyle&degloving	K'wire fix & tendon repair	3	3	6	4	140	12	nil
49	i	Selvasekar	30	m	15717	65	PBSC lt hand	Realease	4	5	7	4	120	13	nil
50	i	Shankar	50	m	14331	60	comp frac ulna&BB # FA	wound debridement&K'wiring2	4	5	7	4	135	10	nil
51	i	Sheik Md	19	m	12601	45	PTS ulnar nerve	Anrerior transposition	3	10	15	3	120	9	nil
52	i	Govindaraj	21	m	13870	65	PTS bone rt hand	ORIF	3	5	9	4	145	12	nil
53	i	Banumathi	45	f	133559	50	PBSC Elbow Rt	ORIF	3	5	9	4	120	12	nil

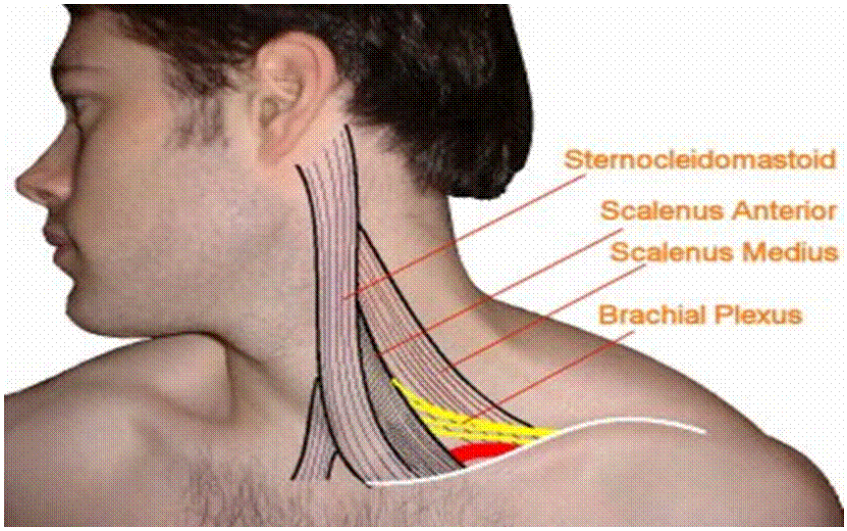
s.no	Group	name	age	sex	IP Nunber	wt	Diagnosis	surgery	time to perform block	onset of motor block	onset of sensory block	successful block	duration of motor block	post op analgesia	complication
54	i	Surita	20	f	14325	40	PTC Lt.Finger3	contrature release&SSG	3	5	7	4	120	10	nil
55	i	Kavitha	18	f	11769	50	rt first MC rec.germ cell tr	incision&biopsy	3	5	9	4	145	12	nil
56	i	Narayanan	45	m	14356	60	#olecrenon rt ORIF done	metal exit	7	7	10	4	120	12	nil
57	i	Dhanasekar	22	m	14452	50	PTS hand	Debridement	3	4	5	4	120	9	nil
58	i	Prasath	18	m	13658	50	raw area lt dorsum-hand	SSG	3	4	6	4	145	9	nil
59	i	Vidhya	18	f	14337	37	PBC lt.F5	release&ssg	3	4	6	4	120	9	nil
60	i	Manikandan	18	m	12443	50	PTC F2-5	release&ssg	4	5	6	4	120	10	nil

AN X RAY DEMONSTRATING THE RELEVANT ANATOMY FOR INFRACLAVICULAR BLOCK

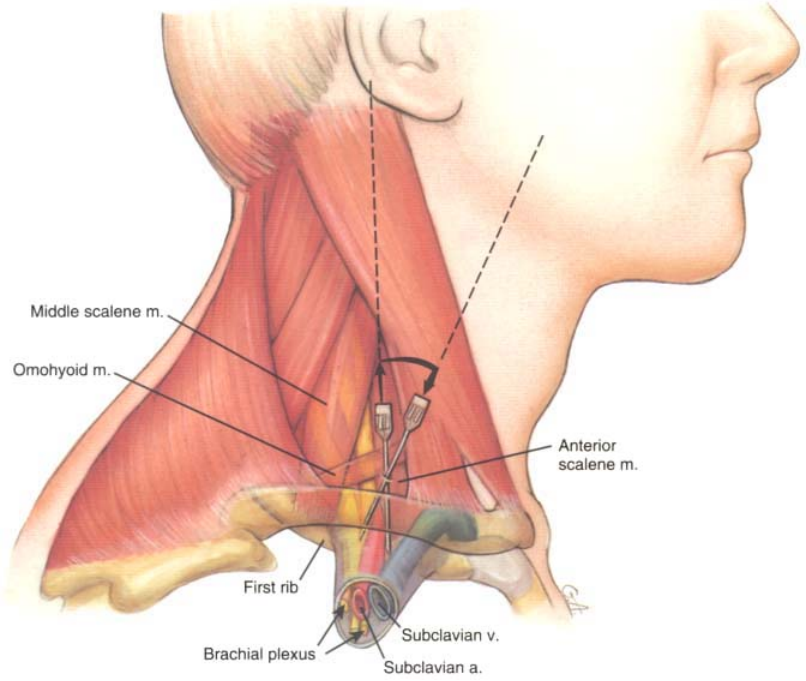
1. COROCOID PROCESS 2. CLAVICLE 3. HUMERUS
2. 4. SCAPULA 5. RIB CAGE



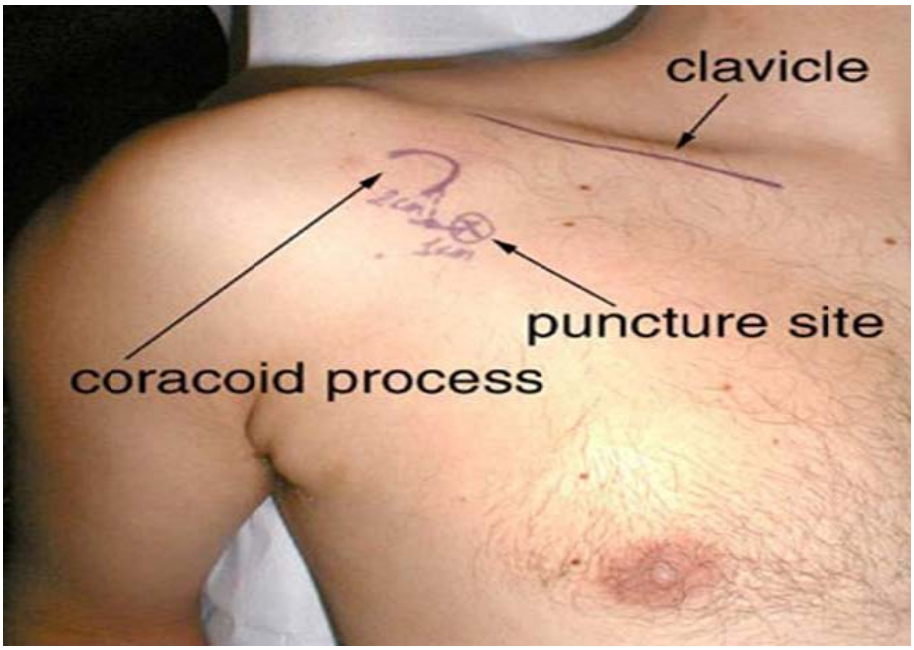
ANATOMY IMPORTANT FOR INFRACLAVICULAR BLOCK



SURFACE ANATOMY FOR SUPRACLAVICULAR BLOCK

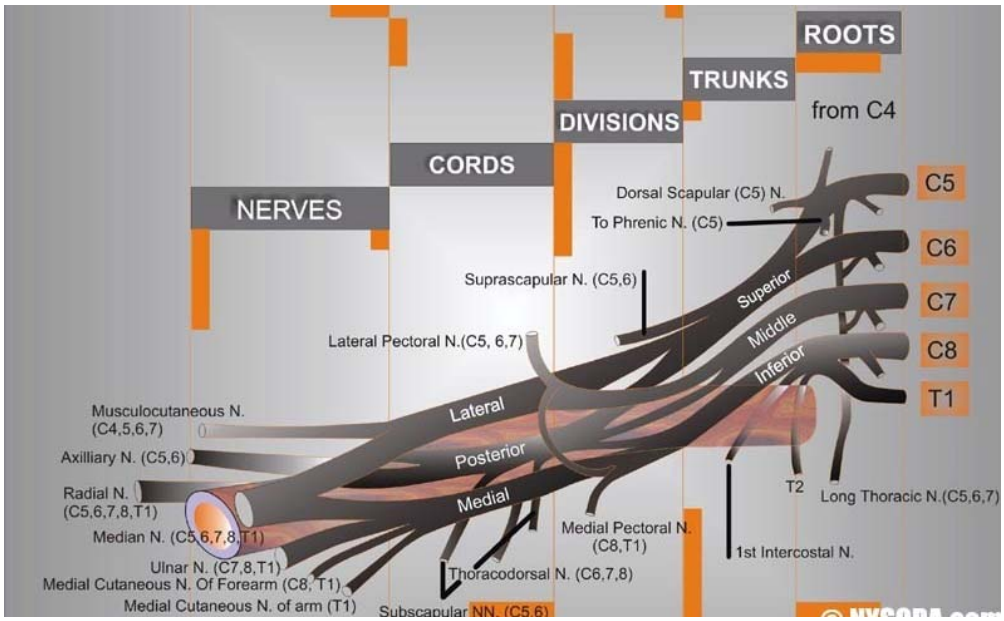


SUPRACLAVICULAR BLOCK: PERIVASCULAR AND PLUMB BOB APPROACHES

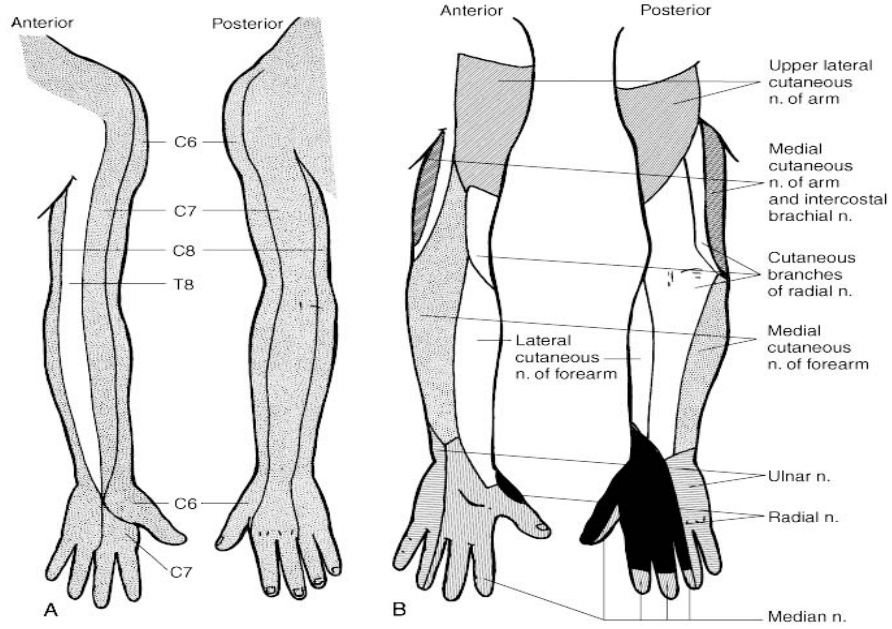


SURFACE MARKINGS FOR INFRACLAVICULAR BLOCK

FINGER TWITCH ELICITATION



ANATOMY OF BRACHIAL PLEXUS



SENSORY INNERVATIONS OR UPPER LIMB

PERIPHERAL NERVE LOCATOR