A Dissertation on

A COMPARISION OF ULTRASOUND GUIDED SUPRACLAVICULAR AND INFRACLAVICULAR BLOCKS FOR FOREARM AND HAND SURGERIES

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In partial fulfillment of the requirements

For the award of degree of

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APRIL 2015

DECLARATION BY THE CANDIDATE

I, **Dr.P.VIJAYA ANANTH**, solemnly declare that the dissertation, titled **A COMPARISION OF ULTRASOUND GUIDED SUPRACLAVICULAR AND INFRACLAVICULAR BLOCKS FOR FOREARM AND HAND SURGERIES,** is a bonafide work done by me during the period of MARCH 2014 to AUGUST 2014 at Government Stanley Medical College and Hospital, Chennai under the expert guidance of

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CONTENTS

ABSTRACT

Introduction:

Surgical procedures involving hand and forearm can be performed either with general anaesthesia or regional anaesthesia techniques. The benefits of performing a surgery under regional anaesthesia far outweighs the risks of general anaesthesia. Brachial plexus block has stood the test of time for upperlimb surgeries.

Initially brachial plexus block was done through interscalene, supraclavicular and axillary approaches. Infraclaviclar block has developed recent times. Initially nerve block was performed with parasthesia technique followed by nerve stimulator technique. Since the introduction of ultrasound into clinical practice, it has become a valuable adjuvant for peripheral nerve blocks. Initially used in conjunction with nerve stimulation, ultrasound guidance has increasingly been used as the sole to localize and anaesthetize the brachial plexus.

Objectives:

We aimed to determine the success of upper limb block based on number of patients reaching 1) sensory block at radial, median, ulnar

and musculocutaneous nerve distribution, 2) motor block at elbow, wrist and hand grip level, 3) complete sensory block, 4) complete motor block, 5) effective upper limb block, 6) surgical block among the two groups. Also to assess the block performance time and adverse events like accidental vessel puncture, Horner's syndrome and pneumothorax.

Materials and methods:

We recruited 120 patients in this study after obtaining institutional ethical committee approval. These patients were aged between 18-50 years, and belonged to ASA class I or II. They were randomly allocated into two groups. Group-S-patient received ultrasound guided supraclavicular block and Group-I –patient received ultrasound guided infraclavicular block. The patients were evaluated for the 1) sensory block at radial, median, ulnar and musculocutaneous nerve distribution using a three point scale. (anaesthesia -score 2 –no pain, no touch sensation, analgesia - score 1 –no pain, pain - score 0 – feels pain). 2) motor block at the level of elbow, wrist and hand grip level using a three point scale.(paralysis -score 2 –no contraction, paresis – score 1 –reduced contraction, no weakness score 0 –normal contraction). 3) complete sensory block in all four nerve territories. 4) complete motor

block in all three joints motor components. 5)effective upper limb block 6) surgical block.

The block performance time was also noted. And the patients were observed for the adverse events like a) accidental vessel puncture ,b) Horner's syndrome, and c) pneumothorax. The results were tabulated and analysed using the SPSS software version 16.

Results:

The two groups were comparable in terms of age, sex, and weight distribution with the 'p' value of 0.105 for age,0.136 for sex and 0.077 for weight. Other demographic parameters such as duration of surgery and surgical area distribution also comparable with the 'p' value of 0.0931 and 0.593

No difference were observed between the two groups in terms of sensory block in the areas distributed by radial, median and musculocutaneous nerve with the 'p' values of 1.000,0.315 and 1.000. The I –Group patients had a significantly better block in the ulnar nerve distribution than the S-Group patients with the 'p' value of 0.013.For motor block no significant results were observed between the two groups at elbow and wrist level with the 'p' value of 1.00 and

0.648.The S-Group patients were poor motor block at hand grip level than I-Group patients with the ‘p’ value of 0.013.Complete sensory block is superior in the I-Group : 91.7% vs 76.7% in the S-Group with the ‘p’ value of 0.013.Complete motor block is also superior in the I-Group: 88.3% vs 75% in the S-Group with the ‘p’ value of 0.018. Effective upperlimb block is inferior in the S-Group (68.3%) compared with I-Group (88.3%) with the ‘p’ value of 0.009.No difference were observed between the two groups for surgical block with the ‘p’ value of 1.000. Compared with the S-Group, the I-Group had a longer block performance time (416.48 seconds [SD-20.550] vs 894.92 [SD-57.063] with the ‘p’ value of 0.000. The I-Group resulted in a higher rate of accidental vessel puncture (36.7 % vs 11.7 %) than the S-Group with the ‘p’ value of 0.001.No difference were observed for the adverse events like Horner’s syndrome and pneumothorax with the ‘p’ value of 1.000 for both the events.

Conclusion:

Ultrasound guided peripheral nerve block have a higher rate of success for achieving surgical anaesthesia. Our study showed 100% success rate for both the groups in view of surgical aneathesia. Inspite of taking longer time for block performance and higher incidence of

accidental vessel puncture, infraclavicular group is better than the supraclavicular group, for complete sensory ,complete motor and effective surgical block. Other than accidental vessel puncture in infraclaviclar group , complications like Horner's syndrome and pneumothorax were not observed in both the groups.

KEY WORDS:

Supraclavicular block, Infraclavicular block, Brachial plexus, Ultrasonogram.

INTRODUCTION

Surgical procedures involving hand and forearms can be performed either with general anaesthesia or regional anaesthesia techniques[1].

In general anaesthesia, patient has a risk of airway manipulation, hemodynamic instability, cognitive dysfunction and post operative nausea and vomiting [2-4].

Anaesthesia with regional techniques can overcome all the complications associated with general anaesthesia. And has an advantages of reduced morbidity, mortality, superior post operative analgesia, cost effectiveness and lower rate of serious complications [2-4].

Peripheral nerve block is one of the regional anaesthetic techniques. Regional anaesthetic technique with peripheral nerve block enables the patients to be discharged on the day of surgery[2-4]. Entire sensory and motor blockade of the upper limb can be achieved by blocking the brachial plexus and has stood the test of time for upper limb surgeries [5]. Interscalene, supraclavicular and axillary blocks are routinely used approaches [1] for brachial plexus. Infraclavicular approach to the brackial plexus block is also commonly used in recent times.

Hand and forearm surgeries were the usual indications for supraclavicular and infraclavicular blocks[1]. Among the various approaches of brachial plexus block,supraclavicular block was considered easiest and blocks at the level of trunks and divisions[1]. Now a days infraclavicular block is also considered as effective as supraclavicular block, and is performed at the level of the cords compared with supraclavicular approaches [1.]

Initially nerve blocks were performed with *Paraesthesia* elicitation technique. The classical approach using paraesthesia technique was a blind, land mark technique and may be associated with higher failure rates and injury to the nerves and surrounding structures [6].

Nerve stimulator was invented for higher success rate and to decrease the complications [7,8].This technique ensures a better blockade than conventional paraesthesia technique[9]. This landmark and nerve stimulator techniques can cause neurovascular injuries, leading to permanent nerve damage[10], injury to the pleura leading to pneumothorax [11-13] and also has more failure rates.

Ultrasonogram was introduced with real time imaging radiological tool. Working with radiological tool gained more importance than paresthesia and peripheral nerve stimulator technique.

The application of ultrasound technique for exact localisation of nerves /plexus [14-18] and vessels has revolutionized the regional anaesthesia field where in ultrasound probes with suitable frequencies have been successfully tried. The availability of suitable instruments caused delay of their usage in day to day practice. However today technology has improved to perform the regional nerve blocks with ultrasonogram guidance.

Due to the advantage of real time visualization, ultrasonogram reduces the number of needle passes to reach the target nerve groups, which in turns can shorten the block performance time and increases the success rate.

Ultrasound for supraclavicular and infraclavicular approaches of brachial plexus block has improved the success rate of block with excellent localization as well as improved safety margin [19.]

Hence study was planned to compare the clinical efficacy of ultrasonogram guided supraclavicular and infraclavicular approaches of brachial plexus block in forearm and hand surgeries.

AIM OF THE STUDY

The aim of this randomized study was to compare the ultrasound guided supraclavicular blocks with infraclavicular blocks for forearm and hand surgeries.

Primary objective

To assess the effectiveness of the upper limb block based on, no of patients reaching,

1) Sensory block over the areas supplied by radial, median, ulnar and musculocutaneous nerve .
2) Motor block at the level of elbow, wrist and hand grip .
3) Complete sensory block.
4) Complete motor block.
5) Effective upper limb block
6) Surgical block.

Secondary objective

To assess the Block performance time, and to study the incidence of adverse events like Pneumothorax, Accidental vessel puncture and Horner's syndrome.

HISTORY OF BRACHIAL PLEXUS BLOCK [20]

The first brachial plexus block was performed by William Stewart Halsted in 1885 [21].Halsted exposed the nerve roots surgically under local infiltration and injected each of them with a small amount of dilute cocaine (0.1%) interneurally under direct vision. In 1897 George Crile used a similar technique in which the plexus was exposed under local anaesthesia, just behind the sternocledomastoid muscle, cocaine was injected into the nerve trunks under direct vision.

EVALUATION OF BRACHIAL PLEXUS BLOCK [20]

In 1911-1912, kulenkampff described the first percutaneous supraclavicular approach[11]. The mid point of clavicle and the subclavian artery provided a constant landmark, most frequently at the point where external jugular vein intersects the clavicle. Direction of the needle was backwards, inwards and downwards. He said that the first rib just prevented pleural penetration.

Labat in 1922 [22] advocated injection at three separate points which failed to elicit paresthesia by Kulenkampff's method . In 1926, Livingston carried out Kulenkampff's technique without the production of paresthesia as soon as the deep cervical fascia had been penetrated.

The “standard technique” of supraclavicular block was introduced by Patrick in 1940, subsequently referred to by many as the “classical supraclavicular technique”. In 1942 Knight modified Patrick’s technique by making the three injections through three separate needle insertions, parallel to one another. For the first time he utilized a directly caudal direction of needle insertion.

In 1944, Murphey used a single injection technique and used lateral border of anterior scalene muscle as the landmark and direction of needle insertion caudal as with Knight’s technique, not medial or dorsal, as with most other techniques.

In 1949, Bonica and Moore utilized both Kulenkampff’s and Patrick’s technique, the classical landmarks, direction of needle insertion and elicitation of paresthesia prior to first injection were followed. This was followed by laying down of a wall of anaesthetic solution by “Walking the rib” and making multiple injections during each withdrawal of the needle.

In 1958, Lookman, fully realized the potential of the fascial sheath around the plexus. Fortin and Tremblay advocated the use of a short needle which was long enough to reach the plexus but too short to

reach the lung, in an attempt to minimize the threat of pneumothorax. Electrical stimulation for to locate the brachial plexus was introduced by Perthes in 1928. Pearson in 1955 demonstrated that motor nerves could be located by electrical stimulation with an insulated needle. Finally in 1969, Wright reported the Block-Aid monitor for nerve blocks which popularized the technique making more feasible.

In 1917 Bazy and Paucet[22] were first describe the infraclavicular approach of the brachial pexus block. 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 patient. In 1998 Wilson et al described an infraclavicular corocoid technique .

In 1978 La Grange [23,24] were first describe the ultrasound guided nerve blocks. Doppler ultrasonogram was first used in 1981 by Abramowitz to identify and mark the location of the axillary artery for brachial plexus block [25 -26]. In 1988 Vaghadia and Jenkins described the use of Doppler ultrasonogram in three patients for intecostal nerve block. But,the ultrasound guided nerve block was grew only after the development of ultrasound technology in 1990s.

ANATOMY AND FORMATION OF BRACHIAL PLEXUS [28]

The knowledge of formation of brachial plexus and its ultimate cutaneous and muscular distribution is absolutely essential for the intelligent and effective use of brachial plexus block for upper limb surgeries. The close familiarity with the vascular, muscular and fascial relationships of the plexus is equally essential to the mastery of various techniques. In its course from intervertebral foramina to the upper arm, the nerve fibres are composed consecutively of roots, trunks, divisions, cords and terminal nerves.

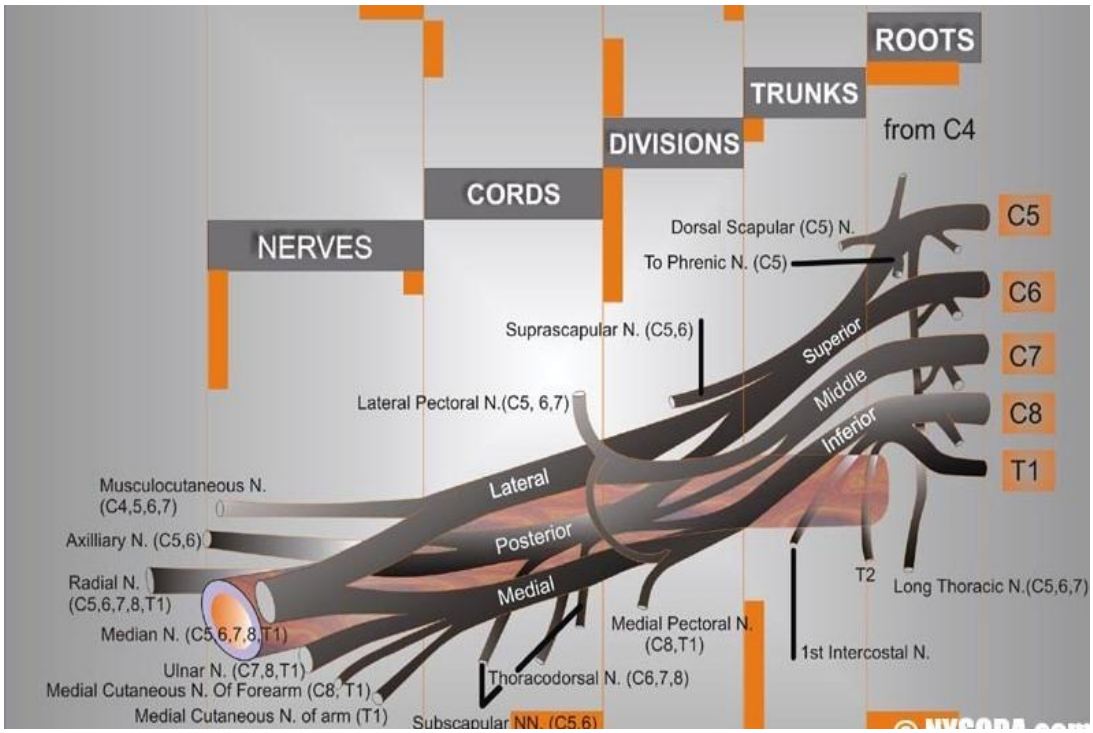
The formation of brachial plexus is by the union of ventral rami of lower four cervical nerves (C5,6,7,8) and first thoracic nerve (T1) with frequent contribution from C4 or T2. If contribution is from C4 , termed 'prefixed', contribution is from T2, termed 'post fixed'.

ROOTS

The roots represent the anterior primary divisions of lower four cervical and first thoracic nerve. They emerge from the intervertebral foramina and fuse above the first rib to form the trunks.

TRUNKS

The roots combine above the first rib to form the three trunks of the plexus. Upper trunk is formed by union of C5 and C6 at the lateral border of scalenus medius muscle. Lower trunk is formed by the union of C8 and T1,posterior to the scalenus anterior muscle .Middle trunk is the sole contributor of C7.



Picture 1: Formation of brachial plexus

DIVISIONS

When the trunks passes over the first rib and below the clavicle, each one of them divides into anterior division ,and posterior division.

CORDS

The fibers as they emerge from under the clavicle, recombine to form three cords. The anterior divisions of upper trunk and middle trunk combine to form the lateral cord, which lies lateral to the axillary artery. The medial cord is formed at the level of medial side of axillary artery, by anterior division of lower trunk. The formation of posterior cord is, first over and then posterior to the axillary artery by posterior divisions of all the three trunks. The nerves which supply the area of flexor surface of upper extremity is, arise from lateral cord and medial cord. The nerves which supply the extensor surface of the upper extremity is, arise from posterior cord.

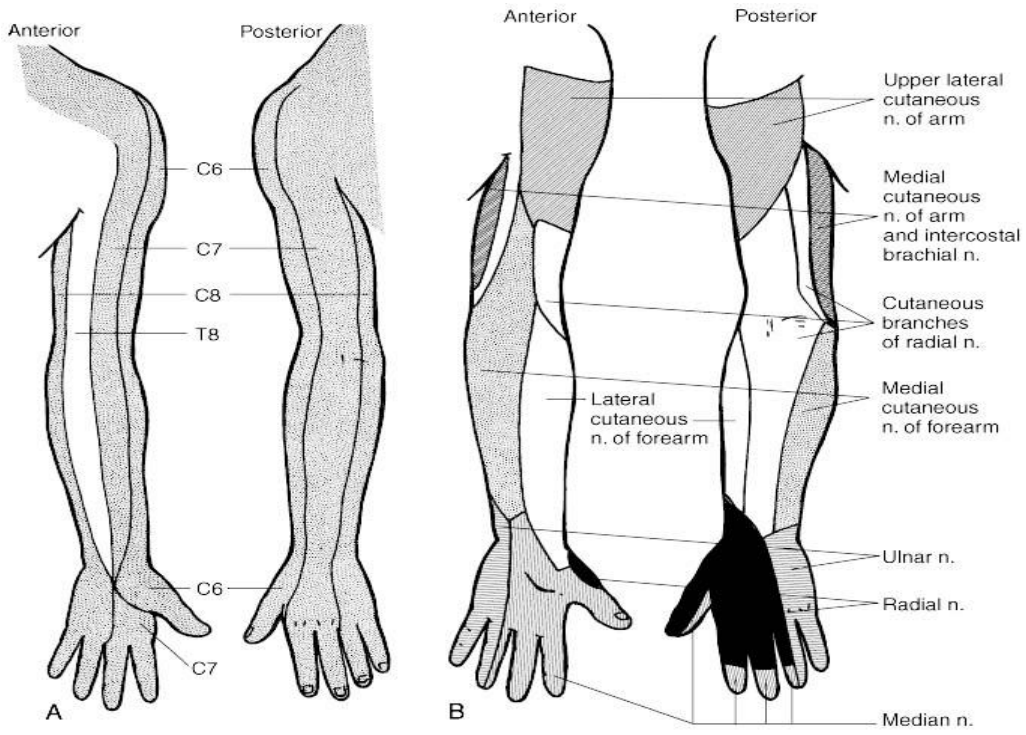
MAJOR TERMINAL NERVES

The branches from the cords , that is contributes to or terminates as a major nerve for the upper extremity . Lateral and medial head of median nerve , which arise from the lateral and median cords and continue as major terminal nerves. Musculocutaneous nerve is the termination of lateral cord and ulnar nerve is the termination of medial cord. The major branch that arise from the posterior cord is axillary nerve and it continues as the radial nerve.

In summary, conveniently it can be considered that brachial plexus begins with five roots (C5-T1) and terminates in five nerves (musculocutaneous, radial, axillary, median and ulnar nerves) with its intermediate portions displaying in sets of three, that is, three main trunks which divide into 2 sets of three, which reunite and give rise to three cords. These three cords give off three lateral branches before becoming the major terminal branches of the plexus.

DISTRIBUTION OF BRACHIAL PLEXUS [28]

These are divided into those that arise above the clavicle the supraclavicular branches and those that arise below it the infraclavicular branches.



Picture 2: Dermatomal distribution of brachial plexus

SPECIFIC BRANCHES

Supraclavicular branches :

From roots:

1. Nerves to scaleni and longus colli – C5,6,7,8
2. Branch to phrenic nerve – C5
3. Dorsal scapular nerve – C5
4. Long thoracic nerve – C5,6,(7) 12

From trunks:

1. Nerve to subclavius –C5,6
2. Suprascapular nerve-C5,6

Infraclavicular branches:

They branch from cords but their fibres may be tracked back to spinal nerves.

Lateral cord

1. Lateral pectoral nerve- C5,6,7
2. Musculocutaneous nerve – C5,6,7
3. Lateral root of median nerve- C5,6,7

Medial cord:

1. Medial pectoral nerve- C8, T1
2. Medial cutaneous nerve of forearm – C8, T1
3. Ulnar nerve- C7,8, T1
4. Medial root of median nerve- C8, T1
5. Medial cutaneous nerve of arm – C8,T

Posterior cord :

1. Upper subscapular nerve- C5,6
2. Thoracodorsal nerve-C6,7,8
3. Lower subscapular nerve- C5,6
4. Axillary nerve-C5,6
5. Radial nerve- C5,6,7,8,T1

Sympathetic distribution of brachial plexus

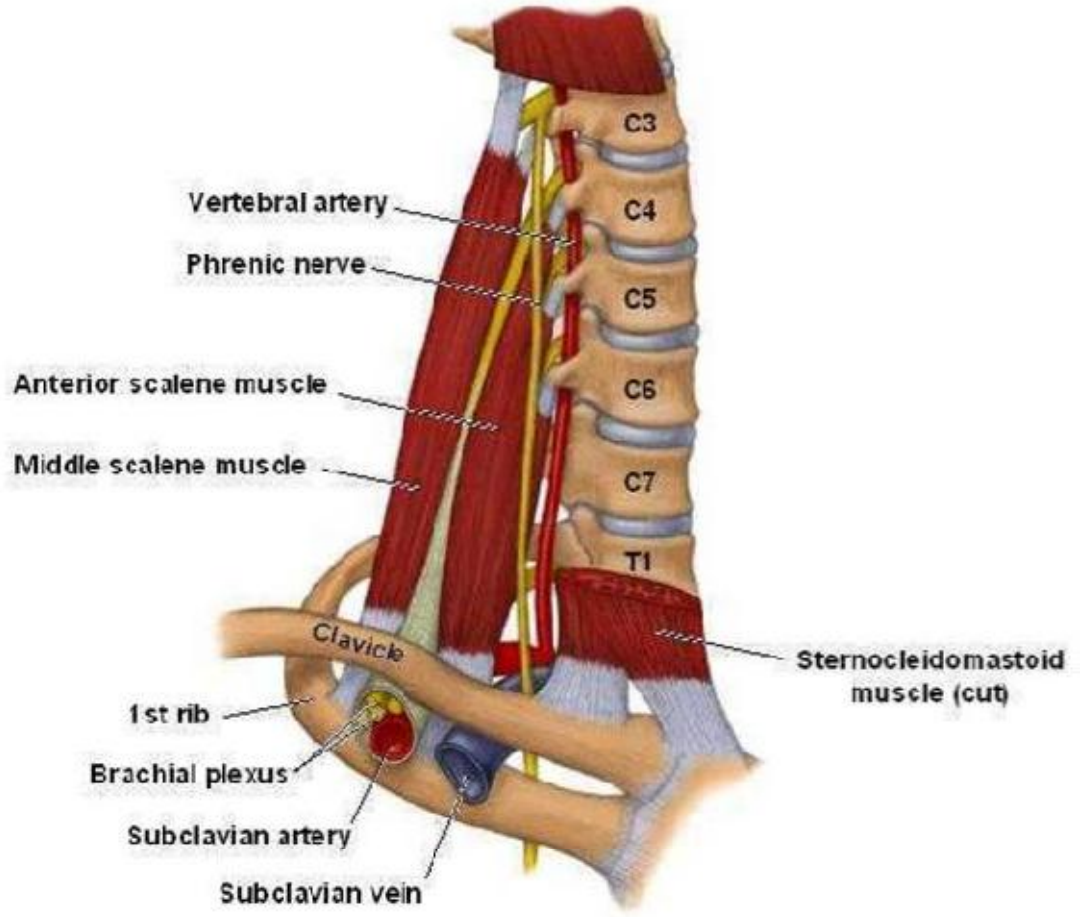
The segmental preganglionic sympathetic contributions are variable, but generally extend more caudal. The highest contribution is usually T2 with T1 contributing only rarely, while lowest may be as far as T8, T9 or even T10 [29] .The post ganglionic contributions are from grey rami communicates from the sympathetic chain **.**

Relations of brachial plexus [29,30]

The two scalene muscles (anterior and middle) " sandwiched " the brachial plexus, when it passes between the cervical transverse process and the first rib. The fascia of these two muscles invests the brachial plexus..

The 'interfascial compartment', along with subclavian artery which crosses the first rib immediately in front of the trunks. Artery is close to the scalenus anterior and the plexus close to the scalenus medius. Subclavian vein is separated from the artery by the scalenus anterior. The fascia covering the muscles is derived from the perivertebral fascia, which splits to invest these muscles and rejoins again at their lateral margins to form an enclosed space, the interscalene space. As the plexus cross the first rib, the three trunks are 'stacked' one

other on top of the other vertically. After the first rib was crossed by the plexus, they split to form 2 divisions and then the cords and the subclavian artery continues as the axillary artery. Above the level of clavicle the subclavian artery lies infront of the trunks, whereas distal to clavicle, the three cords which surrounds the axillary artery. Around the first part of the axillary artery, posterior cord and lateral cord lies just lateral to it, and the medial cord lie posterior to it. Around the second part of the artery, the three cords lies posterior ,medial and lateral to it, their names were related according to their positions around the artery. The cords divides into upper limb nerves in the lower part of axilla. In passing above the first rib and below the clavicle, the subclavian vein also becomes the axillary vein and its relationship with the neurovascular bundle changes. The subclavian vein above the first rib, does not lie within the neurovascular bundle, it is separated by the insertion of scalenus anterior. When the subclavian vein passes above the first rib, becoming the axillary vein. And the axillary vein joins with neurovascular bundle so that parts of the plexus are sandwiched between artery and vein.



Picture 3: relations of brachial plexus [29]

As all the three enters the axilla, they invaginate the perivertebral fascia at the lateral margins of the anterior and medial scalene muscle, carrying this fascial investment of the neurovascular bundle with the axilla as the axillary fascia, perivertebral fascia extension or fascia of scalene muscle, forming the perivascular space of axilla, which is the tubular extenson of the interscalene spaces .In its course through the axilla and upper arm the fascia of the surrounding muscles contribute to the axillary sheath, making it thick and tough, providing the 'fascial click' to the anaesthetist while entering the sheath.

ULTRASOUND [31]

Ultrasound is a form of mechanical sound energy that travels through a conducting medium. Ultrasound waves, that are high frequency sound waves (greater than 20000 cycles/sec) which are not audible by human ear. The frequency of ultrasound waves used in medicine were in the MHz range.

The transducer contains the array of piezoelectric crystals. Application of mechanical stress to the piezoelectric crystals produce an electric current, and this called the piezoelectric effect. When an electric current is applied to the piezoelectric crystals, vibration is generated in the form of mechanical energy. This called the converse piezoeletric effect and this is how ultrasound waves are generated .

The transducer converts electrical energy into extremely rapid mechanical vibrations that are very high pitched sounds to hear. The electrical field required is formed, when a voltage applied between the surface of 2 electrodes, causing a dimensional change in the crystal. Conversely electrical potential is generated when the mechanical vibrations reflecting from the tissue reflects back reaching the transducer.

Depending on the amount of wave returned ,anatomical structures taken on different echogenicity. Hyperechoic areas have a great amount of energy from returning echoes and are seen as white. Hypoechoic areas have less energy from returing echoes and are seen as grey. Anechoic areas without returning echoes are seen as black.

Normal Tissue appearances in ultrasonogram:[31]

Skin: Smooth,Bright (echogenic,hyperechoic,highly reflective).

Fascia: Bright hypoechoic line.

Fat: Hypoechoic background,with hyperechoic line.Fat is compressible,whereas muscle and nerves are not compressible.

Muscle: Hypoechoic background ,with hyperechoic line, not compressible.

Tendons: Hypoechoic.

Fluid: Blood,effusion,cyst (black -anechoic).

Nerve: Hyper/hypoechoic

Bone: Very Bright/Hyperechoic.

Air Bubble: Highly hyperechoic.

Pleura**:** Hperechoic

Image Construction [31:]

The ultrasound probe acts both as a transmitter and a receiver. Using the piezoelectric effect, the piezoelectric crystals in the hand held probe convert the mechanic energy of the returning echoes into an electric current, which is processed by the machine to produce a two-dimensional gray scale image that is seen on the screen.

The process is repeated sequentially along the length of the probe. The time taken for an echo to return is used determine the distance from the probe and is calculated assuming that sound has a constant speed(1540m/s).The strength of the echoes returning from any point is represented by the brightness of that point on the screen.

Time taken for the transmitted pulse to be reflected back is used to calculated the distance of the reflecting boundary from the probe. The path that a single pulse passes along is described as the beam. The width of the beam determines the lateral resolution. The length of the pulse determines the axial resolution. Shorter pulses can be achieved using higher frequency, so the highest frequency practicable is generally used.

Features of an ultrasound image:

Presentation:

The probe represents the top of the screen ,and going further down the screen, deeper tissues are seen.

Depth:

Higher depth of penetration and reduced resolution are seen with lower frequency. Higher frequency transducer have low depth of penetration ,for seeing superficial structures ,but better resolution.

Enhancement:

As the ultrasound wave passes through the tissues the amount absorbed and reflected is reduced ,reducing the signal that reaches deeper tissues. This effect is called as enhancement, and the image formed is compensated for this by applying a standard correction in proportion to the depth.

Attenuation:

Attenuation or shadowing is the reverse effect, where some tissues absorb relatively more of the sound. The area of the image deep to this will appear darker. In the extreme almost no sound is transmitted, leaving a dark shadow behind the structure.

Anisotrophy:

Anisotrophy is a major property describing a difference in echogenicity of soft tissues such as nerves and tendon, when the angle of transducer is altered. The tendon/nerve fibers appear hyperechoic when probe is perpendicular, hence indicates that probe receives the reflected sound only if the beam strikes the surface at right angle.

Probes:

Low frequency probe (3-5 MHz) is used for deep abdominal organ scanning. High frequency probe (10-15 MHz) is used for superficial structure (brachial plexus) scanning. For deeper structures like sciatic nerve and infraclavicular brachial plexus region requires low frequency probes in adults (4-7 MHz).

Scanning technique:

The commonly used views for nerve imaging is tranverse and longitudinal views. When placement of probe is perpendicular to the nerves long axis ,it is called as cross sectional view or short axis view. In this view the nerves appears to be is round to spherical in shape and the nerve fascicles produces hypoechoic areas in the internal surface. Which is surrounded by epineurium that produces hyperechoic areas.

When the placement of probe is parallel to the nerves long axis, the appearance of the nerve is hypoechoic tubular components which represents the fascicular components, and mixed with fascicular epineurium that produces hyperechoic bands, which surrounds the hypoechoic tubular components.

Supraclavicular Area:

Ultrasound Anatomy [30]:

Orienting structure: Subclavian artery

Structures that are required to be identified: Subclavian artery, Brachial plexus, First rib, Pleura.

Structures that may be seen: Anterior scalene muscle, Middle scalene muscle, Srernocleidomastoid muscle, Subclavian vein.

The pulsating subclavian artery is readily apparent as an anechoic pulsatile structure. The hypoechoic linear areas that present immediately deep to it represents the first rib and the parietal pleura. With the pleura medial and lateral to the first rib. The rib, which is an osseous structure, the image deep to the first rib appears dark (anechoic) due the acoustic shadow. Brachial plexus appears as hypoechoic bundles that is oval to spherical nodules (eg., grapes) lies superficial and lateral to the artery. The pleura which is hyperechoic in nature presents on both sides of the first rib, and the lung tissue is by the present deep to it. The sliding motion of the pleura during, patients respiration and comet tail sign was confirm the structure of pleura and the lung. In this location brachial plexus was visualized from a depth of 1- 2 cm from the skin surface.

Picture 4: Ultrasonogram anatomy of supraclavicular area

In the supraclavicular location, C5, C6 and C7 roots derivatives are located in superior, posterior, and lateral region of the subclavian artery. The corner that was situated between the first rib and the subclavian artery, in which C8 and T1 roots derivatives are located.

Infraclavicular Area:

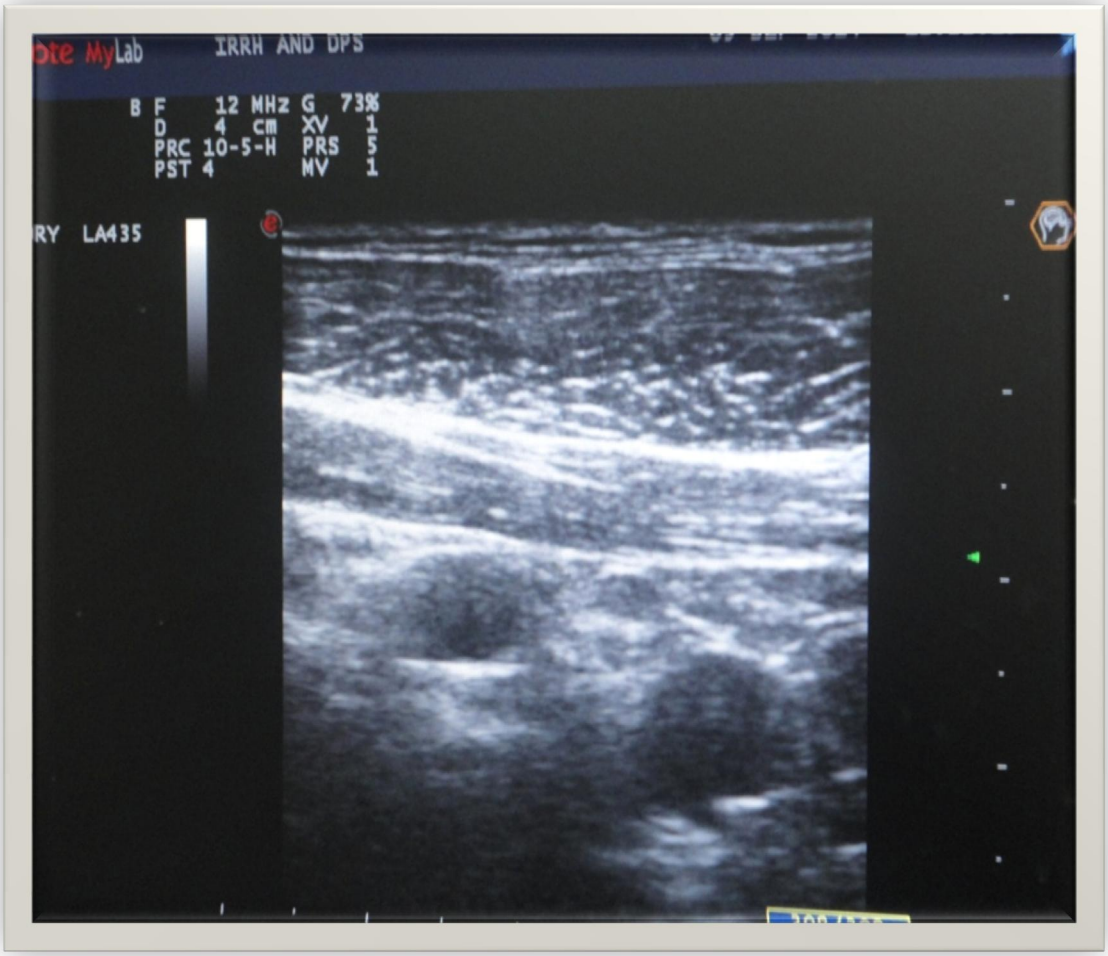
Ultrasound anatomy [30]:

Orienting structure: Axillary artery

Structures that are required to be dentified: Axillary artey, Axillary vein, Cords of brachial plexus.

Structures that may be seen: Pectoralis major muscle, Pectoralis minor muscle, Rib/Lung.

The orienting structure to perform this block is this the axillary artery. At the site where the scanning and procedure are performed, the ultrasound image will show the lateral cord cephalad position to the axillary artery, the posterior cord positioned posterior, and the medial cord positioned caudel to the artery. In patients with normal relative anatomy, the medial cord is typically positioned in the small space between the axillary artery and vein.



Picture 5: Ultrasonogram anatomy of infraclavicular area

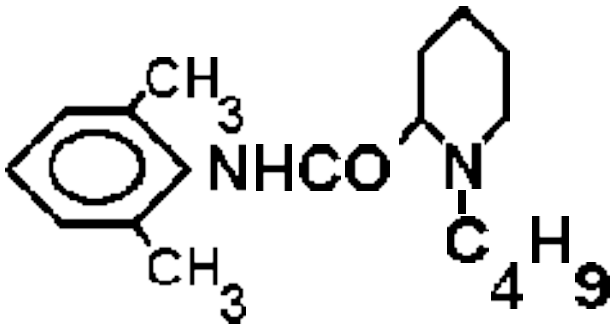
PHARMACOLOGY

BUPIVACAINE:

1-butyl 2', 6' pipecoloxylidide hydrochloride. Bupivacaine is a local anaesthetic agent belonging to amide group.It is one of the homologous series synthesized by Ekenstom [32] in 1957, and its first clinical use was made in 1963 by LJ Telivuo. It is structurally similar to lignogaine,and differ in that it contains the amine group butyl piperidine. S- enantiomer levobupivacaine which is less cardiotoxic is also available.

Mechanism of action [32-34]:

It acts by binding to inner portion of sodium channels (interior gate or H gate) at specific sites, also by obstructing sodium channels near their external opening thus maintaining them in inactivated closed states.



Picture 6 : Structure of Bupivacaine

Pharmacokinetics:

Has a pka value of 8.1,with molecular weight of 288 daltons, 95% protein binding,30% lipid solubility, volume of distribution 0.4 - 0.9 liters/ kg , Has a clearance rate of 2.8 - 7.1ml/min/kg ,and half life of 1.2 - 2.4 hours. Peak time of action 0.17 - 0.5 hours, at a concentration of 0.8microgram/ml. Toxicity occurs when plasma concentration is greater than1.5 microgram/ml. Most important plasma protein binding site is alpha 1 acid glycoprotein.

Metabolism:

Liver is the main site of metabolism, where it undergoes aromatic hydroxylation , N-dealkylation, amide hydrolysis, and conjucation. The metabolite thus formed is N- dealkylated desbutyl bupivacaine.

Dose : 2mg kg

Uses:

a) Epidural and spinal anaesthesia

b) Peripheral nerve block

c) Infiltration anaesthesia

Toxicity:

More cardiotoxic than lidocaine, especially myocardial depressant action on accidental intraarterial injection. This is because bupivacaine though acts at the same site as lignocaine dissociates more slowly from the blockade site. And prolongs the block duration. Centrally mediated toxicity can occur at times. Acidosis, hypoxemia, hypercarpia enchance the toxicity.

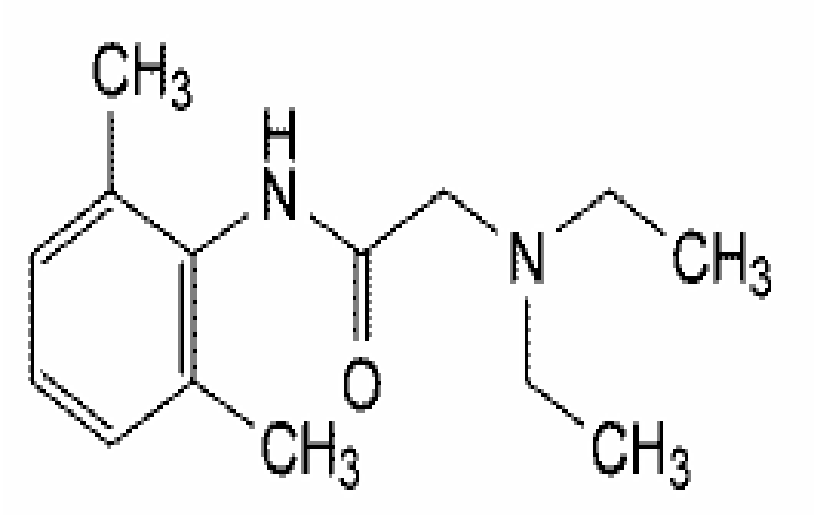
LIGNOCAINE HYDROCHLORIDE [34,35]:

Synthesised in by Loffgren sweden in 1943.Chemically, it is a tertiary amide, the chemical composition being diethyl aminoacetyl, 2, 6, xylidine hydrochloride monohydrate. It is a local anaesthetic agent, rapid onset of action. The advantage is that it has good penetrative powers, but of only moderate poteney.

Mechanism Of Action:

It acts by maintaining the sodium channels in the inactivated state, as well as by blocking them in their inner surface, thus preventing the initiation of action potential.

Adrenaline, when combined with lignanine prolongs the duration of action of lignocaine. Also by producing vasoconstriction, reduces the rate of systemic absorption ,also reduces the systemic toxicity. Adrenaline at a concentration of 5mcg/ml(1:200,000) is added. Tachyphylaxis can occur sometimes if repeated injections are given.



Picture 7 : Structure of lignocaine

Pharmokinetics:

Lignocaine, at room temperature is a stable compound. It has a molecular weight of 271daltons .The pKa value of lignocaine is 7.8,and 70% of the drug is protein bound .Lipid solubility is 2.9, Has a volume of distribution of 91 litres, clearance at a rate of 0.95 litres/minute. The elimination half life of lignocaine is 96

minutes. It reaches toxic plasma concentration when the concentration is >5mg/ml.

Metabolism:

Lignocaine undergoes oxidative dealkylation to monoethyl glycine xylilide in liver, following which hydrolysis occurs to form the metabolite xylilide. The rate of metabolism is reduced in case of hepatic disease.

Dosage:

When given in combination with Adrenaline, the safe dose is 7mg/kg, and when given alone, the safe limit of dosage is 3mg/kg. Adrenaline when given upto a concentration of 5mcg/ml(1 in 200,000 dilutions),no systemic effects occurs.

The concentration of local anesthetic following intercostals block is highest, followed in decreasing order by epidural , brachial plexus block, and subcutaneous infiltration.

Toxicity:

Allergic Reaction*:* They are mainly due to antibody stimulation by substance present in the preservative , mostly

methyl paraben (or) similar preservatives, which are similar in structure to para amino benzoic acid.

Central Nervous System: At low doses, numbnes of tongue, and circumoral paraesthesia occurs. Restlessness, vertigo may occur .At higher doses, slurred speech, skeletal muscle twitching, Tonic clonic seizures CNS depression, hypotension, apnoea can occur. Seizures are produced due to unopposded excitatory neuron activity as a result of selective inhibition of the inhibitory neurons of CNS. Rarely, Cauda Equina Syndrome may occur. When 5% hyperbaric lignocaine is used, transient radicular irritation occurs.

Cardiovacular Systems: Profound hypotension can occur at plasma concentration of 5-10mg/ml. It occurs due to relaxation of arteriolar smooth muscles, and myocardial depressant action.

Therapautic Uses:

- Topical anaesthesia at a concentration of 2-4%.
- Local infiltration, and peripheral nerve block at 0.5-1% concentration.
- Along with prilocaine 2.5%, at concentration of 2.5% as EMLA cream.

- Biers block**:** Interavenous regional anaesthesia.
- For spinal/epidural anaesthesia.
- As antiarrhythmic agent for ventricular cardiac dysrythmias.
- For prevention of rise in intracranial tension by attenuating stress response.

Adrenaline/Epinephrine:

Prototype sympathomimetic .The vasoconstrictor used along with the local anaesthetic agent is frequently adrenaline. Adrenaline reduces the incidence of systemic toxicity of the anaesthetic agent by reducing absorption, and it prolongs the duration of action of the anaesthetic drug. But in microvascular reimplantation and reconstructive hand surgeries, the possibility of decrease in overall arm blood flow remains high.

Mechanism of Action:

It is a agonist at alpha1 ,beta1 and beta 2 adrenergic receptors, and hence mediates their action.

It is poorly lipid soluble, hence denied of cerebral effects.

Functions and Uses:

- Helps in regulating the contractility of myocardium, vascular tone, smooth muscle tone, and heart rate.
- It causes potentiation of glandular secretion.
- Useful in the treatment of life threatening allergic reaction.
- It is a emergency drug, essential during cardiopulmonary resuscitation

REVIEW OF LITERATURE

Geneviève arcand et al (2005)[36] compare the block quality and time to perform the block in 80 patients through supraclavicular and infraclavicular approaches under ultrasound guidance. Two groups were randomized with either Group –S and Group-I. For performance of block ultrasonogram with 7.5 MHz probe was used with a nerve stimulater for all patients. The anaesthetic mixture used for all patients were 0.5% bupivacaine and 2% lignocaine hydrochloride with adrenaline 1:200000 concentration with a volume of 0.5 ml/kg. After the block procedure ulnar, median, radial and musculocutaneous nerves were evaluated for sensory and motor block, and number of patients were supplemented also evaluated. The block performance time was observed equal in both groups, and reduction in time was observed in infraclavicular group as the study progress. In all four nerve territories, there was no difference seen for sensory and motor block component. Complications like pneumothorax and neuropathy were not observed in any of the patients of both groups. And the study concluded that both supraclavicular and infraclavicular block produces same amount of anaesthesia for surgery without any supplementation and both techniques took same amount of time to perform the block.

Koscielnak-Nielsen et al[37], in this study upper extremity surgery patients were selected . Compare this patients with supraclavicular or infraclavicular blocks under ultrasonogram guidance. The main objectives of this study were, time to perform the block, block effectiveness, occurrence of the adverse events, and acceptance of the block procedure by the patients. Two groups were randomized with the total number of 60 patients in each group such as supraclavicular and infraclavicular. For all patients ultrasound machine with frequency of 10 MHz probe was used. All patients received a local anaesthetic mixture of 0.75% ropivacaine and 2% mepivacaine with adrenaline 5 mcg/ml, with the volume of 0.5 ml/kg . The mean time to perform the block in supaclavicular group was 5.7 min, and the mean time to perform the block in infraclavicular group was 5.0 min. The axillary nerve has better block in the supaclavicular group than infraclavicular group. Infraclaviclar group was better block in the ulnar nerve than the supraclavicular group. Incomplete block were observed in medial cutaneous brachii for both groups. Good blocks were observed in medial cutaneous antebrachii, the radial, and the musculocutaneous in both groups. Effective surgical block was seen in 93% of patients in infraclavicular group and only 78% of patients in the supraclavicular group. Adverse events like, Horner's syndrome and diaphragmatic

paresis were occurred only in supraclavicular group. Incidence of accidental vascular puncture was observed in 2% of patients in both groups. The study concluded that the effective surgical block was better with infraclavicular approach and also shows a faster onset, which was due to better blockade of the ulnar nerves. The supraclavicular approach produce a better block in the axillary nerve. Infraclavicular group also had better motor block and less incidence of transient adverse events, than supraclavicular group.

Aman, El.Sawy et al,[38] he studied chronic renal failure adult patients, scheduled for creation of arteriovenous fistula of the distal upper extremity. They were divided randomly into two equal groups: Supra G ($n = 30$): ultrasonic guided supraclavicular brachial plexus block was given and Infra G ($n = 30$): ultrasonic guided infraclavicular brachial plexus block was given. For both groups we used 20–25 ml 1:1 volumes of 0.5% bupivacaine and 2% lidocaine. The block performance time was less than 10 min in both groups and the mean block performance time and procedural pain was comparable in both supraclavicular and infaclavicular approaches. The grades of motor and sensory block in the area supplied by the radial nerve, median nerve, musculocutaneous nerve showed no significant statistical differences

among the two groups. The sensory block grade in the area supplied by the ulnar nerve was higher in the infraclavicular Group than the supraclavicular Group at 20 and 30 min measurement times. The difference was significant. The motor block grade in the area supplied by the ulnar nerve also comparable. None of the patients in both groups had intravascular injection or developed local hematoma or pneumothorax. They concluded that both approaches included in this study to the brachial plexus were comparable in providing very satisfactory sensory and motor block with Infraclaricular group was better than supraclavicular Group.

De Quang Hieu Tran et al[39] studied the effect of brachial plexus block in patients with upperlimb surgeries(hand, wrist, elbow, forearm) by axillay, supraclavicular, infraclavicular blocks under ultrasound guidance. In this study one hundred twenty patients was randomly selected into three groups and each groups comprises fourty patients. For all patients in three groups received the local anaesthetic of 35 ml of 1.5% lignocaine with 5µg/ml epinephrine. There was no differences observed in imaging, performance time and procedural pain between three groups. The success rate for surgical anaesthesia was similar in all patients. The Axillary approach had a faster onset and better of block of

musculocutaneous nerve but radial nerve has inferior rate block compared to that of Infraclavicular approach . The infraclavicular and supraclavicular approaches had similar in onset time for individual nerve block. The proportion of patients requesting sedation was the same in all three approaches. Comparing the above three approaches under ultrasonogram guidance there was a increase number of passage of needles and the time for needling and the block performance time also increase in axillary blocks, when comparing the other two methods and comparing the other two methods adverse events like horner's yndrome were observed only in supraclavicular group.

M .J. Fredrickson et al [40] also compare the patient for upper extremity surgery in which they use ultrasonogram for both supraclavicular and infraclavicular approaches. In this study they used to inject the drug for supraclavicular group in the area of corner pocket that is lateral and inferolateral to the subclavian artery .In infraclavicular group they used to inject the drugs into three areas one lateral to the axillary artery ,next one posterior to the axillary artery ,third was in between axillary artery and axillary vein .The drug used for all the patients in both groups were 2% lignocaine with adrenaline 5mcg per ml concentration. Time taken for scanning there is a reduction of 30

seconds in infraclavicular block compared with supraclavicular block and also had advantages of reduction of needle time in infraclavicular block. After 30 minutes of block procedure difference were observed between the two groups in view of rate of success of motor and sensory blocks. But comparing the surgical anaesthesia infraclavicular block gives better surgical anaesthesia than supraclavicular block due to the complete involvement of ulnar nerve in infraclavicular block. The results were observed by surgical blockade in view of complete loss of pinbrick sensation in the four nerve sensory distribution. But the time taken for loss of pinbrick sensation were similar between these two groups with the value of twenty two minutes for supraclavicular and twenty one minute for infraclavicular group .For complete sensory block infraclavicular block is better with seventy percentage when comparing the supraclavicular group which fifty seven percentage. Less number of patients were required supplementation in infraclavicular group with ninety five percentage of success when comparing the supraclavicular group which is sixty seven percentage of success. The supraclaviclar group failure was due to the incomplete block of ulnar nerve territory. No patients were observed for adverse events like pneumothorax and other system toxicity. They concluded that corner pocket for supraclavicular block was not a better and also a, not

suitable alternative for infraclavicular group for triple injection technique of infraclavicular block.

Chiyo Ootaki, M.D., et al[41] studied the ultrasound guided infraclavicular block. Infraclavicular block was less popular than other approaches used for brachial plexus block because it have ununiformity of landmark and increase patient discomfort due to the use of longer needle in this approaches ,so this study was plan to study the advantages of ultrasonogram guidance in this approaches and overcome the disadvantages that was previously present in this approaches. In this study also patient undergoing upper extremity surgery were selected with the number of sixty patients. For all patients 7.0 MHz frequency probe is used .Probe placement was in the lateral head of the clavicle for all patients with the intention of seeing the subclavian artery and subcalvian vein. Twenty three gauge needle is used for all the patients, the drug used in the study was 1.5 percent of lignocaine with 1:2 lakhs concentration of adrenaline .The drug was injected for all patients were close to the subclavian artery that is lateral and medial to the subclavian artery with a distance of fifteen centimeter from the subclavian artery. After thirty minutes of block procedure the patients were evaluated for motor and sensory block. Ninety five percentage of patients(57

patients)go with surgery and there is no need for supplementation with any other drug during interoperatively .And they concluded that infraclavicular approach using ultrasonogram guidance produce more accurate block and less patient discomfort when comparing landmark techniques.

Perlasa, et al(2009) [42] studied the supraclavicular block by using ultrasonogram guidance in five hundred and ten patients .For all patients they used in plain technique for nerve localization either from medial and lateral orientation. They were observed ninety four point six percentage of patients were achieved complete surgical anaesthesia by single attempt.Supplementation of local anaesthesia was needed for two point eight percentage of patients .And two point six percentage of patients go with general anaesthesia .No significant complications were observed in this study .And they concluded that ultrasonogram guided technique produces better block success and lesser number of complications .Hence they concluded that ultrasonogram guided supraclavicular block is better alternative when comparing the landmark technique.

N.S. Sandhu And L. M. Capan (2002) et al [43]studied the infraclavicular block under the ultrasound guidance. They selected one twenty six patients for this study. For all patients 2.5 MHz probe was used and visualize the three cords. The drugs used in the study was eight to twelve ml of 2% lignocaine with adrenaline 1:2 lakhs concentration and sodium bicarbonate(0.9 mEq/10 ml).The drug was injected around the each cord for all patients. Complete surgical anaesthesia was observed in 90.4% of patients. Local anaesthetic supplementation was needed for 7.2 percentage of patients. In this study2.4% of patients twere need for general anaesthesia for surgery .From this study they concluded success rate, onset time better with the ultrasonogram guidance in the infraclavicular block .And also concluded that ultrasonogram was better advantage with lesser number of complications.

MATERIALS AND METHODS

Patient selection :

This was a prospective randomized study conducted at Govt. Stanley Hospital, attached to Stanley Medical College, Chennai. 120 adult patients of ASA grade 1 and 2 of either sex undergoing surgeries on the forearm and hand were randomly allocated , into two groups, Group- S and Group- I. Each group comprises of 60 patients. Surgery was done under ultrasonogram guided supraclavicular block in S group and ultrasonogram guided infraclavicular block in I group.

Inclusion Criteria :

ASA grade I and 2

Age 18 to 50 years

Both Sex

Undergoing forearm and hand surgeries

Exclusion criteria :

- Patient refusal for the procedure
- Un-cooperative patients

- Clinically significant pulmonary pathology
- Pregnant women
- Known neuropathy involving the forearm and hand undergoing surgery
- Infection at the needle insertion site
- Coagulopathies.

EQUIPMENT:

The materials required for the study included

1) Esaote my lab 25 Gold portable Ultrasonogram Machine, 2012 model no 7340, with 10-18MHz linear probe.
2) Ultrasonogram probe Jelly
3) Multipara monitor
4) 8cm long 18G needle
5) 10ml syringe

Picture 8 : Portable Ultrasonogram Machine

Picture 9 : Ultrasonogram Probe and Jelly

DRUGS:

The following drugs were kept ready

1) 0.5% Bupivacaine
2) 2% Lignocaine with adrenaline
3) Injection. Midazolam
4) Injection. Fentanyl
5) Emergency drugs

MONITORING :

Monitors that made available

1) Pulse oximeter

2) Non invasive blood pressure monitor

3) Electrocardiogram

The following emergency equipments were also checked and kept ready

1) Laryngoscope with blade

2) Working suction apparatus

3) Appropriate size endotracheal tubes

4) Ambu bag

GROUPS :

Group S : patients received USG-guided supraclavicular block

Group I : patients received USG-guided infraclavicular block

Sample Size**:**

Based on previous literature [37] it was assumed that 95% of patients underwent Infraclavicular block and 80% of Supraclavicular block had total sensory and motor block. To estimate this difference with 95% confidence limits and 80% power the minimum sample size needed was calculated as 60 patients per group (total 120 patients).

$$n=z^2\{P1(1-P1)+P2(1-P2)\}/(P1-P2)^2$$

$$P1=95$$

$$P2=80$$

$$=6.18\{95 \times 5+80 \times 20\}/(95-80)^2$$

$$\sim 57=60 \text{ patients}$$

60 patients per group and a total of 120 patients.

METHODOLOGY:

20 patients with the age range of 18 –50 years undergoing forearm and hand surgeries were randomized into either the supraclavicular (S) or the infraclavicular (I) group using computer generated random numbers and a closed envelope method into two groups of 60 each.

Written informed consent was obtained from all the patients. After shifting the patient to operation theatre, a randomization envelope was opened and the patients were allocated to either the (1) S group or the (2) I group. An 18G IV line secured on the non surgical limb. Intravenous fluid in the form of 0.9% sodium chloride for diabetic patients, 5% Dextrose normal saline for non diabetic patients were started, at the rate of 100ml/hour. The patients were premedicated with 0.025mg/kg of midazolam intravenously 5 minutes before the procedure. Pulse Oximeter, ECG, NIBP monitors were attached to the patient and baseline parameters was recorded.

A local anaesthetic mixture was prepared with, equal volumes of 0.5% bupivacaine and 2% lignocaine with adrenaline. The local anaesthetic mixture was given in a dose of 0.5ml/kg.

A ultrasound machine(Esaote my lab 25 Gold portable 2012,model no7340) that was equipped with colour Doppler and a linear 10-18 mHz probe was used to all patients in both groups. USG machine was power on to get ready for the use. Ultrasonogram probe jelly was applied over the probe, and the probe was covered with sterile covering. Skin was prepared with povidine iodine solution.

The targets for both groups were:

S group:

The trunks , divisions of the brachial plexus and the subclavian artery.

I group:

The axillary artery, axillary vein and the cords of brachial plexus.

SUPRACLAVICULAR GROUP:

In the S group, the patients were placed in supine position [49] . The operating arm was placed on the side of the body and adduction at shoulder joint and the head was turned away from the side to be blocked with shoulder elevated. Area was prepared with povidine iodine solution .

Probe placement in supraclavicular group was coronal oblique plane, in the supraclavicular fossa just lateral to the clavicular head of the sternocledomastoid muscle,with the intention of visualizing the subclavian artery,pleura, first rib and the brachial plexus.

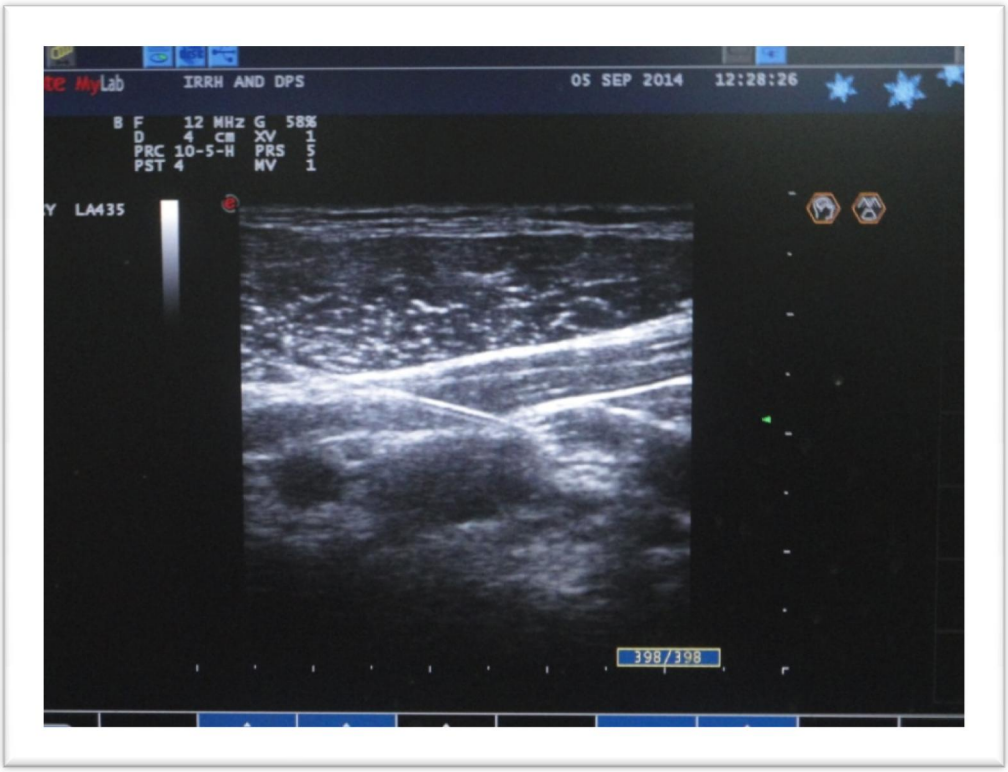
Picture 10 : Needle tip lateral /inferolateral to the subclavian artery

Picture 11 : Needle tip superior to the subclavian artery

After anaesthetizing the skin and subcutaneous tissue with 1- 2 ml of 2% lignocaine, a 8 cm long 18G needle was introduced under the probe, along with the probe's (in plane technique) long axis. The first 20 ml of the local anaesthetic mixture was injected infero lateral/ lateral to the subclavian artery around the plexus and the remaining anaesthetic mixture was injected superior to the plexus after repositioning the needle tip [50,51].

INFRACLAVICLAR GROUP:

In the I group, the patient was placed in supine position. The operating arm was positioned 90% abduction at the shoulder joint and elbow flexed.



Picture 12: Needle tip at the level of medial cord

Patient's head turned away from side to be blocked. The pillow was positioned underneath the shoulder blades ,so as to extend the both shoulders and therefore to expose the deltopectoral groove .

Picture 13 : Needle tip at the level of lateral cord

The probe placement in infraclavicular was over the deltopectoral groove in the parasagittal plane with a medial to lateral position with the intention of visualizing the axillary artery, axillary vein and the cords of the plexus. A 8 cm long 22G needle was introduced under the probes , along with the probes long axis(in plane technique). The first 10ml of the local anaesthetic mixture was injected posterior to

the artery. Second 10ml of local anaesthetic mixture was injected lateral to the axillary artery. The remaining local anaesthetic mixture was injected in between axillary artery and axillary vein after repositioning needle tip [52].

Picture 14 : Needle tip at the level of posterior cord

OUTCOME MEASURES

1. *SENSORY BLOCK*- is assessed every 10 minutes after the needle removal for 30 minutes. Sensory block was evaluated by pinprick stimulation at the areas supplied by radial nerve, median nerve, ulnar nerve and musculocutaneous nerve.

   A. Radial Nerve-dorsal aspect of the radial two thirds of the hand and thumb.Dorsal aspect of the thumb,index,middle and radial half of the ring finger upto the proximalinterphalangeal joint.Middle one third of the dorsal aspect of forearm.

   B. Median Nerve-volar aspect of the hand and fingers from the thumb to the radial half of the ring finger.Dorsal aspect of index,middle,and radial half of the ring finger from the proximalinterphalangeal joint to the tip of the fingers.

   C. Ulnar Nerve-Dorsal and volar aspects of the ulnar side of the hand.Dorsal and volar sides of the medial half of the ring finger and entire little finger.

   D. Musculocutaneous nerve - forearm component assessed at lateral half of the volar aspect of forearm.Lateral one third of the dosal aspect of foearm.

E. The assessment of sensory block documented for each nerve as[37]:

a) anaesthesia-score 2(no pain ,no touch sensation)

b) analgesia -score1(no pain)

c) pain-score 0 (feels pain)

2. *MOTOR BLOCK*- is assessed at 30 minutes after needle removal in hand grip and wrist and elbow joints .

A. Elbow: by flexion and extension of the elbow

B. Wrist: by flexion and extension of the wrist

C. Hand grip: by flexion of the fingers at the metacorpophalangeal and interphalangeal joints. Flexion and adduction of the fingers and thumb.

Motor function was graded such that [39],

a) paralysis - score 2(no contraction)

b) paresis –score 1(reduced contraction)

c) no weakness-score 0(normal contraction)

3. *COMPLETE SENSORY BLOCK* -is defined as a sensory block of score 2 in all four nerve territories.

4. *COMPLETE MOTOR BLOCK* - is defined as a motor block of score 2 in all

   the three joints motor components.

5. *EFFECTIVE UPPER LIMB BLOCK*- is defined as a complete sensory block (score 2 in all four nerve territories) and complete motor block (score 2 in all three joints motor components)

6. *SURGICAL BLOCK*- is defined as a sensory score of 1 (analgesia) or score of 2 (anaesthesia) in all four nerve territories after 30 minutes of block, irrespective of the motor block [37.]

7. BLOCK PERFORMANCE TIME -

Block performance time is defined as the time interval from the time of first insertion of the blocking needle to the time of its removal. Block performance time was recorded by the anaesthesia assistant with an electronic stop watch.

8.ADVERSE EVENTS-

The following adverse events were looked for in all the patients.

a) Accidental vessel puncture was identified by the appearance of blood in the syringe.

b) Horner's syndrome can be identified by the appearance of ptosis and miosis.

c) Pneumothorax can be identified clinically by persistent cough, chest pain, difficulty in breathing and shortness of breath within 24 hours after performance of block [53] . It was confirmed by taking chest X ray for the clinically suspected patients.

Patients those who had an *'effective surgical block'* were declared as, ready for the surgical procedure. Intraoperatively patients with score 1 of sensory block was given additional dose of 0.25mg/kg of Inj Midazolam and 1mcg/kg of Inj Fentanyl. Patients with score 2 of sensory block, directly go with the surgical procedure. For anxious patients, additional dose of Inj. Midazolam 0.25mg/kg was given. All patients were supplemented with nasal oxygen 3 – 4 liters/ min through face mask intra-operatively. Patient was monitored through out the procedure. At the end of procedure ,patient was transferred to post

anaesthesia care unit. In the post anaesthesia care unit patient was monitored for 24 hours. For all patients inj. paracetamol 1 gram was given intravenously[54] after 6 hours of the procedure and continued thrice daily for two days.

All the blocks in both the groups were performed by the principle investigator. Outcome measures were assessed by anaesthesia resident, except block performance time. Block performance time was recorded by anaesthesia assistant.

Statistical Tools:

The information collected regarding all the selected cases were recoded 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 Pearson Chi-Square**,** Fishers Exact Test and independent 't' were used. A p value <0.05 was considered significant.

OBSERVATION AND RESULTS

This study was designed to compare the ultrasound guided supraclavicular block with infraclavicular block for forearm and hand surgeries.120 patients were selected and randomized.

Group S:

60 patients received ultrasound guided *supraclavicular blocks.*

Group :I

60 patients received ultrasound guided infraclavicular blocks.

The outcome measures assessed were

1) Sensory block at radial, median, ulnar and musculocutaneos nerve distribution.
2) Motor block at elbow, wrist, and hand grip.
3) Complete sensory block
4) Complete motor block
5) Effective upper limb block
6) Surgical block
7) Block performance time

8) Adverse events

a)Accidental vascular puncture

b)Horner's syndrome

c)Pneumothorax

Age Distribution:

Age distribution in supraclavicular group varies from minimum of 18 years to maximum of 50 years. The range of count upto 20 years is 7 patients, that is 11.7% . Age range from 21 to 30 years, the count is 24 patients, that is 40.0%. The age from 31 to 40 years count is 18 patients, that is 30.0% and above 40 years count is 11patients, that is 18.3%.

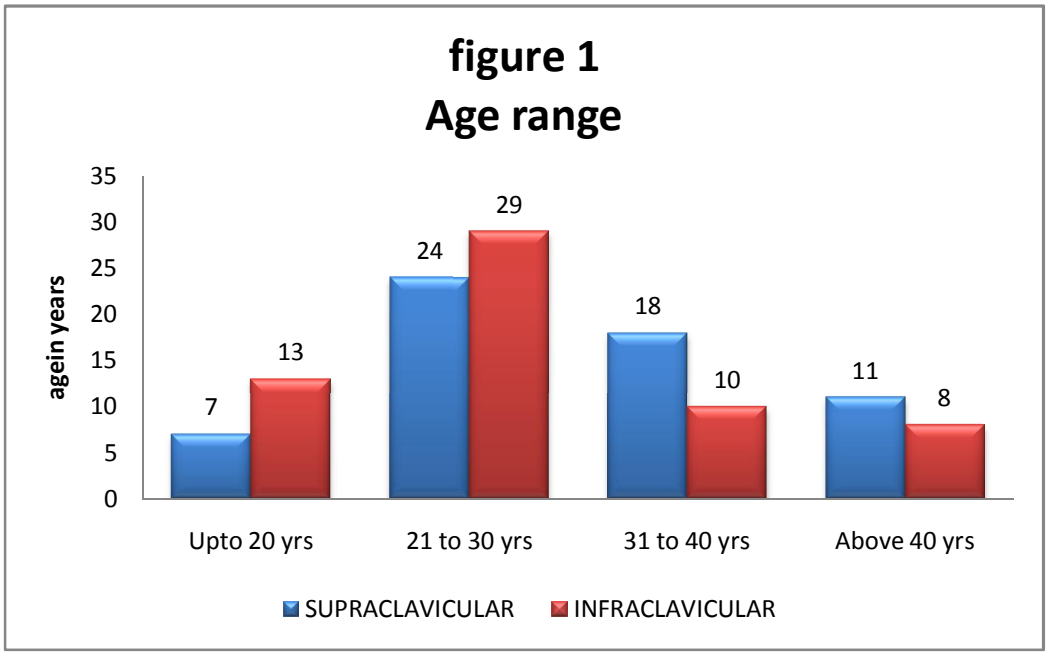


Table 1						
AGE RANGE						
	SUPRACLAVICULAR		**INFRACLAVICULAR**		**T0TAL**	
	Number of patients	%	Number of patients	%	Number of patients	%
Upto 20 yrs	7	11.7	13	21.7	20	16.7
21 to 30 yrs	24	40	29	48.3	53	44.2
31 to 40 yrs	18	30	10	16.7	28	23.3
Above 40 yrs	11	18.3	8	13.3	19	15.8
Total	60	100	60	100	120	100
'p' value		0.105 not significant				

Age distribution in infraclavicular group varies from minimum of 18 years to maximum of 50 years, in which upto 20 years count is 13 patients, that is 21.7% . The age range from 21 to 30 years count is 29 patients, that is 48.3%.The age from 31 to 40 years count is 10 patients, that is 16.7% and above 40 years count is 8 patients, that is 13.3%. (table 1& figure1)

In the supraclaviclar group mean age is 31.5 and standard deviation is 9.306.In the infraclavicular group mean age is 28.60 and the standard deviation is 8.460.The age group 'P' value is 0.105 which is statistically not significant.(table 2 & figure 2)

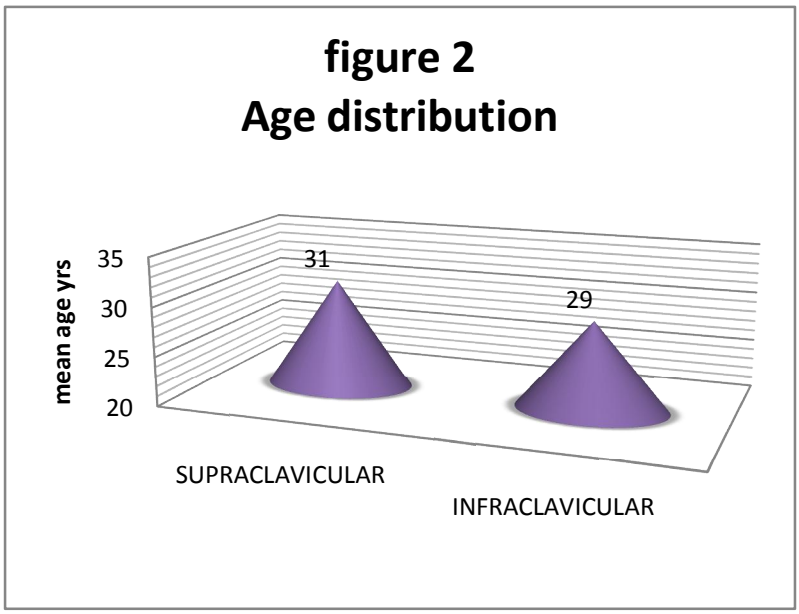


TABLE 2		
AGE DISTRIBUTION		
	GROUP-S	**GROUP-I**
MEAN(age in yrs)	31.5	28.60
S.D	9.306	8.460
'p' –value	0.105 not significant	

Sex Distribution:

In supraclavicular group 45 patients are males, which is 75.0% and 15 patients are females which is 25%. In infraclavicular group 44 patients are males which is 73.3% and 16 patients are females which is 26.7%. The 'p' -value is 0.136 which is statistically not significant. (table 3 & figure 3)

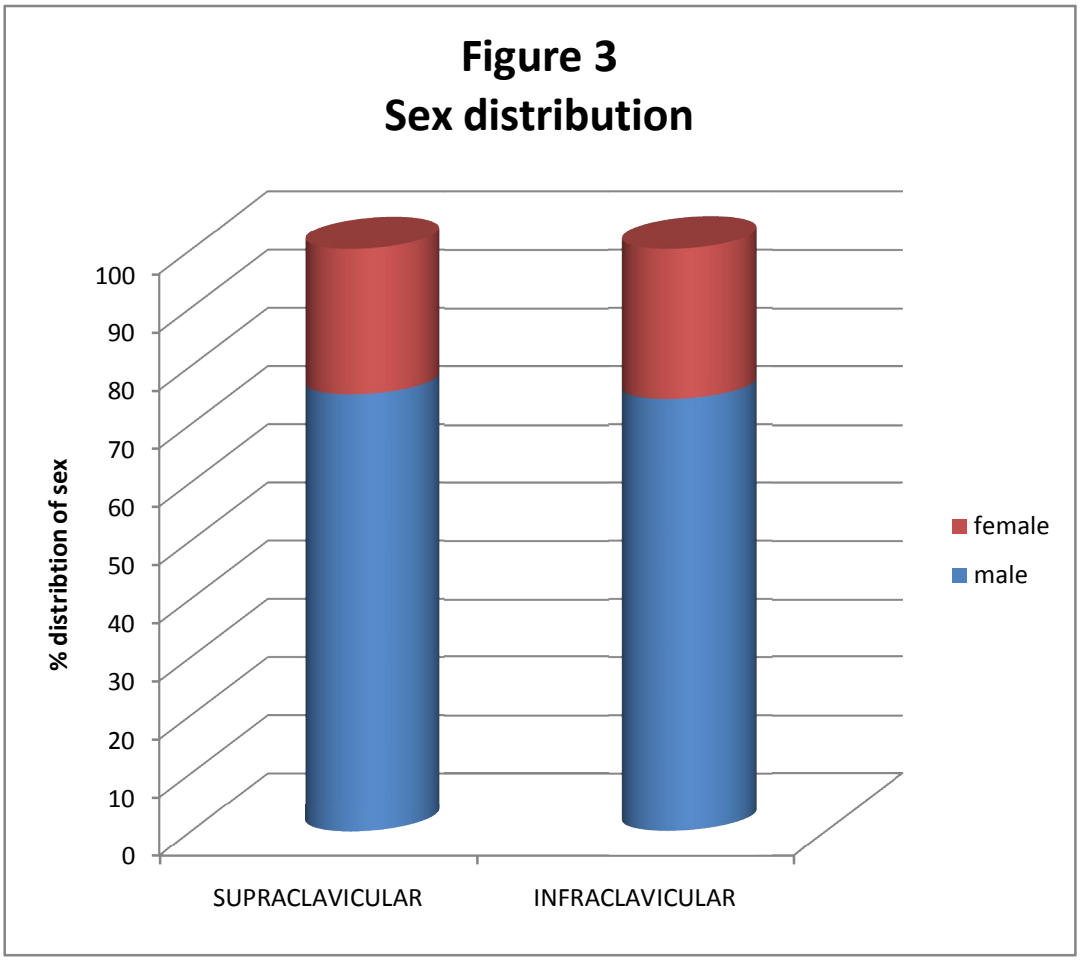
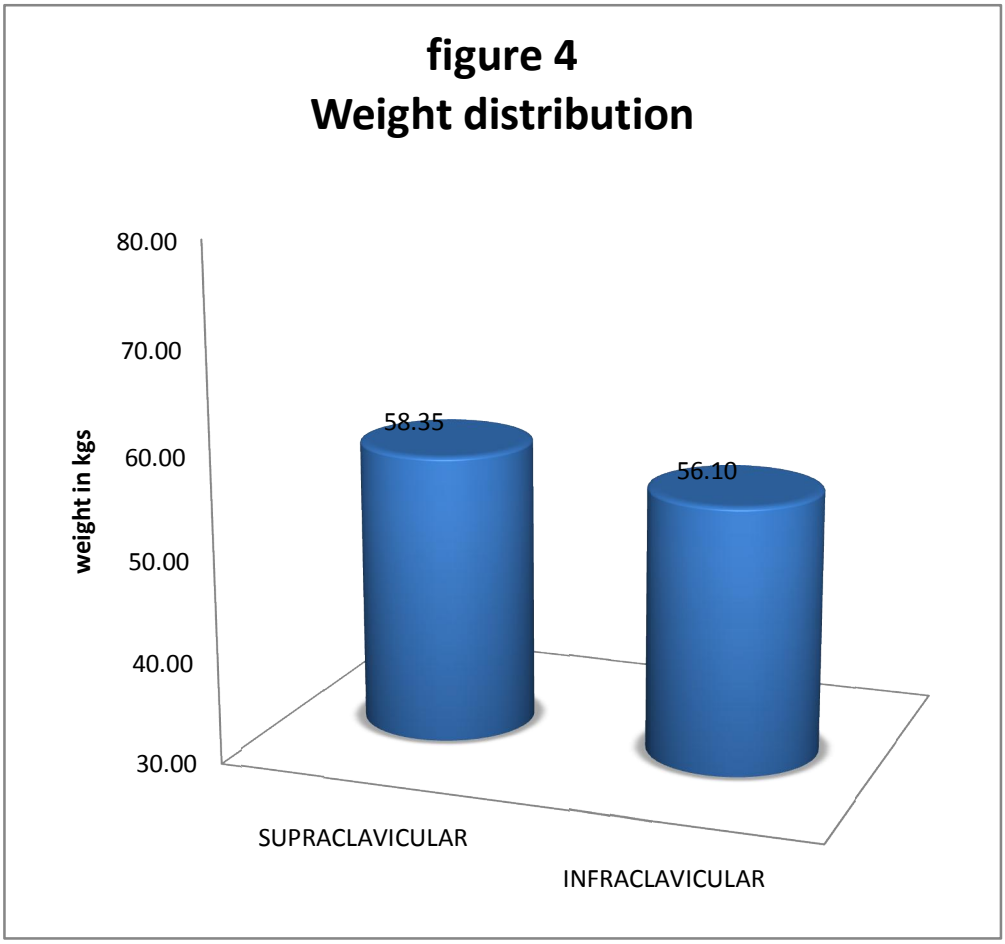


TABLE 3						
SEX DISTRIBUTION						
Sex	**Group S**		**Group I**		**Total**	
	Number of patients	%	Number of patients	%	Number of patients	%
Male	45	75	44	73.3	89	74.2
Female	15	25	16	26.7	31	25.8
Total	60	100	60	100	120	100
'p' value	0.136 not significant					

Weight Distribution

In Group-S weight of patients ranges from minimum of 43 kgs to maximum of 71 kgs, with a mean of 58.35kgs,and a standard deviation of 7.299.In Group –I weight of patients ranges from minimum of 41kgs to maximum of 68kgs,with a mean of 56.10 ,and a standard deviation of 6.501. The 'p' value for weight is 0.077 which is not significant.(table 4 & figure 4)

TABLE 4		
WEIGHT DISTRIBUTION		
Weight(in Kgs)	Group S	Group I
Mean	58.35	56.10
SD	7.299	6.501
‘p’ value	0.077 not significant	



DURATION OF SURGERY:

Surgery duration ranges from minimum of 35 minutes to maximum of 180 minutes, with a mean of 79.07,and the standard deviation of 49.36 in group-S. The duration of surgery in group-I ranges from minimum of 30 minutes to maximum 185 minutes, with a mean of 79.93 ,and the standard deviation of 59.10. The 'p' value for duration of surgery is 0.931 which is not significant. (figure 5 & table 5)

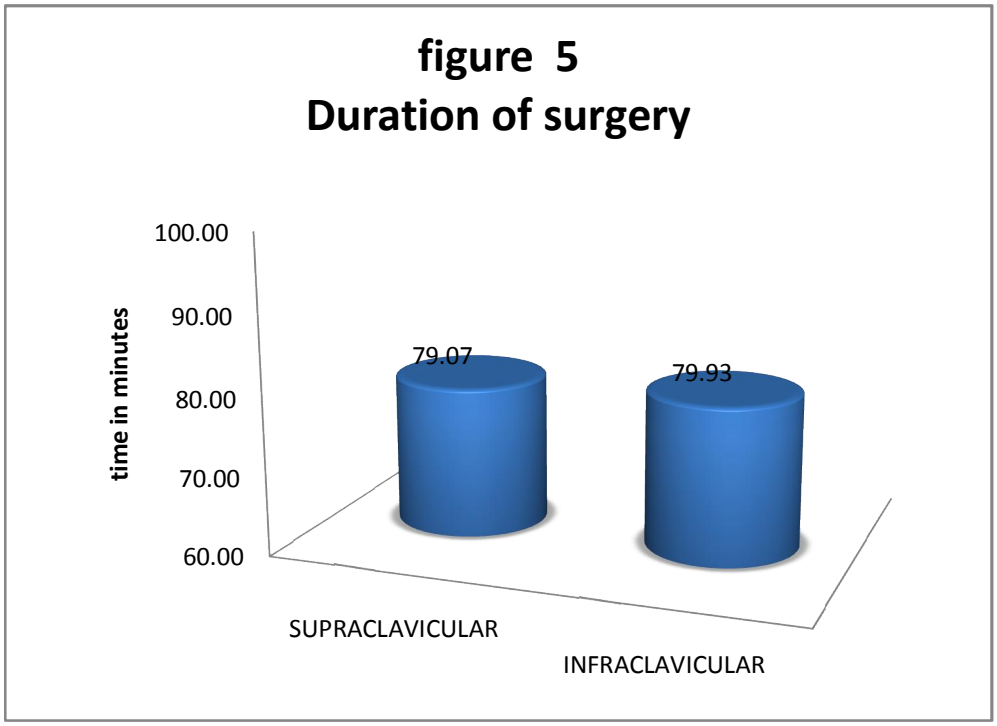
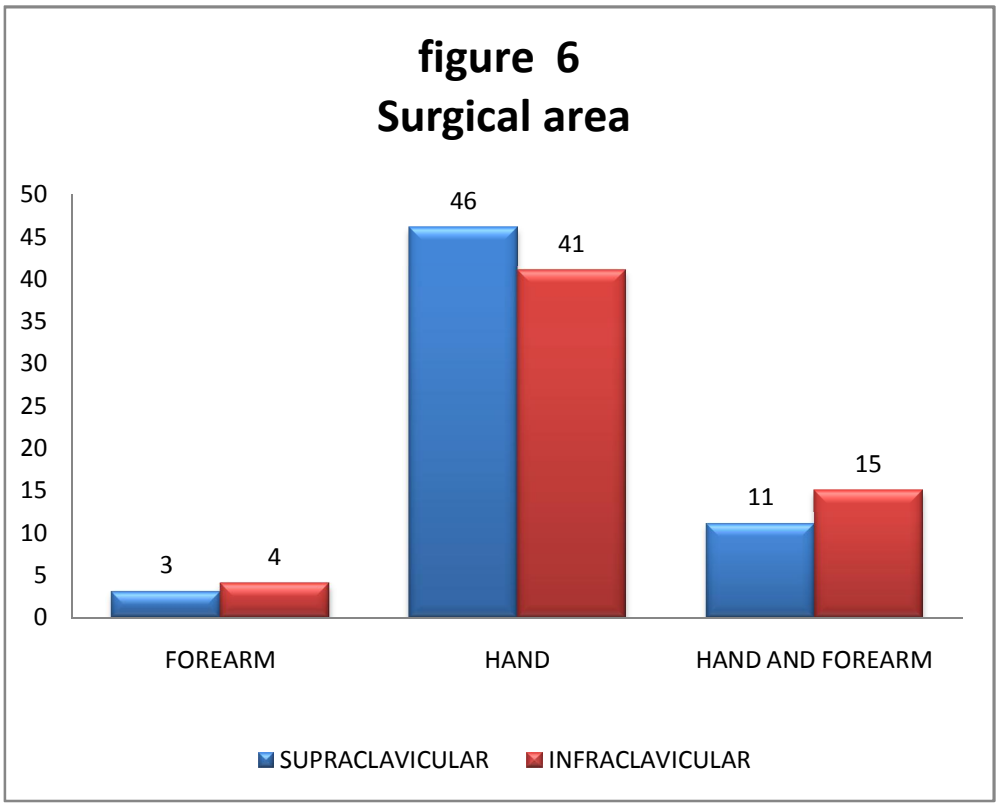


TABLE 5		
DURATION OF SURGERY		
Duration of surgery(minutes)	**Group S**	**Group I**
Mean	79.07	79.93
SD	49.36	59.10
'p' value	0.931 not significant	

Surgical area distribution:

In Group S 46 patients had surgical procedure over the area of hand, which is 76.7 %. Over hand and forearm 11 patient had surgical procedure, that is 18.3% and 3 patients had surgical procedure over forearm, which is 5% .In Group I is 41 patients had surgical procedure over the area of hand. which is 68.3%. Over hand and forearm, 15 patients had surgical procedure, that is 25% .and 4 patients had surgical procedure over foearm, which is 7.1% . The 'p' value is 0.593,which is not significant.(figure 6 & table 6).

TABLE 6				
SURGICAL AREA DISTRIBUTION				
Surgical area	**Group S**		**Group I**	
	Number of patients	%	Number of patients	%
Hand	46	76.7	41	68.3
Hand and Forearm	11	18.3	15	25
Forearm	3	5.0	4	7.1
Total	60	100	60	100
'p' value	0.593 not significant			



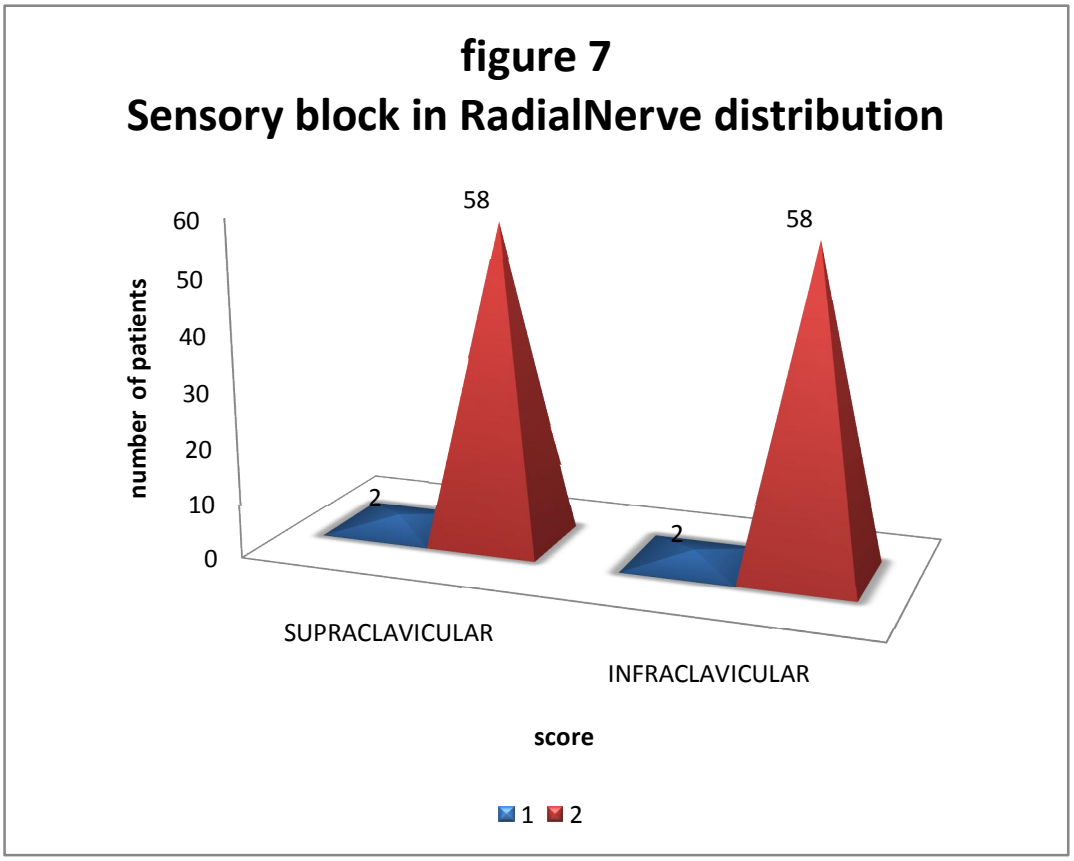
Sensory block in radial nerve distribution:

At radial nerve distribution , 58 patients had a sensory block score of 2 in both the groups. Two patients in both groups were found to have sensory block score of 1. None of them were found with a sensory score of 0. The 'p' value is 1.000 which is not significant .(table 7 & figure 7)

TABLE 7

SENSORY BLOCK IN RADIAL NERVE DISTRIBUTION

	Group S		**Group I**		**Total**	
	Number of patients	**%**	**Number of patients**	**%**	**Number of patients**	**%**
Score 0	0	0	0	0	0	0
Score 1	2	3.3	2	3.3	4	3.3
Score 2	58	96.7	58	96.7	116	96.7
'p'value	1.000 not significant					



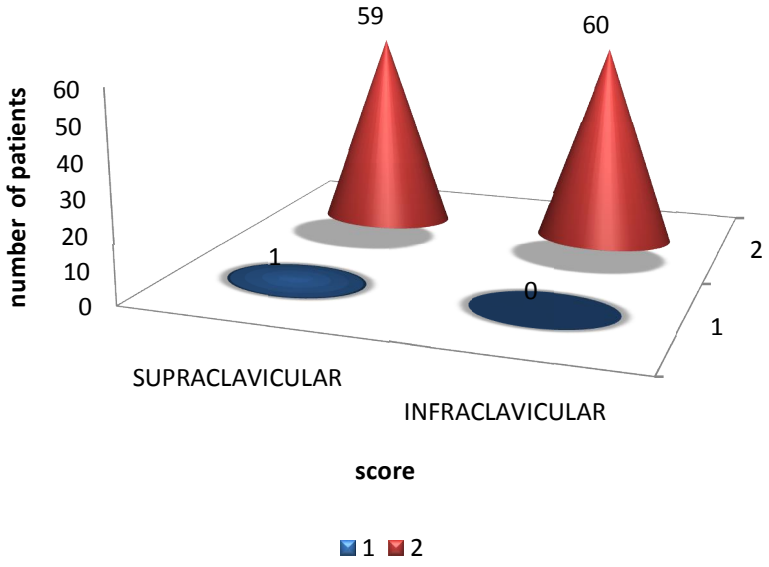
Sensory block in median nerve distribution:

In median nerve distribution ,sensory score of 2 is found in 59 patients that is 98.3% in supraclavicular group. In Infraclavicular group 60 patients have a sensory score of 2 that is 100%. In supraclavicular group only one patient is having sensory score of 1 but none of the patients have a score of 1 in infraclavicular group . Sensory block of score 0 is not found in both groups. The ' p' value is 0.315, which is not significant.(table 8 & figure 8).

TABLE 8						
SENSORY BLOCK IN MEDIAN NERVE DISTRIBUTION						
	Group S		**Group I**		**Total**	
	Number of patients	**%**	**Number of patients**	**%**	**Number of patients**	**%**
Score 0	0	0	0	0	0	0
Score 1	1	1.7	0	0	1	0.8
Score 2	59	98.3	60	100	119	99.2
'p' value	0.315 not significant					

figure 8

Sensory block in MedianNerve distribution



Sensory block in ulnar nerve distribution:

In ulnar nerve distribution ,sensory block score of 2 is found in 48 patients of supraclavicular group and 57 patients of infraclavicular group. 12 patients in supraclavicular group and 3 patients in infraclavicular group are found to have sensory score of 1.At ulnar nerve distribution, none of the patients is having sensory block score 0 in both groups. The 'p' value is 0. 013 which is significant. From the observation sensory block in ulnar nerve distribution is compared better with infraclaviclar than supraclavicular group. (table 9 & figure 9)

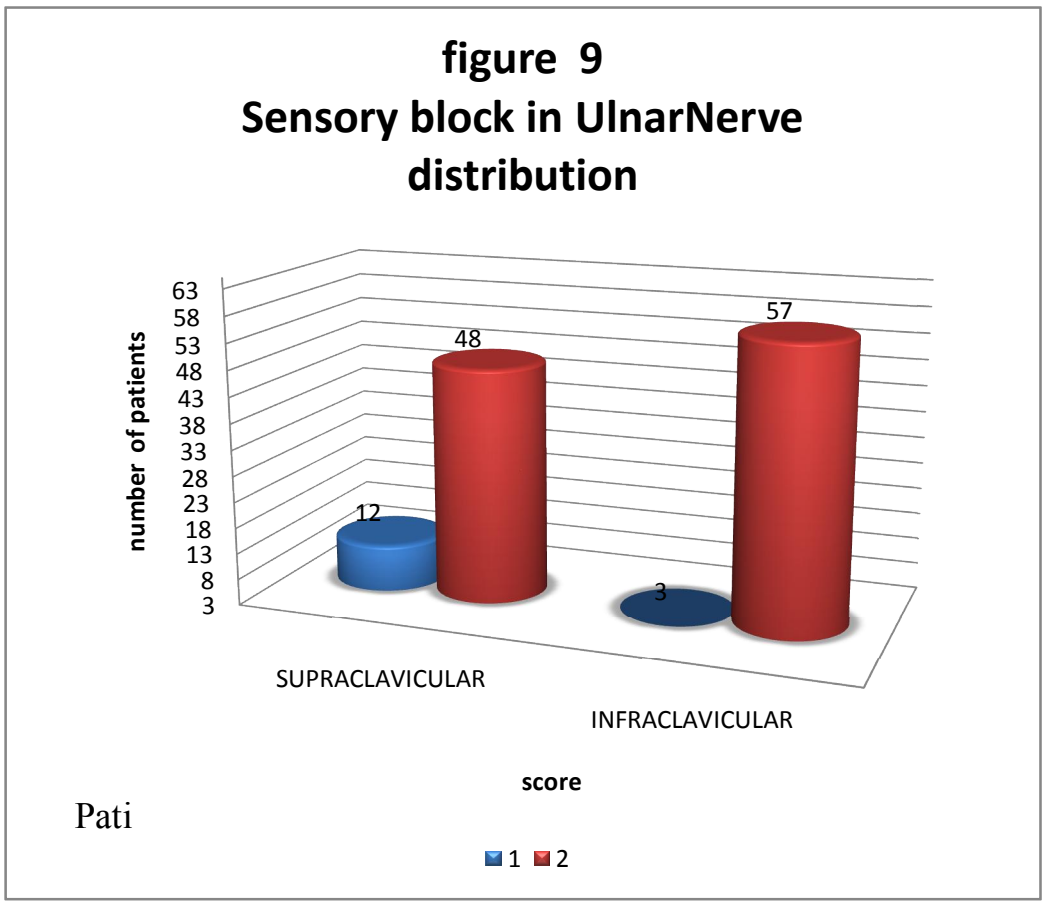


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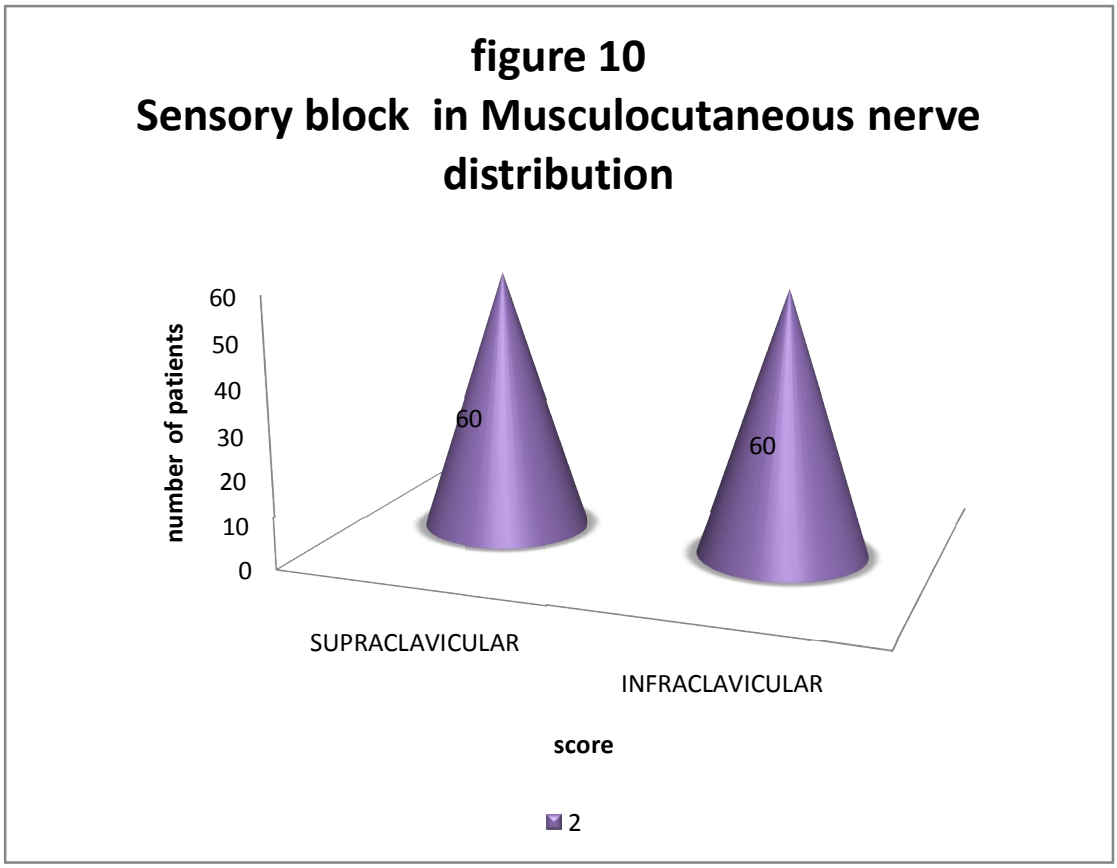
TABLE 9						
SENSORY BLOCK IN ULNAR NERVE DISTRIBUTION						
	Group S		**Group I**		**Total**	
	Number of patients	**%**	**Number of patients**	**%**	**Number of patients**	**%**
Score 0	0	0	0	0	0	0
Score 1	12	20	3	5	15	12.5
Score 2	48	80	57	95	105	87.5
'p'value	0.013 significant					

Sensory block at musculocutaneous nerve :

In musculocutaneos nerve sensory score of 2 is found in all patients of both the groups. In both the groups none of them having score 1 and 0. The 'p' value is 1.00 which is not significant (table 10 & figure 10)

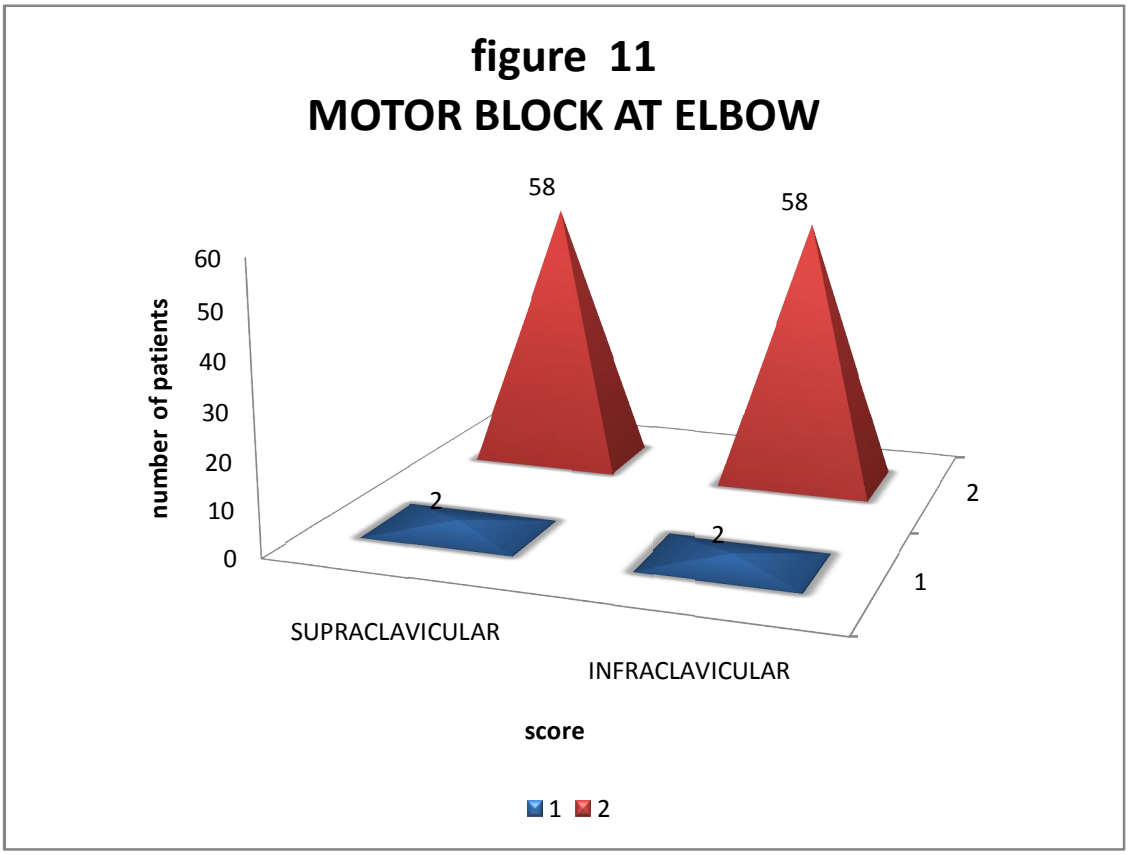
TABLE 10						
SENSORY BLOCK IN MUSCULOCUTANEOS NERVE						
	Group S		**Group I**		**Total**	
	Number of patients	**%**	**Number of patients**	**%**	**Number of patients**	**%**
Score 0	0	0	0	0	0	0
Score 1	0	0	0	0	0	0
Score 2	60	100	60	100	120	100
'p' value	1.000 Not significant					



Motor block at Elbow Level

In motor block at elbow level ,58 patients from each group are having sensory block score of 2.Motor block score of 1 at elbow level is found only in 2 patients of both the groups. None of them are having sensory block score of 0 in both the groups. The 'p' value is 1.000 ,which is not significant.(table 11 & figure 11)

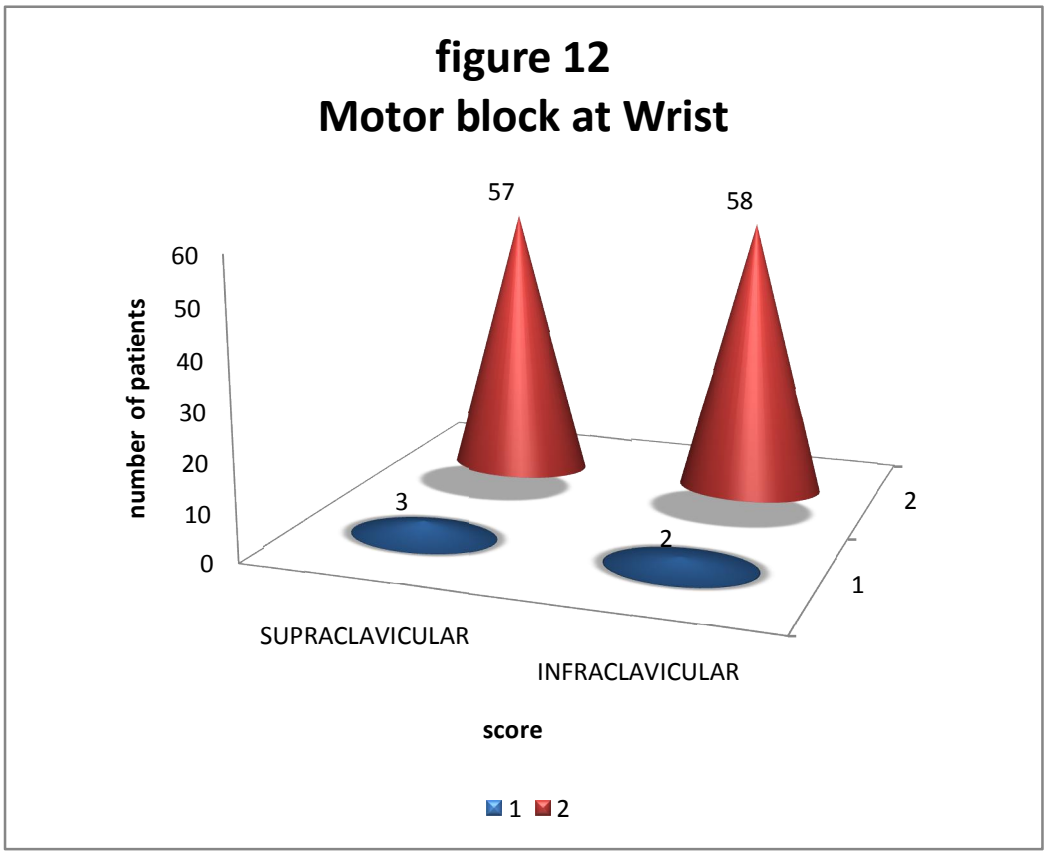
TABLE 11						
MOTOR BLOCK AT ELBOW						
	Group S		**Group I**		**Total**	
	Number of patients	**%**	**Number of patients**	**%**	**Number of patients**	**%**
Score 0	0	0	0	0	0	0
Score 1	2	3.3	2	3.3	4	3.3
Score 2	58	96.7	58	96.7	116	96.7
'p' value		1.00 Not significant				



Motor block at Wrist Level:

At wrist level ,57 patients of supraclavicular group and 58 patients of infraclavicular group are found to be having motor block score of 2.In supraclavicular group, motor block score of 1 is found only in 3 patients and in infraclavicular group only 2 patients are having motor score 1. Both the groups do not have motor block score of 0.The ' p' value is 0.648,which is not significant.(table 12 & figure 12)

TABLE 12						
MOTOR BLOCK AT WRIST						
	Group S		**Group I**		**Total**	
	Number of patients	**%**	**Number of patients**	**%**	**Number of patients**	**%**
Score 0	0	0	0	0	0	0
Score 1	3	5	2	3.3	5	4.2
Score 2	57	95	58	96.7	115	95.8
'p' value	0.648 Not significant					



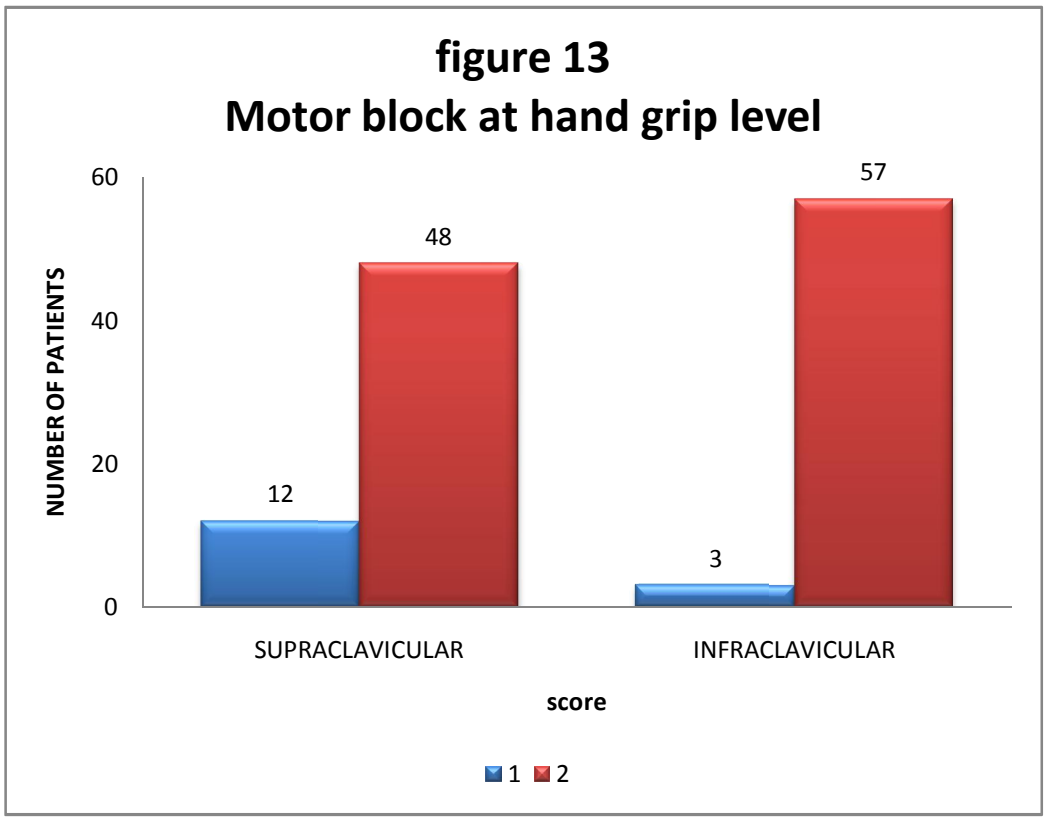
Motor block at Handgrip Level:

In handgrip level motor block score of 2 is found in 48 patients of supraclavicular group and 57 patients of infraclavicular group. Motor block score of 1 is seen in 12 patients of supraclavicular group and 3 patients of infraclavicular group. No one is found to be motor block score of 0 in both the groups. The ' p' value is 0.013 ,which is significant. From the above observation motor block at hand grip level is better with infraclavicular group than supraclaviclar group. (figure 13 & table 13)

TABLE 13

MOTOR BLOCK AT HAND GRIP

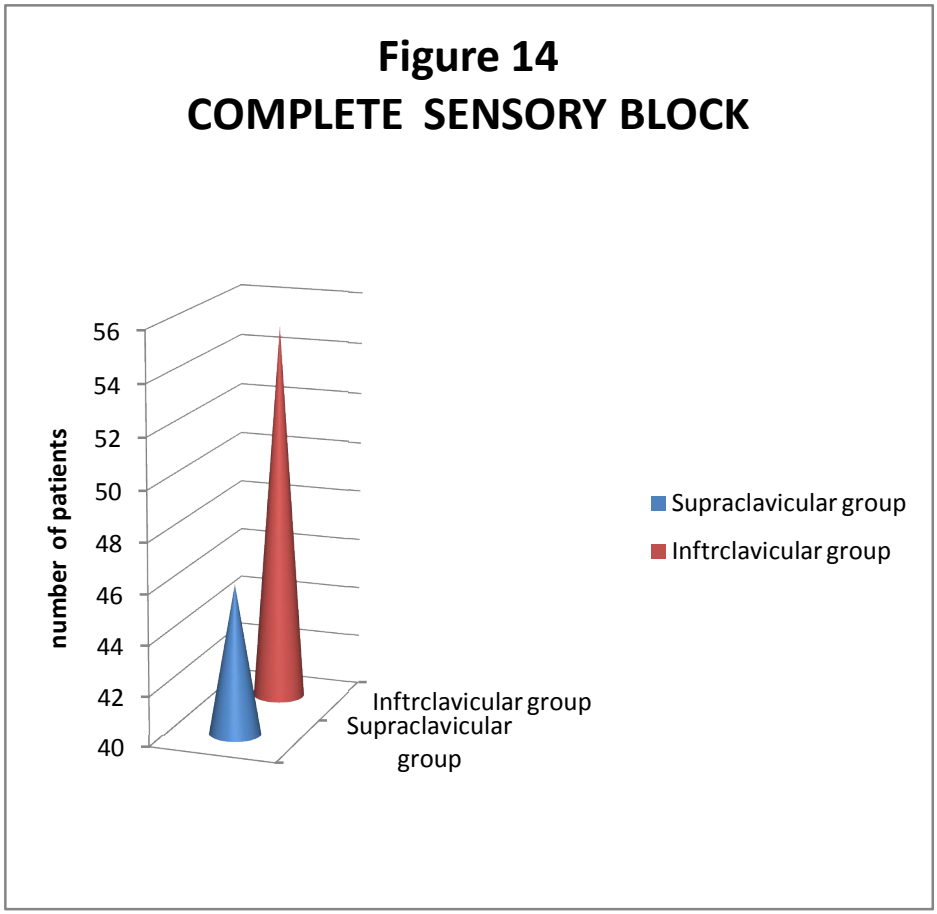
	Group S		**Group I**		**Total**	
	Number of patients	**%**	**Number of patients**	**%**	**Number of patients**	**%**
Score 0	0	0	0	0	0	0
Score 1	12	20	3	12.5	5	12.5
Score 2	48	80	57	95	105	87.5
'p' value		0.013 significant				



Complete Sensory block :

In all four nerve distribution, 46 patients in supraclavicular group and 55 patients in infraclavicular group is having sensory block of score 2. The 'p' value is 0.013 which is statistically significant. From the above observation it is understood that complete sensory block is better with infraclavicular group than supraclavicular group. (table 14 & figure14)

TABLE 14				
COMPLETE SENSORY BLOCK				
Complete sensory block	**Group S**		**Group I**	
	No of Patients	%	No of Patients	%
Score 2	46	76.7	55	91.7
'p' value	0.013 significant			



Complete motor block :

In all three joints complete motor block score of 2 is found in 45 patients of supraclavicular group, and 53 patients of infraclavicular group. The 'p' value is 0.018, which is statistically significant. Complete motor block is better in infracavicular group when compared to than supraclavicular group by the above observation. (table 15 & figure 15)

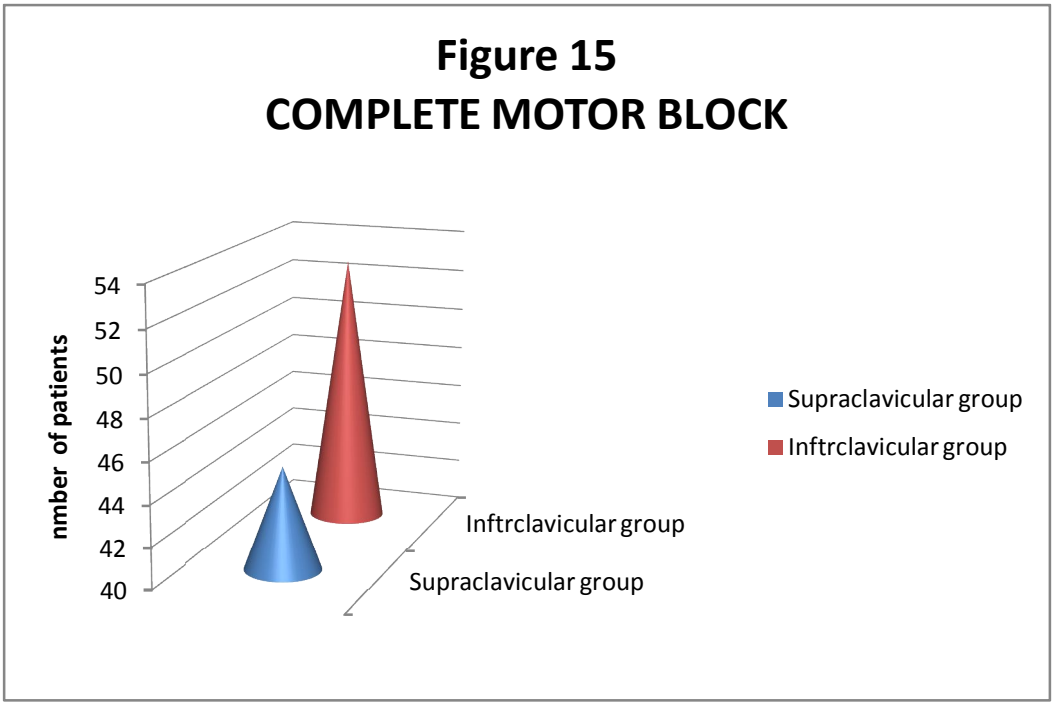
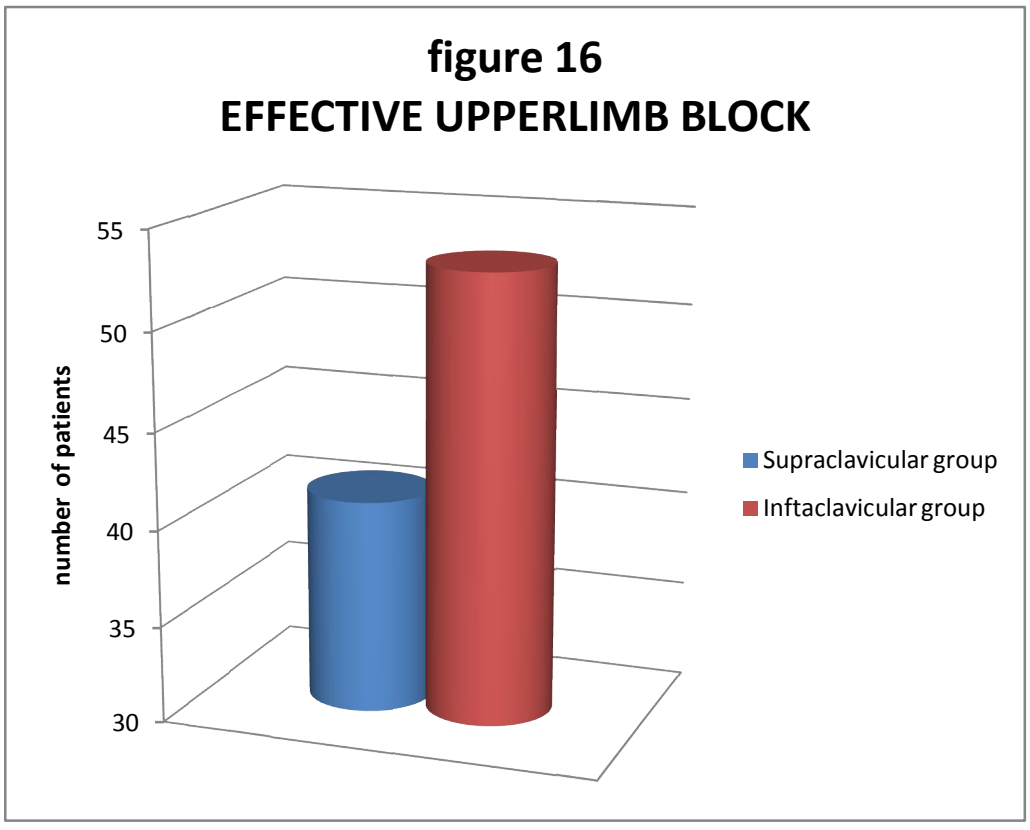


TABLE 15				
COMPLETE MOTOR BLOCK				
Complete Motor block	**Group S**		**Group I**	
	No of Patients	%	No of Patients	%
Score 2	45	75	53	88.3
'p' value	0.018 significant			

Effective upper limb blockade

Effective upper limb block is defined as a complete sensory (score 2 in all four nerve distribution) and complete motor block (score 2 in all joint motor components). The effective upper limb block is found in 41 patient of supraclavicular group (68.3%) and 53 patients of infraclavicular group (88.3%). Effective upper limb block is seen better with infraclavicular group when compared to supraclavicular group by this statistical analysis. And the 'p' value of 0.009 which is statistically significant. (figure 16 & table 16)

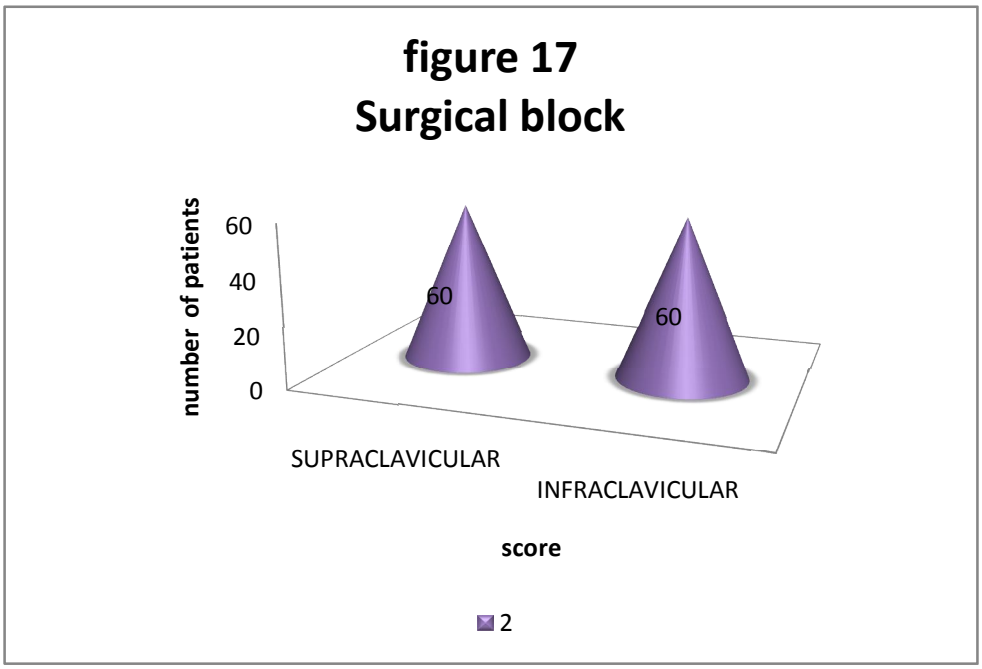
TABLE 16				
EFFECTIVE UPPER LIMB BLOCK				
	Group S		**Group I**	
	Number of patients	**%**	**Number of patients**	**%**
Score 2	41	68.3	53	88.3
'p' value	0.009 significant			



Surgical block:

Surgical block is defined as a sensory score of 1 (analgesia) or score of 2 (anaesthesia) in four nerve territories after 30 minutes of block, irrespective of the motor block. All patients of both the groups satisfy the surgical block score. And the 'p' value is 1.000 ,which is not significant.(table 17 & figure 17)

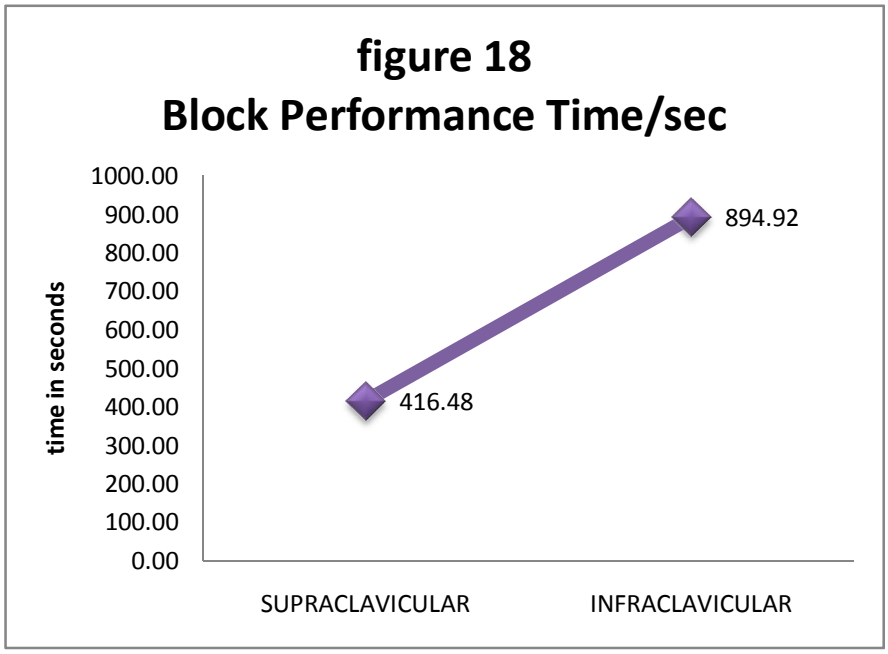
TABLE 17				
SURGICAL BLOCK				
	Group S		**Group I**	
	Number of patients	**%**	**Number of patients**	**%**
	60	100	60	100
'p'value	1.000 not significant			



Block performance Time:

Block performance time in supraclavicular group is 416.48 sec and the standard deviation is 20.550. In infraclavicular group block performance time is 894.92sec and the standard deviation is 57.063. By statistical analysis 'p' value is 0.000.Which is highly significant. This shows that the performance of infraclavicular block takes more time when compared with supraclavicular block. (table 18 & figure18)

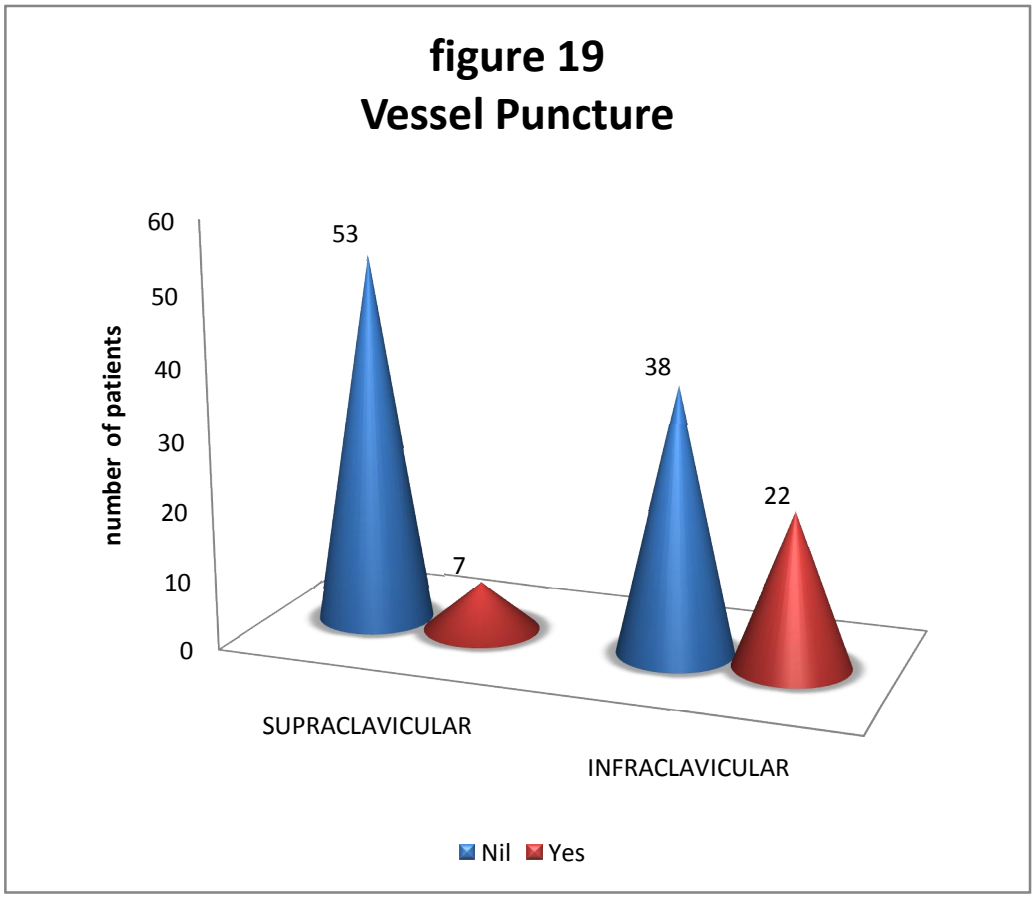
TABLE 18		
BLOCK PERFORMANCE TIME		
Block performance time(sec)	**Group S**	**Group I**
Mean	416.48	894.92
SD	20.550	57.063
'p'	0.000 significant	



Vessel Puncture:

Accidental vessel puncture is seen in 7 patients of supraclavicular group ,which is 11.7% and 22 patients of infraclavicular group, which is 36.7% .The ‘ p’ value is 0.001 which is statistically significant .By statistical analysis, vessel puncture occur more in infraclavicular group compared with supraclavicular group.(table 19 & figure 19)

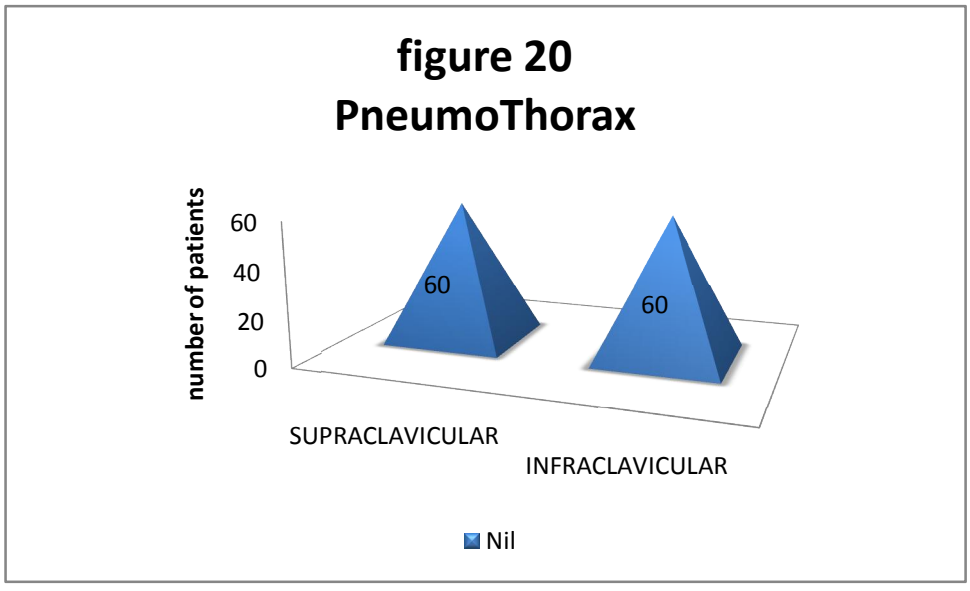
TABLE 19						
VESSEL PUNCTURE						
	Group S		**Group I**		**Total**	
	Number of patients	**%**	**Number of patients**	**%**	**Number of patients**	**%**
Nil	53	88.3	38	63.3	91	75.8
Yes	7	11.7	22	36.7	29	24.2
'p'	0.001 significant					



Pnemothorax:

From the observations complications like pneumothorax is not seen in both the groups. And the 'p' value is 1.000, it is Clinically and statistically not significant.(table 20 & figure 20)

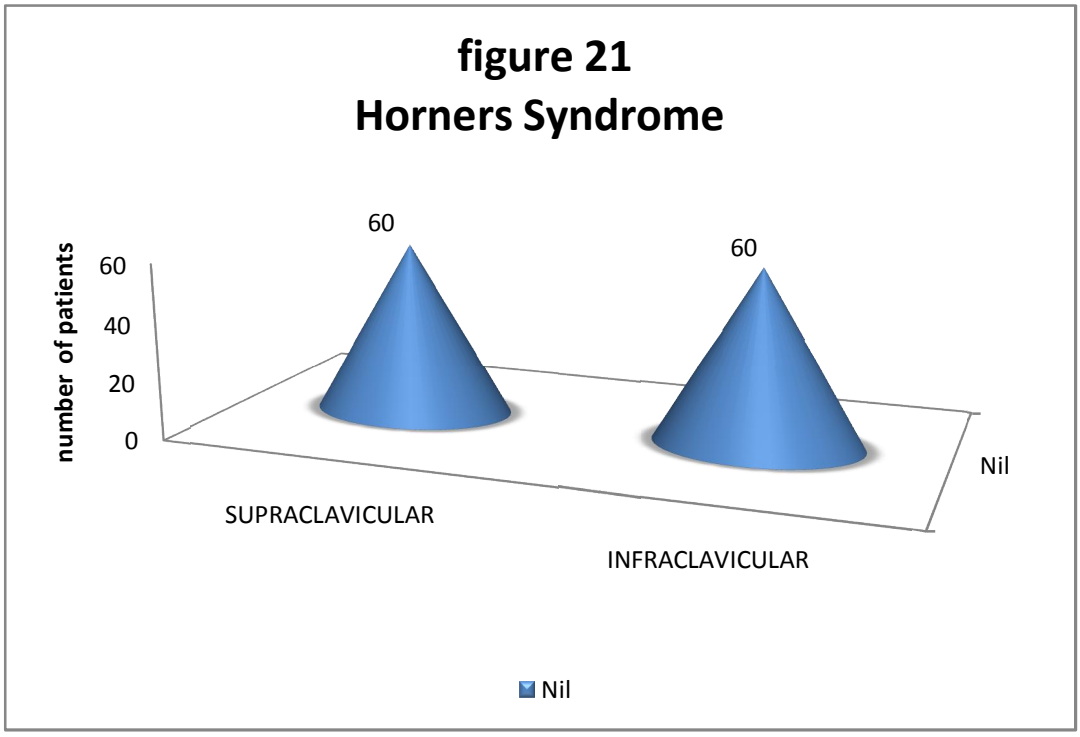
TABLE 20						
PNEUMOTHORAX						
	Group S		**Group I**		**Total**	
	Number of patients	**%**	**Number of patients**	**%**	**Number of patients**	**%**
Nil	60	100	60	100	120	100
Yes	0	0	0	0	0	0
'p' value		1.0000 not significant				



Horners Syndrome:

Horners syndrome was not observed in both groups, with the 'p' value of 1.000.(figure 21 & table 21)It is statistically not significant.

TABLE 21						
HORNER'S SYNDROME						
	Group S		**Group I**		**Total**	
	Number of patients	**%**	**Number of patients**	**%**	**Number of patients**	**%**
Nil	60	100	60	100	120	100
Yes	0	0	0	0	0	0
'p' value		1.0000 not significant				



DISCUSSION

In recent years, the number of industrial and road traffic accidents have increased at an alarming rate. Our hospital is situated in the heart of north Chennai, which is the home for many industrial establishments. The emergency department of our hospital every day receives a number patients with forearm and hand injuries due to industrial and road traffic accidents. Our hospital is the institute for hand and plastic surgery in Tamil Nadu .Everyday around 15 to 20 hand and forearm surgeries are being conducted in the hand and plastic surgery department. Due to this enormous case load we selected patients posted for hand and forearm surgeries in our study.

Surgical procedures involving hand and forearms can be performed either with general anaesthesia or regional anaesthesia technique. In general anaesthesia patient have risk of airway manipulation, hemodynamic instability ,cognitive dysfunction and post operative nausea and vomiting[2-4.]

Anaesthesia with regional techniques can overcome all the complications associated with general anaesthesia. Also regional anaesthsia techniques have advantage of decreasing morbidity, mortality, providing superior post operative analgesia, being cost

effectiveness and lower in the rate of serious complications[2-4,] when compared to general anaesthesia. Regional anaesthetic technique with peripheral nerve block enables the patients to be discharged on the same day, hence facilitating day care surgery.

In upper limb the entire sensory and motor blockade can be achieved by blocking the brachial plexus and has stood the test of time for upper limb surgeries.[5] And it is easy and relatively safe procedure for upper limb surgeries. Interscalene block, supraclavicular block and axillary blocks are routinely performed blocks for upper limb surgeries. Infraclavicular block has also been common used recently.

Hand and forearm surgeries are the usual indications for supraclavicular and infraclavicular approach to brachial plexus block [1]. Among the various approaches of brachial plexus block, supraclavicular block is considered easiest , and it also provides the most reliable, uniform , predictable anaesthesia for upper extremity and blocks at the level of trunks and divisions [1.]Hence it is one of the most popular techniques used for upper limb surgeries. Supraclavicular block has been routinely used in our hospital for upper limb surgeries. And it has proven to be a safe technique[15]. Now a days infraclavicular block also considered same as effective as supraclavicular block. The cords of

the brachial plexus were blocked in infraclavicular approaches when compared with supraclavicular approaches,here the block was performed at the level of trunks and divisions.It is an excellent block for providing either surgical anaesthesia or post operative analgesia for all distal upper limb procedures [43,44].This block is typically performed between the anterior shoulder and chest wall, in the deltopectoral groove [55].

Initially nerve blocks were performed with *Paraesthesia* elicitation technique. The classical approach using paraesthesia technique was a blind, land mark technique and be associated with higher failure rates and injury to the nerves and surrounding structures [6.]

Later *Nerve stimulator* was invented for higher success rate and to decrease the complications[7,8]. This technique ensures a better blockade than conventional paraesthesia technique[9]. This landmark and nerve stimulator techniques can cause neurovascular injuries, which will lead to permanent nerve damage[10], injury to the pleura leading to pneumothorax[11-13] and also had more failure rates. The problem with designated anatomical landmarks is that they are variable from patient to patient. When searching blindly for the plexus to block[56], a invasive

needle with the sharp edge can damage or pierce the vessels, nerves and other anatomical structures.

Ultrasonogram was introduced with real time imaging radiological tool. Working with radiological tool gains more importance than paresthesia and peripheral nerve stimulator technique. The application of ultrasound guided technique for exact localisation of nerves /plexus [14-18] and vessels has revolutionized the regional anaesthesia field, where in ultrasound probes with suitable frequencies have been successfully tried [57]. Due to the advantage of real time visualization, ultrasonogram reduces the number of needle passes to reach the target nerve groups, which in turns can shorten the block performance time, and increases the success rate [59].

Ultrasound for supraclavicular and infraclavicular brachial plexus block has improved the success rate of block with excellent localization as well as improved safety margin [42-44]. Ultrasonogram is more better than any other radiological tools for needle guidance in peripheral nerve block[57-59].It also provides real time examination of the nerve, and also it provide visualization of the needle manipulation and local anaesthetic spread [59-62].

This study was intended to compare the supraclavicular and infraclavicular approaches of brachial plexus block method by ultrasound guidance, in terms of time taken for the procedure(Block performance time), sensory block at the distribution of radial ,median, ulnar and musculocutaneous nerve, motor block at the level of elbow, wrist and hand grip, complete sensory block, complete motor block, effective upper limb block, and surgical block, and the incidence of complications. This study was done in patients undergoing forearm and hand surgeries with similar demographic profile.

We included patients in the age group of 18 to 50 years in our study. It was done for two reasons. The paedatric patients were uncooperative for the procedure.

In geriatric patients, age related changes in hearing and other senses along with difficulty in positioning for the procedure precluded us from including these patients in our study.

Sex does not have any effect on ultrasonogram guided blocks as proven in the previous studies[30].Hence both the sexes were included in our study.

Patients undergoing forearm and hand surgeries were only selected for our study. Other surgeries over the upper limb were excluded from our study.

As both supraclavicular and infraclavicular blocks may lead to pulmonary complications like pneumothorax, which would proved detrimental in patients with pulmonary pathology[10].Hence, we decided to exclude these patient with pulmonary pathology from our study.

Because of the reported aortocaval compression that may leads to supine hypotension syndrome[63] in pregnant women, when they lie supine .It was decided to exclude pregnant patient from our study.

Patients with known neuropathy[64] were excluded from our study. Because it may confound the results of sensory and motor blockade, that are the primary parameters in our study. Hence we decided to exclude the patients with known neuropathy in our study.

Infection at the needle site is an absolute contraindication [64] for nerve blocks. Hence we decided to exclude the patients with infection at site of needle insertion.

Patients with coagulopathies were absolute contraindication[64] for the nerve blocks. Hence we decided to exclude the patient with known coagulopathy from our study.

Patients who refusal for the procedure and uncooperative for the procedure also excluded from our study.

The ultrasound machine related for the study is esaote my lab 25 gold portable , 2012 model , no of 7340 with 10-18 MHz linear probe. This machine is used for all the patients in both groups.

Disposable sterile 8cm length, 18G needle is used to all the patients of both groups for, local anaethetic administration in our study. For scanning, 15-18 MHz frequency probe is used for all patients in the supraclavicular group, and 10 to 12 MHz frequency probe is used for all patients in the infraclavicular group. The drug injection site is inferolateral/lateral and superior to the subclavian artery for all patients in supraclavicular group. In infraclavicular group the drug is injected around the axillary artery, that is posterior, lateral and in between axillary artery and axillary vein for all patients.

Local anaesthetic mixture [32-35] used for all the patients were 0.5% bupivacaine and 2% lignocaine with adrenaline in a volume of 0.5 ml/kg. Lignocaine has a more rapid onset of action with profound motor block when compared with bupivacaine. But bupivacaine was prolonged duration of action with greater sensory block than motor block when comparing lignocaine. Hence combining of these two drugs only would leads to synergistic effect at the target site. Adrenaline prolongs the duration and intensity of the most local anaesthetics used for peripheral nerve blockade due its vasoconstricting property. These effects prolong the exposure to local anaesthetics by limiting clearance .The toxic dose for bupivacaine is 2mg/kg and lignocaine is 7mg/kg with adrenaline. So we select the mixture of equal volume of 0.5% bupivacaine and 2% lignocaine with adrenaline in a dose of 0.5ml/kg dose for all the patients in both groups.

Various criteria have been used by different authors to determine the success rate of block. A block is considered successful by most authors when analgesia is present in all areas subjected to surgical intervention. From clinical point of view, this definition was sufficient . But it gives a falsely high success rate and makes difficult to compare the different block techniques . Therefore to standardized the criteria of success, we considered the following outcome measures for the ultrasound guided supraclavicular block and ultrasound-guided infraclavicular block in our study.

1. Sensory block in all four nerve territories - redial, median, ulnar and musclocutaneous nerve.

2. Motor block at elbow ,wrist and handgrip level

3. Complete sensory block is defined as a sensory score of 2 in all four nerve territories.

4. Complete motor block is defined as a motor block of score 2 in all three joints of motor components.

5. Effective Upper limb Block: It is defined as a complete sensory block (score 2 in all four nerve territories) and complete motor block (score 2 in all three jonts motor components).

6. Surgical block: It is defined as a sensory score 0f 2 (anaesthesia) or score of 1 (analgesia) all four nerve territories after 30 minutes of block irrespective of the motor block.

In our study, sensory block is assessed for each nerve as

a) anaesthesia-score 2 (no pain,no touch sensation)

b) analgesia-score 1 (no pain)

c) pain-score 0 (feels pain)

Comparison of sensory block of four individual nerve in our study reveals that sensory block is not statistically significant between both groups for radial, median, and musculocutaneous nerve. The 'p' values was 1.000 for radial nerve,0.315 for median nerve, and 1.000 for musclocutaneous nerve. The sensory block of ulnar nerve was significant in both the groups with the 'p' value of 0.013 .From the above observation infraclavicular block was better than supraclavicular

group in our study. This may be due to the fact that we encountered difficulty in reaching the corner pocket between the first rib and the subclavian artery .This is the site where lower trunks are situated. Hence the results of sensory block of ulnar nerve were better with infraclavicular approach than with the supraclaviclar group. The result obtained in our study were analogues to a previous study [37].

In our study motor block at elbow, wrist and hand grip level was assessed as

a) paralysis-score 2 (no contraction)

b) paresis -score 1 (reduced contraction)

c) no weakness score 0 (normal power)

The above three individual joint groups motor component was not assessed in any of the previous studies. In our study the motor block at elbow and wrist level was statistically not significant in both the groups with the 'p' value of 1.00 for elbow joint and 0.648 for wrist joint. At the hand grip level the motor block was statistically significant in both the groups. Infraclavicular group recorded better block than the supraclaviclar group with a 'p' value of 0.013.

In our study complete sensory block was significant in both groups with the p value of 0.013, with better complete sensory block for infraclavicular group (91.7%) than supraclavicular group(76.7%).One previous study also state that significant difference between supraclavicular and infraclavicular groups for complete sensory block. The study conducted previously was support the results of our study[37,40].

In our study complete motor block was higher with infraclavicular group(88.3%) than supraclavicular group (75%) with the significant 'p' value of 0.018 . The study conducted previously was support the results of our study[37.]

Another one study also favour our study by stating that complete motor block is higher with infraclavicular group than supraclavicular group [40].

In our study effective upper limb block was defined , as a complete sensory block (score 2 in all four nerve territories) and complete motor block (score 2 in all three joints motor components).

Our study shows effective upper limb block was better in infraclavicular group(88.3%) than supraclavicular group(68.3%) with the significant 'p' value 0f 0.009. The results obtained in our study were analogues to the previous study [37.]

In our study surgical block was defined as a sensory score of 2 (anaesthesia) or sensory score of 1 (analgesia) in all four nerve territories after 30 minutes of block irrespective of the motor block. In our study no significant difference occurred between the two groups for surgical block with 100% success in both groups. One previous study supports the similar results of success rate in our study [37].

Out of 60 patients in supraclavicular group 18 patients were supplemented with Injection Midazolam 0.25mg/kg and Injection. Fentanyl 1mcg/kg intraoperatively. Four patients were supplemented with Injection.Midazolam 0.25mg, kg intraoperatively.

In infraclavicular group out of 60 patients 9 patients were supplemented with Injection Midazolam 0.25mg/kg and Injection Fentanyl 1mcg/kg intraoperatively. Seven patients were supplemented with Injection.Midazolam 0.25mg/kg intraoperatively.

Hence our study concludes that patients in infraclavicular group requires less intraoperative supplementation than supraclavicular group.

The block performance time taken by infraclavicular block is much more than supraclavicular block in our study, with the mean time of 416.48 seconds for supraclavicular group and 894.92 seconds for infraclavicular group. This may be due to the fact that difficulty to reach the posterior cord which is deeply placed in position. And also the medial cord which placed in between the axillary artery and the axillary vein.

Accidental vessel puncture is seen in 7 patients of supraclavicular group (11.7%),and 22 patients in infraclavicular group (36.7%) . This may be due to the fact that accidental puncture of the axillary artery was occur,when approach the posterior cord which was deeply placed posterior to the axillary artery. Also the accidental puncture of either axillary artery or axillary vein were occur, when approach the medial cord which was placed in between the axillary artery and the axillary vein.

In our study no patients in both the groups were observed for pneumothorax and Horner's syndrome. The result obtained in our study were analogues to the previous study [37].

CONCLUSION

Ultrasound guided peripheral nerve blocks have a higher rate of success for achieving surgical anaesthesia. Our study showed 100% success rate for both the groups in view of surgical anaesthesia. Inspite of taking longer time for block performance and higher incidence of accidental vessel puncture, infraclavicular group is better than the supraclavicular group, for complete sensory, complete motor and effective surgical block .Because the sensory block in ulnar nerve distribution and motor block at the hand grip level were better with infraclaviclar group. Other than accidental vessel puncture in infraclavicular groups, complications like Horner's syndrome and pneumothorax were not observed in both the groups.

SUMMARY

Introduction:

Surgical procedures involving hand and forearm can be performed either with general anaesthesia or regional anaesthesia techniques. The benefits of performing a surgery under regional anaesthesia far outweighs the risks of general anaesthesia. Brachial plexus block has stood the test of time for upperlimb surgeries.

Initially brachial plexus block was done through interscalene, supraclavicular and axillary approaches. Infraclaviclar block has developed recent times. Initially nerve block was performed with parasthesia technique followed by nerve stimulator technique. Since the introduction of ultrasound into clinical practice, it has become a valuable adjuvant for peripheral nerve blocks. Initially used in conjunction with nerve stimulation, ultrasound guidance has increasingly been used as the sole to localize and anaesthetize the brachial plexus.

Objectives:

We aimed to determine the success of upper limb block based on number of patients reaching 1) sensory block at radial, median, ulnar

and musculocutaneous nerve distribution, 2) motor block at elbow, wrist and hand grip level, 3) complete sensory block, 4) complete motor block, 5) effective upper limb block, 6) surgical block among the two groups. Also to assess the block performance time and adverse events like accidental vessel puncture, Horner's syndrome and pneumothorax.

Materials and methods:

We recruited 120 patients in this study after obtaining institutional ethical committee approval. These patients were aged between 18-50 years, and belonged to ASA class I or II. They were randomly allocated into two groups. Group-S-patient received ultrasound guided supraclavicular block and Group-I –patient received ultrasound guided infraclavicular block. The patients were evaluated for the 1) sensory block at radial, median, ulnar and musculocutaneous nerve distribution using a three point scale. (anaesthesia -score 2 –no pain, no touch sensation, analgesia - score 1 –no pain, pain - score 0 – feels pain). 2) motor block at the level of elbow, wrist and hand grip level using a three point scale.(paralysis -score 2 –no contraction, paresis – score 1 –reduced contraction, no weakness score 0 –normal contraction). 3) complete sensory block in all four nerve territories. 4) complete motor

block in all three joints motor components. 5)effective upper limb block 6) surgical block.

The block performance time was also noted. And the patients were observed for the adverse events like a) accidental vessel puncture ,b) Horner's syndrome, and c) pneumothorax. The results were tabulated and analysed using the SPSS software version 16.

Results:

The two groups were comparable in terms of age, sex, and weight distribution with the 'p' value of 0.105 for age,0.136 for sex and 0.077 for weight. Other demographic parameters such as duration of surgery and surgical area distribution also comparable with the 'p' value of 0.0931 and 0.593

No difference were observed between the two groups in terms of sensory block in the areas distributed by radial, median and musculocutaneous nerve with the 'p' values of 1.000,0.315 and 1.000. The I –Group patients had a significantly better block in the ulnar nerve distribution than the S-Group patients with the 'p' value of 0.013.For motor block no significant results were observed between the two groups at elbow and wrist level with the 'p' value of 1.00 and

0.648.The S-Group patients were poor motor block at hand grip level than I-Group patients with the 'p' value of 0.013.Complete sensory block is superior in the I-Group : 91.7% vs 76.7% in the S-Group with the 'p' value of 0.013.Complete motor block is also superior in the I-Group: 88.3% vs 75% in the S-Group with the 'p' value of 0.018. Effective upperlimb block is inferior in the S-Group (68.3%) compared with I-Group (88.3%) with the 'p' value of 0.009.No difference were observed between the two groups for surgical block with the 'p' value of 1.000. Compared with the S-Group, the I-Group had a longer block performance time (416.48 seconds [SD-20.550] vs 894.92 [SD-57.063] with the 'p' value of 0.000. The I-Group resulted in a higher rate of accidental vessel puncture (36.7 % vs 11.7 %) than the S-Group with the 'p' value of 0.001.No difference were observed for the adverse events like Horner's syndrome and pneumothorax with the 'p' value of 1.000 for both the events.

Conclusion:

Ultrasound guided peripheral nerve block have a higher rate of success for achieving surgical anaesthesia. Our study showed 100% success rate for both the groups in view of surgical aneathesia. Inspite of taking longer time for block performance and higher incidence of

accidental vessel puncture, infraclavicular group is better than the supraclavicular group, for complete sensory ,complete motor and effective surgical block. Other than accidental vessel puncture in infraclaviclar group , complications like Horner's syndrome and pneumothorax were not observed in both the groups.

KEY WORDS:

Supraclavicular block, Infraclavicular block, Brachial plexus, Ultrasonogram.

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PROFORMA

Name: Age/Sex: IP no:

Date: Wt: Blood Group:

Diagnosis:

Surgery:

Brief History:

Coexisting Illness:

Examination:

PR: BP: RR: RS: CVS: AIRWAY:

Anesthesia Details:

Group:

Duration of surgery:

Sensory Block	S-Group	I-Group
Radial Nerve		
10 min		
20 min		
30 min		
Median Nerve		
10 min		
20 min		
30 min		

Ulnar Nerve		
10 min		
20 min		
30 min		
Musculocutaneous Nerve		
10 min		
20 min		
30 min		
Motor Block at 30 min	S-Group	I-Group
Elbow-0		
1		
2		
Wrist-0		
1		
2		
Hand Grip-0		
1		
2		

Block Performance Time:

Need for supplementation/GA:

Complications:

Horner's syndrome:

Vessel Puncture:

Pneumothorax:

INTRA OP MONITORING:

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

INSTITUTIONAL ETHICAL COMMITTEE, STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work : A Comparison of Ultrasound-guided supraclavicular and infraclavicular blocks for forearm and hand Surgeries

Principal Investigator : Dr. P Vijaya Ananth

Designation : PG in MD (Anaesthesiology)

Department : Department of Anaesthesiology
Government Stanley Medical College,
Chennai-01

The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 02.07.2014 at the Council Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

1. You should inform the IEC in case of changes in study procedure, site investigator investigation or guide or any other changes.
2. You should not deviate from the area of the work for which you applied for ethical clearance.
3. You should inform the IEC immediately, in case of any adverse events or serious adverse reaction.
4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any extension of time is required, you should apply for permission again and do the work.
6. You should submit the summary of the work to the ethical committee on completion of the work.

K Vasantha

MEMBER SECRETARY,
IEC, SMC, CHENNAI

PATIENT INFORMATION SHEET

1. We are conducting a study on "A COMPARISION OF ULTRASOUND GUIDED SUPRACLAVICULAR AND INFRACLAVICULAR BLOCKS FOR FOREARM AND HAND SURGERIES, Stanley Medical College & Hospital, Chennai and for that you may be valuable to us.

2. We are selecting certain patients and if you are found eligible, we may be using you to perform procedures which will not harm you.

3. The privacy of the patients in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

4. Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time; your decision will not result in any loss of benefits to which you are otherwise entitled.

Date:

Signature of investigator Signature of participant

நோயாளியின் தகவல் தாள்

கை மற்றும் முழங்கையில் அறுவை சிகிச்சை செய்து கொள்ளும் போது, அறுவை சிகிச்சையின் போது ஏற்படும் வலியை குறைப்பதற்கு அல்ட்ரா சோனோகிராம் கருவி உதவிகொண்டு கழுத்து எலும்பிற்கு (கிளாவிக்கிள்) மேல் மற்றும் கீழ் பகுதியில் உள்ள நரம்புதிட்டுகளை பார்த்து அதன்மீது மருந்தை செலுத்தி செயலிழக்க செய்வதன் மூலம் ஏற்படும் விளைவுகள் பற்றிய ஆய்வு

ஆராய்ச்சியின் நோக்கமும், ஆதாரங்களும்

அறுவை சிகிச்சை செய்வதற்கு மயக்க மருந்து மிகவும் அவசியமானது அவ்வாறான மயக்க மருந்துகளும் மயக்க முறைகளும் பலவகை உண்டு கை மற்றும் முழங்கையில் அறுவை சிசிச்சை செய்வதற்காக அல்ட்ராசோனோகிராம் உதவிகொண்டு கழுத்து எலும்புக்கு மேல் மற்றும் கீழ் பகுதியில் உள்ள நரம்புதிட்டுகளை (பிரேக்கியல் பிளக்ஸஸ்) பார்த்து அதன்மீது மயக்க மருந்து கொடுக்கப்பட்டால் மயக்க மருந்தின் பயன்பாடு நன்றாக இருக்கும் மற்றும் பக்கவிளைவுகளும் குறைவாக இருக்கும் இதன் முக்கியத்துவத்தை உணர்த்தவே இந்த ஆய்வு மேற்கொள்ளப்படுகிறது.

ஆய்வுமுறை

நீங்கள் இரு குழுக்களாகப் பிரிக்கப்படுவீர்கள் ஒரு குழுவிற்கு கை மற்றும் முழங்கையில் அறுவை சிகிச்சை செய்வதற்காக கழுத்து எலும்புக்கு மேல் உள்ள நரம்புத்திட்டையும் இன்னொரு குழுவிற்கு கழுத்து எலும்புக்கு கீழ் உள்ள நரம்புதிட்டையும் அல்ட்ராசோனோகிராம் உதவிகொண்டு பார்த்து அதன்மீது

புபிவகைன் மற்றும் அட்ரினலின் கலந்த லிக்னோகைன் மயக்க மருந்து கலவை கொடுக்கப்படும். அத்தருணத்திலிருந்து 10, 20, 30 வது நிமிடங்களில் ரேடியல், மீடியன், அல்நார், மஸ்குலோகுட்டேனியஸ் நரம்புகளின் இடங்களில் கை மற்றும் முழங்கையில் தொடு உணர்வு, கை மற்றம் முழங்கை அசைவை கண்காணிக்கப்பட்டு அறுவை சிகிச்சை மேற்கொள்ளப்படும்.

மேலும் மயக்க மருந்து செலுத்தப்பட்டதிலிருந்து 24 மணி நேரத்திற்கு ஏதேனும் பக்கவிளைவுகள் ஏற்பட்டதா என்றும் கண்காணிக்கப்படும்.

<u>உண்டாகக்கூடிய இடர்கள்</u>

இந்த ஆய்வின் பொழுது பயன்படுத்தப்படும் புபிவகைன் மற்றும் லிக்னோகைன் மருந்தினால் இதயதுடிப்பு மற்றும் இரத்த அழுத்தத்தில் மாற்றங்கள் ஏற்படவோ மற்றும் காக்கா வலிப்பு ஏற்படவோ வாய்ப்புகள் உண்டு.

மேலும் நுரையீரலை சுற்றியுள்ள சவ்வில் ஓட்டைவிழுந்து நீமோதொராக்ஸ் ஏற்படும் வாய்ப்பும் உண்டு.

மேலும் அதனை ஒட்டியுள்ள வேறு நரம்புதிட்டுகள் பாதிக்கப்பட்டு கார்னர்ஸ் சிண்டரோம் ஏற்படும் வாய்ப்பும் உள்ளது.

<u>ஆய்வில் உள்ள உரிமைகள்</u>

உங்கள் மருத்துவ பதிவேடுகள் அந்தரங்கமாக வைத்துக்கொள்ளபடும். இந்த ஆயிவின் முடிவுகள் மருத்துவ இதழ்களில் வெளியிடப்படலாம் ஆனால் உங்கள் பெயர் அடையாளம் காட்டப்படமாட்டாது இந்த ஆய்வில் பங்கேற்பது தன்னிச்சையானது மற்றும் வேறு காரணங்களால் நீங்கள் எதுவும்

கூறாமலேயே எப்பொழுது வேண்டுமென்றாலும் விலகிக்கொள்ளலாம் ஏதேனும் பக்கவிளைவுகள் ஏற்பட்டால் முழு சிகிச்சையும் மருத்துவ குழுவினரால் உடனடியாக வழங்கப்படும்

நோயாளியின் கையொப்பம்

(இடது பெருவிரல் ரேகை)

தேதி

மருத்துவரால் தெளிவாக
படித்துக் காட்டப்பட்டது

INFORMED CONSENT FORM

சுய ஒப்புதல் படிவம்

கை மற்றும் முழங்கையில் அறுவை சிகிச்சை செய்து கொள்ளும் போது, அறுவை சிகிச்சையின் போது ஏற்படும் வலியை குறைப்பதற்கு அல்ட்ரா சோனோகிராம் கருவி உதவிகொண்டு கழுத்து எலும்பிற்கு (கிளாவிக்கிள்) மேல் மற்றும் கீழ் பகுதியில் உள்ள நரம்புதிட்டுகளை பார்த்து அதன்மீது மருந்தை செலுத்தி செயலிழக்க செய்வதன் மூலம் ஏற்படும் விளைவுகள் பற்றிய ஆய்வு

ஆய்வாளர் : மரு. P. விஜய ஆனந்த
முதுநிலை பட்ட மேற்படிப்பு மாணவர்
மயக்கவியல் துறை
ஸ்டான்லி மருத்துவ கல்லூரி - சென்னை

வழிகாட்டி : பேராசிரியர் மரு. S. பொன்னம்பல நமசிவாயம்
M.D, D.A, DNB
மயக்கவியல் துறை
ஸ்டான்லி மருத்துவ கல்லூரி - சென்னை

பெயர் : வயது: உள்ளிருப்பு எண்:

இந்த மருத்துவ ஆய்வின் விவரங்கள் எனக்கு விளக்கப்பட்டது என்னுடைய சந்தேகங்களை தீர்க்கவும் அதற்கான தகுந்த விளக்கங்களை பெறவும் வாய்ப்பளிக்கப்பட்டது.

நான் இவ்வாய்வில் தன்னிச்சையாகத்தான் பங்கேற்கிறேன். எந்த காரணத்தினாலும் எந்த கட்டத்திலும் எந்த சட்டசிக்கலும் இன்றி இந்த ஆய்விலிருந்து விலகிக் கொள்ளலாம் என்றும் அறிந்து கொண்டேன்

நான் ஆய்விலிருந்து விலகிகொண்டாலும் ஆய்வாளர் என்னுடைய மருத்துவ அறிக்கைகளை பார்ப்பதற்கோ அல்லது உபயோகிக்கவோ என் அனுமதி தேவையில்லை எனவும் அறிந்து கொண்டேன். என்னை பற்றிய தகவல்கள் ரகசியாமாக பாதுகாக்கப்படும் என்பதையும் அறிவேன்.

இந்த ஆய்வின் மூலம் கிடைக்கும் தகவல்களையும் பரிசோதனை முடிவுகளையும் ஆய்வாளர் அவர் விருப்பத்திற்கேற்ப பயன்படுத்திக் கொள்ளவும் அதனை பிரசுரிக்கவும் முழுமனதுடன் சம்மதிக்கிறேன்.

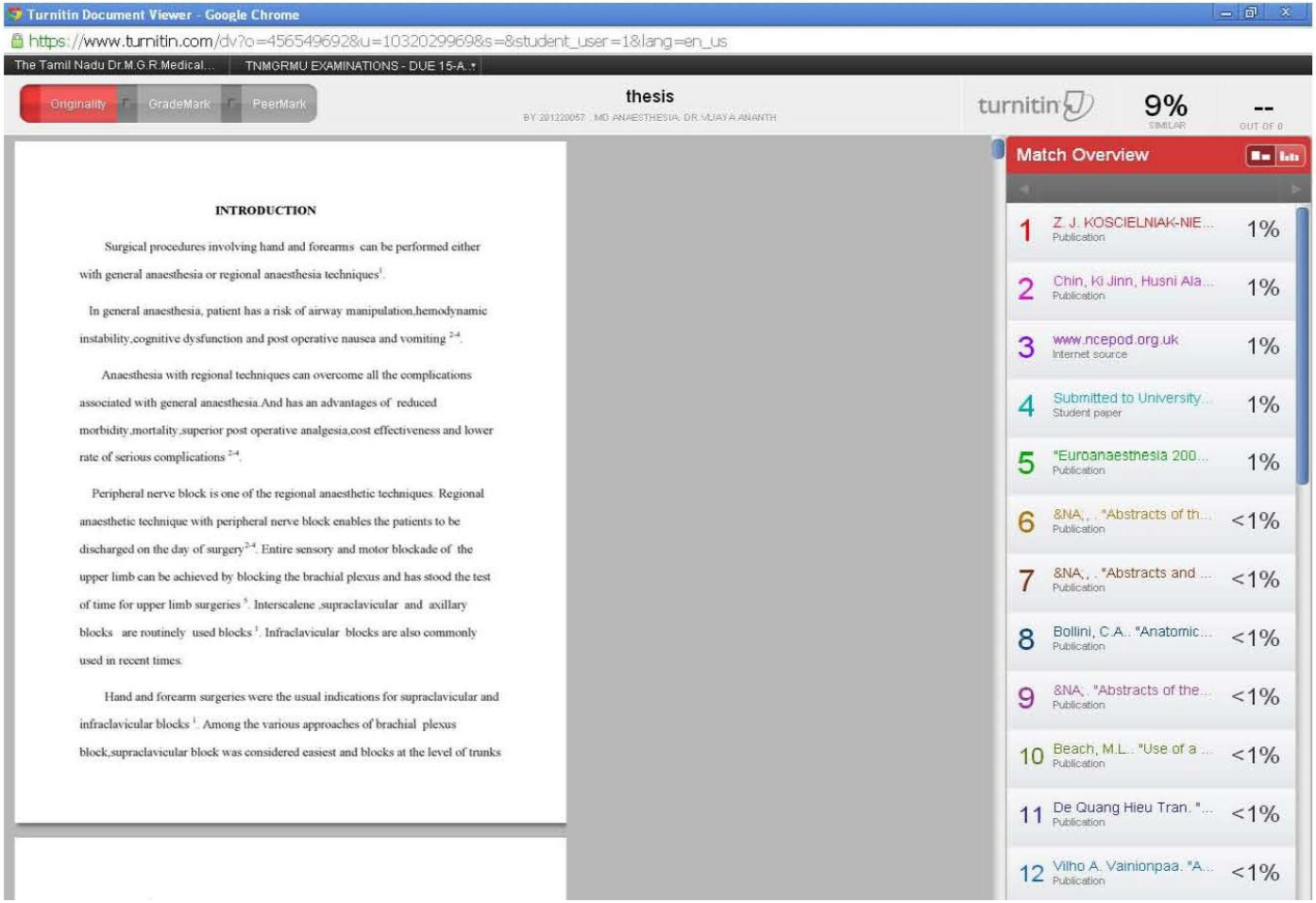
இந்த ஆய்வில் பங்கு கொள்ள ஒப்புக்கொள்கிறேன் எனக்கு கொடுக்கப்பட்டுள்ள அறிவுரைகளின்படி நடந்து கொள்வதுடன் ஆய்வாளருக்கு உண்மையுடன் இருப்பேன். என்றும் உறுதி அளிக்கிறேன்.

உடல்நலம் பாதிக்கப்பட்டாலோ வழக்கத்திற்கு மாறான ஏதேனும் நோய்குறி தென்பட்டாலோ அதனை தெரிவிப்பேன் என்றும் உறுதி கூறுகிறேன்.

இந்த ஆய்வில் எனக்கு எவ்விதமான பரிசோதனைகளையும் சிகிச்சை களையும் மேற்கொள்ள நான் முழுமனதுடன் சம்மதிக்கிறேன்.

இப்படிக்கு,

ஆய்வாளரின் கையொப்பம் நோயாளியின் கையொப்பம்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INTRODUCTION
Surgical procedures involving hand and forearms can be performed either with general anaesthesia or regional anaesthesia techniques[1].
In general anaesthesia, patient has a risk of airway manipulation,hemodynamic instability,cognitive dysfunction and post operative nausea and vomiting [2-4].
Anaesthesia with regional techniques can overcome all the complications associated with general anaesthesia.And has an advantages of reduced morbidity,mortality,superior post operative analgesia,cost effectiveness and lower rate of serious complications [2-4].
Peripheral nerve block is one of the regional anaesthetic techniques. Regional anaesthetic technique with peripheral nerve block enables the patients to be discharged on the day of surgery[2-4]. Entire sensory and motor blockade of the upper limb can be achieved by blocking the brachial plexus and has stood the test of time for upper limb surgeries [5]. Interscalene ,supraclavicular and axillary blocks are routinely used blocks [1]. Infraclavicular blocks are also commonly used in recent times.
Hand and forearm surgeries were the usual indications for supraclavicular and infraclavicular blocks [1]. Among the various approaches of brachial plexus block,supraclavicular block was considered easiest and blocks at the level of trunks
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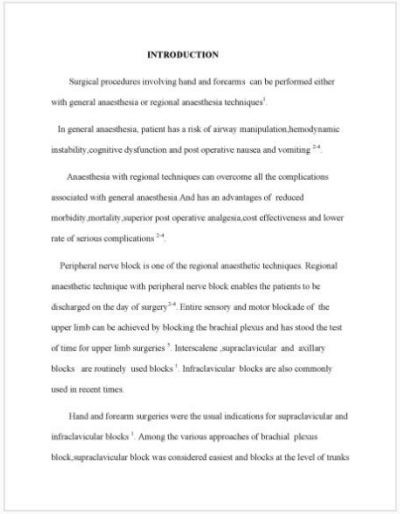

INTRODUCTION

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MASTER CHART

									Motor Block Score After 30 mts			Sensory Block Score After 30 mts					Complications		
Sl.No	Group	Name	Age	Sex	IpNo	Weight	Diagnosis	Surgery	Duration of surgery (Mins)	Elbow	Wrist	HandGrip	RadialNerve	MedianNerve	UlmarNerve	Musculocutaneous N	Block Performance Time (sec)	PneumoThorax	Vessel Puncture	Horners Syndrome
1	S	Selvakumar	34	M	331575	67	Ptra rt FA	Debridement	40	2	2	1	2	2	2	2	420	nil	nil	nil
2	S	Mugesh	23	M	343882	67	Ptra R FA	Division	35	2	2	2	2	2	2	2	432	nil	nil	nil
3	I	Murugan	34	M	342210	63	Ptra L hand	Flap cover	140	2	2	2	2	2	2	2	723	nil	yes	nil
4	S	Balaji	22	M	343191	54	Pbsc Lt Hand	Release and Ssg	60	2	2	2	2	2	2	2	435	nil	nil	nil
5	I	Gnanasekar	42	M	342976	63	PTRA L Hand	Abdominal flap	180	2	2	2	2	2	2	2	845	nil	nil	nil

6	I	Harish	19	M	342687	62	Pts&gangrene	Shortening&closure	35	2	2	2	2	2	2	2	828	nil	nil	nil
7	S	Adhiyaman	43	M	343340	59	Pts Rt Hand	Orif	180	2	2	2	2	2	2	2	412	nil	nil	nil
8	S	Venkateswari	30	F	343822	63	Ptra Rt Hand	Abdominal flap	180	2	2	2	2	2	2	2	414	nil	nil	nil
9	I	Thivendrakumar	43	M	342487	59	GangerneLlitle finger	Debridement	40	2	2	2	2	2	2	2	842	nil	nil	nil
10	I	Babu	27	M	342562	62	Ptra rt hand	Flap cover	170	2	2	2	2	2	2	2	932	nil	yes	nil
11	I	Sakthi	37	M	341911	47	Rt FA lipoma	Excision	35	2	2	2	2	2	2	2	913	nil	nil	nil
12	I	Adithya	23	M	337662	63	PTS Rmid finger	Fdp reconstrction	45	2	2	2	2	2	2	2	921	nil	yes	nil
13	S	PremKumar	35	M	344484	68	Pts L Hand	Sec Suturing	30	2	2	2	2	2	1	2	450	nil	yes	nil
14	S	Priya	28	F	344574	64	Pts Lt Hand	Exploration	120	2	2	2	2	2	2	2	396	nil	nil	nil
15	I	Ganesan	29	M	338520	56	Hyperopicscar l hand	Scar excision	40	2	2	1	2	2	2	2	897	nil	yes	nil
16	S	Ramu	35	M	344296	61	Pbsc L hand	Release and ssg	90	2	2	2	2	2	2	2	423	nil	nil	nil
17	I	Kaviya	21	F	70459	48	Ptra R hand	Debridement	50	2	2	2	2	2	2	2	934	nil	nil	nil
18	S	Jesim	19	M	332325	57	Pts Lt Hand	Ulnar Bone Graft	110	2	2	2	2	2	2	2	418	nil	nil	nil
19	I	Prabu	24	M	334478	62	Contrature rt mid	Release	55	2	2	2	2	2	2	2	897	nil	nil	nil
20	I	Mageswari	27	F	342623	67	Ptra rt hand	Groin flap	185	2	2	2	2	2	1	2	935	nil	nil	nil
21	I	Pavithra	26	F	342987	48	Post trau gangrene	Nibbling closure	35	2	2	2	2	2	2	2	885	nil	nil	nil
22	S	Jeyaish	34	M	70580	64	Tumour R hand	Excision	30	2	2	2	2	2	2	2	427	nil	nil	nil
23	S	Kumar	50	M	343775	67	Post Groin flap status	Division and Inset	40	2	2	1	2	2	1	2	426	nil	nil	nil
24	I	Paivendan	21	M	342039	67	Pts lt index	Shortening	40	2	2	2	2	2	2	2	924	nil	yes	nil

25	I	Sadiq basha	22	M	342150	57	Ptra rt fa	Ssg	55	2	2	2	2	2	2	2	923	nil	nil	nil
26	S	Saroja	48	F	343662	56	Rt Wrist gangion	Excision	32	2	2	2	2	2	2	2	404	nil	nil	nil
27	S	Siva	21	M	343993	57	Pts rt mid	Cont release	43	2	2	2	2	2	2	2	398	nil	nil	nil
28	I	Saravanan	28	M	342913	54	Ptra rt forearm	Flap cover	170	2	2	2	2	2	2	2	897	nil	nil	nil
29	S	Runakaran	32	M	337805	68	Ptra R hand	Flap cover	160	2	2	2	2	2	2	2	413	nil	nil	nil
30	S	Vijay	18	M	344284	58	Ptra Rt Hand	Debridement	36	2	2	2	2	2	2	2	406	nil	nil	nil
31	I	Roopavathy	31	F	333538	52	Ptra rt hand	Debridement	40	2	2	2	2	2	2	2	967	nil	yes	nil
32	I	Hitesh	29	M	302470	65	PBSC Lhand	Release	38	2	2	2	2	2	2	2	895	nil	yes	nil
33	S	Madhavi	34	F	334571	71	Ptra R hand	Debridement	40	2	2	1	2	2	1	2	408	nil	nil	nil
34	I	Tharun	28	M	341840	62	ORIF insitu	Removal	30	2	2	2	2	2	2	2	978	nil	nil	nil
35	S	Sachin Kumar	29	M	339285	58	Pta L hand	Flap cover	145	2	2	2	2	2	2	2	421	nil	yes	nil
36	S	Sankari	23	F	342690	58	Ptra rt hand	Groin flap	160	2	2	2	2	2	2	2	399	nil	nil	nil
37	S	Mani	37	M	302600	58	Pbsc lt hand	Release/ssg	90	2	2	2	2	2	2	2	432	nil	nil	nil
38	I	Santhosh	26	M	338609	61	Post cont	Ssg	50	2	1	2	2	2	2	2	789	nil	nil	nil
39	I	Shathanu	27	M	324283	58	Ptra lt hand	Groin flap	174	2	2	2	2	2	2	2	932	nil	nil	nil
40	S	Soundarya	33	F	342536	46	Pbsc rt mid	Cont release/ssg	110	2	2	2	2	2	2	2	396	nil	nil	nil
41	S	Narayanan	31	M	342716	68	Ptra Rt Hand	Flap cover Ssg	165	2	2	2	2	1	1	2	458	nil	yes	nil
42	I	Pavithra	25	F	342944	66	Ptra rt hand	Debridement/gr flap	160	1	2	2	1	2	2	2	987	nil	yes	nil
43	S	Tulasi Mani	37	M	342671	49	S/p GroinFlap	Division/Inset	40	2	2	2	2	2	2	2	412	nil	nil	nil
44	I	Seguta	26	M	66882	52	Post flap status	Flap thinning	40	2	2	2	2	2	2	2	834	nil	nil	nil
45	I	Mruganathan	29	M	331412	62	Con lt hand	Release	40	2	2	2	2	2	2	2	879	nil	nil	nil
46	S	Anand	19	M	342819	63	Pts rtf a/hand	exploration	123	2	1	1	2	2	2	2	439	nil	nil	nil

47	I	Gnanasekar	19	M	342742	49	Ptra rt hand	Debridet/skin cover	55	2	2	2	2	2	2	2	945	nil	yes	nil
48	S	Sham	22	M	391113	56	Pbsc little/mid	Release	35	2	2	2	2	2	2	2	423	nil	nil	nil
49	S	Samson	23	M	343209	58	Gangrene little finger	Shortening Closure	42	2	2	2	2	2	2	2	412	nil	nil	nil
50	S	Ashwin	18	M	342624	69	Syndactyly	Release	46	2	2	2	2	2	1	2	390	nil	nil	nil
51	I	Monoj kmar	18	M	23904	51	Ptra rt forearm	Flap cover	160	2	2	2	2	2	2	2	948	nil	nil	nil
52	I	Sivarajan	19	M	342356	56	Ptra rt hand	Flap cover	164	2	2	2	2	2	2	2	897	nil	yes	nil
53	S	Silambarasan	24	M	341797	62	Ptra L hand	Exploration	114	2	2	1	2	2	2	2	418	nil	nil	nil
54	I	Viveksurya	29	M	342545	53	L wristganglion	Excision	30	2	2	2	2	2	2	2	939	nil	nil	nil
55	I	Shanmgam	39	M	342927	54	Ptra lt hand	debridement	175	2	2	2	2	2	2	2	878	nil	yes	nil
56	I	Ponnsamy	37	M	29926	58	Rt hand cont	Release/cff	50	2	2	2	2	2	2	2	965	nil	nil	nil
57	I	Rajaguru	26	M	339520	54	Con lt ind	Flap cover	172	2	2	2	2	2	2	2	947	nil	yes	nil
58	S	Haritha	43	F	340002	51	Pts R Hand	Orif 5 mc	64	2	2	2	2	2	2	2	389	nil	nil	nil
59	I	Arumugam	20	M	339814	45	Post flap stats	Thnning	35	2	2	2	2	2	2	2	912	nil	nil	nil
60	I	Selvakmar	28	M	343853	49	Pbsc lateral FA	Excision/ssg	55	2	2	2	2	2	2	2	934	nil	nil	nil
61	S	Subhashini	28	F	342095	47	Pbsc R wrist	Release/z plasty	72	2	2	2	2	2	2	2	464	nil	nil	nil
62.	S	Kumar	25	M	342835	56	Ring Avulson injury	Tubed Groin flap	142	2	2	2	2	2	2	2	396	nil	nil	nil
63	I	Vicky	20	M	344485	50	PBSC lt hand/fa	Release/ssg	50	2	2	2	2	2	2	2	918	nil	nl	nil
64	S	Ragu	18	M	336309	49	Pts lt fa/hand	debridement	43	2	2	2	2	2	2	2	465	nil	nil	nil
65	I	Neela	18	F	319145	46	Pts hand ind	capsulotomy	30	2	2	2	2	2	2	2	934	nil	nil	nil
66	I	Selvi	19	F	330126	49	Scar wrist	Release	35	2	2	2	2	2	2	2	894	nil	nil	nil

67	I	Jeyanthi	28	F	336307	41	PBSC lt hand	Cont release	40	2	2	2	2	2	2	2	914	nil	nil	nil
68.	S	Loganathan	50	M	336745	64	Groin Flap done	Flap Thinning	46	2	2	2	2	2	2	2	432	nil	yes	nil
69	S	Pushpa	35	F	338386	49	Pts R little	Exploration	134	2	2	2	2	2	2	2	398	nil	nil	nil
70	I	Jeevatharani	39	F	344553	53	PBSC lt hand	Shortening closre	40	2	2	2	2	2	2	2	798	nil	nil	nil
71	I	Priya	29	F	342766	49	Ptra rt hand	debrdement	40	2	2	2	2	2	2	2	943	nil	nil	nil
72	S	Suresh	34	M	342773	65	Ptra lt fa/hand	debridement	40	2	2	1	2	2	1	2	388	nil	nil	nil
73	S	Kothandan	34	M	342404	62	Ptra R Hand	Ssg	52	2	2	2	2	2	2	2	413	nil	nil	nil
74	S	Sharmila	25	F	342843	49	Gangerene R little	Ssg	40	2	2	2	2	2	2	2	389	nil	nil	nil
75	I	Murugan	42	M	343621	61	Post flap status	Thinning	35	1	2	2	2	2	2	2	895	nil	nil	nil
76	S	Murugan	38	M	342210	63	Ptra L Hand	Debridement	46	2	2	2	2	2	2	2	422	nil	nil	nil
77	I	Balaguru	28	M	344468	63	Ptra R hand	Abd flap	170	2	2	2	2	2	2	2	917	nil	nil	nil
78	S	Sangeshwaran	30	M	342514	58	Ptra R Hand	Groin Flap	174	2	2	1	2	2	1	2	431	nil	nil	nil
79	I	Sherin	27	M	344595	56	Trigger thump	Release	35	2	2	2	2	2	2	2	949	nil	yes	nil
80	I	Vijayalakshmi	21	F	344724	62	Ptra L FA	Flap cover	170	2	2	2	1	2	2	2	978	nil	yes	nil
81	I	Rishab	24	M	344231	49	R wrist ganglion	Exicision	35	2	2	2	2	2	2	2	876	nil	nil	nil
82	S	Suresh	30	M	342667	62	Ptra R Hand	Ssg	45	1	2	2	1	2	2	2	436	nil	nil	nil
83	S	Sundar Raj	52	M	342497	54	Ptra R Hand	Flap conver	170	2	2	2	2	2	2	2	387	nil	nil	nil
84	I	Thirumalaivasan	19	M	344166	49	Ptra L hand	Flap cover	150	2	1	2	2	2	2	2	911	nil	nil	nil
85	S	Mari	31	M	342543	51	Ptra L Hand	Deb/ssg	55	2	1	2	2	2	2	2	431	nil	nil	nil

86	S	Hitesh	41	M	302470	57	Cont Ind/Mid L Hand	Release	40	2	2	1	2	2	1	2	412	nil	nil	nil
87	I	Manimegalai	37	F	344702	56	PBSC rt hand	Release /ssg	40	2	2	2	2	2	2	2	897	nil	nil	nil
88	S	Jai	38	M	342708	64	Duplication ofThumb	Excision	35	2	2	2	2	2	2	2	389	nil	nil	nil
89	I	Selvam	28	M	344757	58	Ptra rt hand	Groin flap	170	2	2	2	2	2	2	2	953	nil	yes	nil
90	S	Sadio Basha	43	M	342150	61	Groin flap Done	Division/Inset	35	2	2	2	2	2	2	2	452	nil	yes	nil
91	S	Kumar	25	M	342835	67	Crush L lit finger	deb with Ssg	55	2	2	2	2	2	2	2	396	nil	nil	nil
92	I	Parthasarathy	50	M	344205	63	Lipoma lt FA	Excision	30	2	2	2	2	2	2	2	813	nil	nil	nil
93	S	VijayaKumar	35	M	342747	73	Ptra R arm/fa	Tup flap	130	2	1	2	1	2	2	2	423	nil	nil	nil
94	S	VibhuRaj	19	M	342373	56	Gct L little	Excision Bone Graft	55	2	2	2	2	2	2	2	444	nil	nil	nil
95	S	Vijayalakshmi	48	F	342515	51	Ptra L mid	Groin flap	180	2	2	2	2	2	2	2	408	nil	nil	nil
96	I	Thamayanthi	48	F	70559	54	Ptra L hand	Flap cover	160	2	2	2	2	2	2	2	913	nil	yes	nil
97	S	Shankar	23	M	342690	64	Ptra R Hand	Flap cover	165	2	2	2	2	2	2	2	402	nil	nil	nil
98	I	Arjun	18	M	344070	53	Ptra L hand	debridement	30	2	2	2	2	2	2	2	892	nil	nil	nil
99	S	Veeramani	22	M	331028	61	Pt Surg Synd R Hand	Syndactyly Release	35	1	2	1	2	2	1	2	387	nil	nil	nil
100	I	Balu	19	M	344178	49	Ptra R hand	Flap cover	150	2	2	2	2	2	2	2	924	nil	yes	nil
101	S	Selva	30	M	341875	65	Pts R fa	Exploration	120	2	2	2	2	2	2	2	424	nil	yes	nil
102	S	Balamurugan	30	M	338011	56	Abdominal flap	Division	40	2	2	2	2	2	2	2	389	nil	nil	nil
103	S	Sundari	45	F	342747	52	Ptra R Hand	Ssg	70	2	2	1	2	2	1	2	453	nil	nil	nil
104	I	Elumalai	43	M	344305	63	Pbsc L hand	Release	30	2	2	2	2	2	2	2	762	nil	nil	nil

105	I	Mohanavalu	37	M	339165	62	Ptra Lt hand	debridement	32	2	2	2	2	2	2	2	789	nil	nil	nil
106	S	Laxmi	31	F	342373	46	Ptra rtf a/hand	Ssg	65	2	2	1	2	2	2	2	434	nil	nil	nil
107	S	Santhanu	19	M	342833	57	Ptra L Hand	release/Ssg	90	2	2	2	2	2	2	2	398	nil	nil	nil
108	I	Thirumalai	45	M	344168	57	Ptra L hand	debridement	34	2	2	2	2	2	2	2	794	nil	nil	nil
109	S	SurendaraGiri	50	M	342713	54	PtraL Hand	Groin flap	160	2	2	1	2	2	1	2	416	nil	nil	nil
110	I	Madhankumar	23	M	37199	53	PiraL hand	Flap cover	170	2	2	2	2	2	2	2	867	nil	nil	nil
111	S	Haritha	24	F	340002	43	Pts Hand	Orif	35	2	2	2	2	2	2	2	398	nil	nil	nil
112	I	Priyanka	28	F	315257	65	Orif insitu	K wire removal	30	2	2	1	2	2	1	2	934	nil	yes	nil
113	I	Saidhar	19	M	336205	49	Ptra L hand	Flap cover	140	2	2	2	2	2	2	2	867	nil	nil	nil
114	S	Ashwin	28	M	342624	69	syndactyly	Release	40	2	2	2	2	2	1	2	421	nil	yes	nil
115	I	Chandra	43	F	344211	56	PPX #	Orif	42	2	2	2	2	2	2	2	829	nil	nil	nil
116	S	Pavithra	23	F	342944	43	Ptra R Hand	Orif	50	2	2	2	2	2	2	2	394	nil	nil	nil
117	I	Sanker	28	M	340930	68	Pts lt ind	Flex ten reconstr	90	2	2	1	2	2	1	2	913	nil	yes	nil
118	S	Rajesh	25	M	342756	49	Groin flap done	Division	35	2	2	2	2	2	2	2	426	nil	nil	nil
119	I	Kamala	36	F	342372	52	Trigger finger	Release	40	2	2	2	2	2	2	2	796	nil	nil	nil
120	I	Palanisamy	32	M	342841	54	Trigger finger	Release	40	2	2	2	2	2	2	2	897	nil	yes	nil