CLINICAL OUTCOMES AFTER ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCKADE FOR UPPER LIMB SURGERIES AT MUHIMBILI ORTHOPAEDIC INSTITUTE

Getruda Frank Mwang'amba (MD)

Mmed (Anaesthesiology) Dissertation.
Muhimbili University of Health and Applied Sciences
October, 2017

Muhimbili University of Health and Allied Sciences

Department of Anesthesiology

CLINICAL OUTCOMES AFTER ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCKADE FOR UPPER LIMB SURGERIES AT MUHIMBILI ORTHOPAEDIC INSTITUTE

By

Getruda Mwang'amba (MD)

Dissertation submitted in (partial) fulfillment of the Requirement for the Degree of Master of Medicine (Anesthesiology) of Muhimbili University of Health and Allied Sciences

October, 2017

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance for examination by the Muhimbili University of Health and Allied Sciences a dissertation entitled: **"*Clinical Outcomes after Ultrasound Guided Supraclavicular Brachial Plexus Blockade for Upper Limb Surgeries at Muhimbili Orthopaedic Institute,*"** In (partial) fulfillment of the requirements for the degree of master of medicine in anaesthesiology of the Muhimbili University of Health and Allied Sciences**.**

.....

Dr. Frederick W. Mbanga

(Supervisor)

Date…….....

.....

Dr. Karima Khalid

(Supervisor)

Date……....

DECLARATION AND COPYRIGHT

I, **Dr. Getruda Mwang'amba**, declare that this **dissertation** is my own original work, and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature……..... Date …….....…

This dissertation is a copyright material protected under the Berne convention, the copyright Act 1966 and other international and national enactments, in that behalf on intellectual property. It may not be reproduced by any means, in full or in part, except for shorts extracts in fair dealing, for research or private study, critical scholarly review or discourse with an acknowledgement, without written permission of the Directorate of Postgraduate Studies, on behalf of both the author and the Muhimbili University of Health and Allied Sciences.

ACKNOWLEDGEMENT

I, am ever grateful to God. Thank you my father in heaven for everything during the accomplishment of this masters thesis. I can do everything through you who gives me strength.

I would like to express my sincere gratitude to my principal supervisor Dr. Frederic W. Mbanga, Consultant anaesthesiologist at Muhimbili Orthopaedic Institute (MOI) and Senior Lecturer in the Department of Anaesthesiology (MUHAS), and to my co supervisor Dr Karima Khalid, Anaesthesiologist and lecturer in the department of Anaesthesia (MUHAS) for continuous support and encouraging me to go ahead with this thesis, your guidance helped me all the time of this dissertation. Thank you so much.

Special thanks to Dr Albert Ulimali, Anaesthesiologist at Muhimbili Orthopaedic Institute, for teaching and supervising me during data collection. You made it possible for me to reach this far, may God bless you.

Sincere gratitude extended to all staff members of the department of Anaesthesiology at MUHAS.

Thanks to all patients who participated in this study, my research assistants and all the nurses in theatres and in the wards at MOI.

With most love, I thank my husband Waziri Kawasa and my children Juntwa, Jerry and Joan for understanding and tolerance during my busy academic schedule.

DEDICATION

To my loving husband Waziri Kawasa, my sons Juntwa and Jerry, and to my daughter Joan.

To my parents Subira and Frank, and to my young sisters Rahabu and Grace.

Abstract

Short background

Upper limb surgeries can be done with regional anaesthesia, general anaesthesia or combination of the two. Ultrasound guided regional anaesthesia has become a popular technique and has transformed Supraclavicular blocks into potentially safe superficial blocks. The improved safety and efficacy that ultrasound brings to regional anaesthesia has helped to promote its use and realize the benefits that regional anaesthesia has over general anaesthesia.

Broad objective

The objective of this study was to determine clinical outcomes after ultrasound guided supraclavicular brachial plexus blocks among patients who underwent upper limb surgeries at Muhimbili orthopaedic institute.

Aim of study.

Ultrasound guided blocks is a poorly researched area in our country. No research has been done in ultrasound guided supraclavicular brachial plexus block. This study was done for the purpose of understanding clinical outcomes after ultrasound guided supraclavicular brachial plexus blockade.

Methodology.

After local ethical committee approval and obtaining informed consent, a hospital based prospective observation cross-sectional study was done in 86 adult patients of both sexes aged 18 years and above who underwent upper limb surgeries under regional anaesthesia by ultrasound guided supraclavicular blocks.

The study was done at MOI whereby 0.5% Bupivacaine plain and 2% lidocaine with 1:200000 epinephrine were used. Blocks were performed in supine position with the head turned contralateral to the block site. Block success, motor and sensory blockade, complications, duration of analgesia and patient satisfaction were assessed. Pain assessment was done based on patient's awareness to pain, using visual analogue scale at recovery (00hrs) and at time of breakthrough analgesia. Patients

were followed up to 24 hours for any complications.

Data was analyzed using SPSS version 20.0 computer software. Continuous variables were expressed as means and standard deviations. Association between independent and dependent variables was done using independent t-test for continuous variables and chi-square test for categorical variables. Difference was considered statistically significant with a P value of <0.05.

Results

Ultrasound guided supraclavicular block were performed in 86 patients with a success rate of 97.6% of which 89.5% were successful after the first attempt and 8.1% were successful after supplementation. There were 2.4% failures. The average duration of analgesia was 211.73± 24.79 mins. Mean duration of analgesia had no statistically significant correlation to type of surgery. The most common complication was unintended vascular puncture (9.3%) followed by haematoma (4.7%), Horner's syndrome (2.3%) and pain and paraesthesia (2.3%). Complications were statistically significant associated with BMI and sex with a P values of <0.001 and 0.02 respectively. Most of the patients were comfortable with the technique.

Conclusion

The results of the study show very high successful block rate and good analgesia that extends for adequately longer time postoperatively. Patients were satisfied with the block and no serious complications were reported. Therefore, in absence of contraindication, the technique offers the best choice for upper extremities procedures especially to patients with cormobities like chronic renal failure and hypertension where general anaesthesia is associated with increased risk of complications.

Recommendation

Ultrasound guided supraclavicular block should be routinely done to patients undergoing upper limb surgeries in Tanzania.

Contents

DEDICATION vi
Abstract vii
LIST OF ABBREVIATION xi
Definition of terms xiv
CHAPTER ONE: 1
INTRODUCTION 1
1.1: BACKGROUND 1
1.1.1: Anatomical consideration. 2
1.1.2: Basics of Ultrasound 6
1.1.3: Phamacological consideration. 7
1.2: LITERATURE REVIEW 8
1.2.1. Block success 8
1.2.2: Complications 8
1.2.3. Duration of analgesia 10
1.2.4. Patient satisfaction 10
1.3: PROBLEM STATEMENT 11
1.4: RATIONALE 11
1.5: CONCEPTUAL FRAMEWORK. 12
Explanations of the conceptual framework. 12
1.6: STUDY OBJECTIVES 13
1.6.1: Broad Objective 13
1.6.2: Specific Objectives 13
CHAPTER TWO 14
MATERIALS AND METHODS 14
2.1: Type of the Study 14
2.2: Study setting 14
2.3: Study population 14
2.4: Variables 15
2.5: Sampling procedure. 16
2.6: Data collection 16
Block technique. 17

2.7: Data management and analysis. 20
2.8: Ethical consideration 20
CHAPTER 3: RESULTS 22
CHAPTER 4 29
DISCUSSION 29
4.1 Block success 29
4.2 Complications 30
4.3 Duration of analgesia 32
4.4 Patient satisfaction 33
CONCLUSION: 34
RECOMMENDATION: 34
STUDY LIMITATION 34
REFFERENCES 35
APPENDICES 39
Appendix 1(a): Informed Consent Form (English version) 39
Appendix 1 (b): Informed Consent Form (Kiswahili version) 41
RESEARCH TOOL. 43

LIST OF ABBREVIATION

ASA	American society of Anaesthesia
BP	Blood pressure
BPB	Brachial Plexus Block
ECG	Electrocardiogram
GA	General Anaesthesia
LA	Local Anaesthesia
MOI	Muhimbiliorthopaedic institute
MUHAS	Muhimbili University of Health and Allied Science
NS	Normal saline
PACU	Post Anaesthesia Care Unit
RA	Regional Anaesthesia
SPSS	Statistical Package for Social Sciences
VAS	Visual Analogue Scale
BMI	Body Mass Index
PT	Patient
USGSBPB	Ultra Sound Guided Supraclavicular Brachial plexus Blockade
US	Ultrasound
BPB	Brachial Plexus Block

List of Table

Table 3.1: Demographic and surgical data…….23

Table 3.2: Block characteristics……..24

Table 3.3: Block success with BMI and sex……...27

Table 3.4: Complication with BMI and Sex……...28

Table 3.5: Mean duration of analgesia with type of procedure……..28

List of Figures

Figure 1.1: Brachial plexus anatomy……....3

Figure 1.2: Conceptual framework…….12

Figure 2.1: Ultrasound guided supraclavicular approach…….....4

Figure 3.1: Study flow diagram……..22

Figure 3.2: Satisfaction……...25

Figure 3.2: Complications……..26

Definition of terms

Local anaesthesia toxicity: Occurs when excessive amount of local anaesthesia enters blood circulation.

Paresthesia: is unpleasant electric shock like sensation that occurs during direct contact of needle and nerve.

Regional anaesthesia complications: This comprises of local anaesthesia toxicity, horner's syndrome, pneumothorax, vascular injuries and nerve injuries.

Horner's syndrome: Characterized by miosis (constricted pupil), partial ptosis (drooping of upper eyelid) and unhidrosis (loss of hemifacial sweating). The syndrome is due to stellate ganglion block.

Sensory blockade: free from pain sensation.

Motor blockade: loss of muscle power.

Pneumothorax: occurs when air leaks into pleural cavity and cause lung collapse.

CHAPTER ONE:

INTRODUCTION

1.1: BACKGROUND

Upper limb surgeries can be done with regional anaesthesia, general anaesthesia or combination of the two (1). Regional anaesthesia in upper limb can be achieved by blocking Brachial plexus whereby a local anaesthetic agent is introduced into brachial plexus through different approaches, supraclavicular, interscalene, infraclavicular or axillary for the production of regional anaesthesia and analgesia of the upper limb which is innervated via the plexus (2, 3). The choice of approach depends on several factors including site of surgery, equipment availability, risk of complication, knowledge and preference of the anaesthetist (4). The technique has several advantages over general anaesthesia including decreased hemodynamic instability, avoiding of airway instrumentation, ability to communicate during surgery and improves intraoperative and postoperative analgesia (5–7). High risk of complications, longer placement time, patient discomfort and high failure rate from traditional RA technique, made many anaestheologists in developing countries to opt GA rather than RA(6). However, in developed countries RA technique is becoming popular as a gold standard due to increased use of ultrasound guidance. The improved safety and efficacy that ultrasound guided brings to regional anaesthesia helps to promote its use and realize the benefits that regional anaesthesia has over general anaesthesia, such as decreased morbidity and mortality, superior postoperative analgesia, cost-effectiveness, decreased postoperative complications and an improved postoperative course(7,8).

The first literature description of use of ultrasound for supraclavicular block was done by Grange and colleagues in 1978 for needle positioning. Since1994 the technology and clinical understanding of anatomical sonography has evolved whereby Kapra et al were first to report direct needle, plexus and local anesthetic visualization (9). This technique brings potential advantages to RA that serve to overcome the shortcoming of landmark techniques (3).These potential advantages

include direct nerve observation, direct observation of surrounding structures (vessels muscles and tendons), direct observation of LA deposition and spread, decrease in block complication, faster onset of block, longer duration of block, decreased dose of LA and improved blocks quality (10). Also the technique helps to detect abnormal anatomy that would not easily being detected by blind approach (11).

In daily clinical practice the use of ultrasound guidance requires sonographic equipment and high degree of training for current and future clinicians to be competent in needle visualization, probe stability, machine familiarity and distinguishing between normal and abnormal neurovascular anatomy (12, 13). Anaesthetist need to acquire knowledge in ultrasound technology and practical skills to visualize nerve structures.

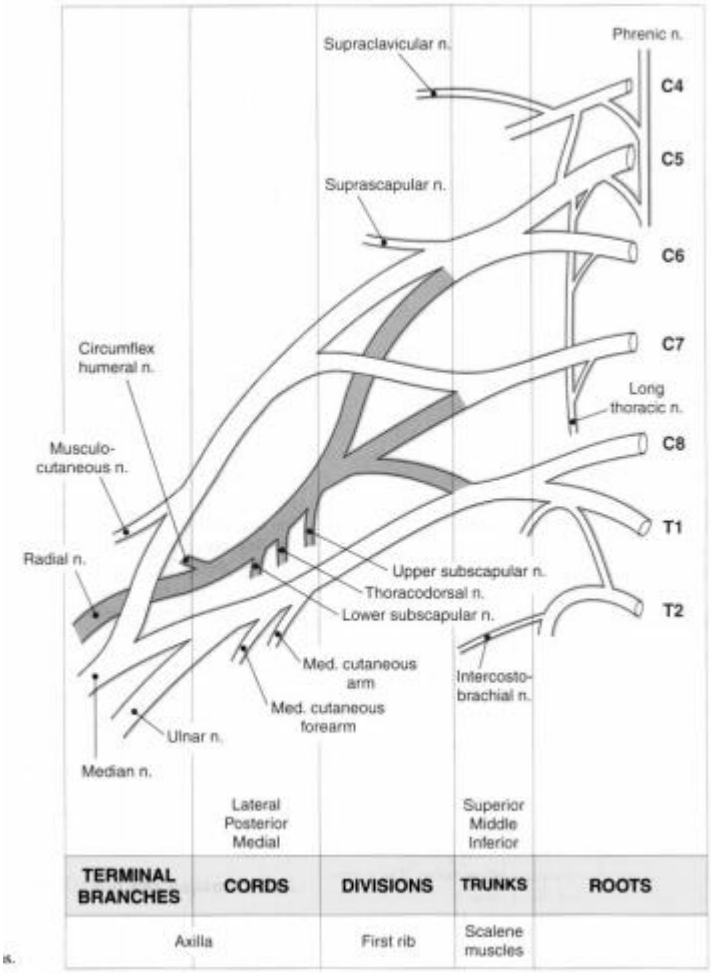
1.1.1: Anatomical consideration.

1.1.1.1: Brachial plexus

The nerve supply of the upper limb is mainly derived from the brachial plexus, which is formed from the anterior primary rami of the fifth to eighth cervical and first thoracic nerve root, fourth cervical and second thoracic nerve root contribute to the plexus in prefixed and postfixedplexal anatomical variants respectively(1,14). The roots of the plexus divide repeatedly and recombine to form trunks, divisions, cords and terminal nerves (Fig 1.1). The roots after leaving the intervertebral foramen they emerge between the anterior and middle scalene muscles between which they descend towards the first rib and converge into three trunks. Trunks separates above the clavicle into anterior and posterior divisions. In the axilla divisions recombine into three cords surrounding the axillary artery and these cords form the terminal nerves (3).

The roots are invested in the sheath derived from prevertebralfascial. This covering extends into the axilla and causes solution injected anywhere within the sheath to spread along the line of the plexus (15). The cutaneous and deep nerve supplies of the upper limb are as shown in Figure 1:1. Part of the cutaneous nerve supply of the upper limb is not derived from the brachial plexus, the upper medial part of the arm

is supplied by the intercostobrachial nerve (T2) and has to be blocked separately if a tourniquet is to be used for a prolonged period (16).



(17)

Figure 1.1: Brachial plexus anatomy

1.1.1.2: Brief description of some of the approaches and techniques available for branchial plexus blockade.

It was William Stuart Halstead an American surgeon who in 1884 performed the first brachial plexus blockade (18). Since then several approaches and techniques were discovered and described. There are multiple approaches for brachial plexus blockade, and these approaches named according to the level at which the needle is inserted for injecting the local anaesthetic. These approaches includes interscalene, supraclavicular, infraclavicular and axillary.

Interscalene approach. (Winnies'technique)

The approach was introduced by Winnie in 1970. He approaches the brachial plexus sheath higher up in the neck via the interscalene space at the level of cricoid cartilage (C6). The block aimed at depositing local anaesthetic to the root of the plexus as they lie between the middle and anterior scalene muscles (5). The block is indicated for analgesia and anaesthesia of the shoulder, humerus or elbow surgery. The incidence of phrenic nerve block is so high up to100%.

Supraclavicular approach. (Subclavian perivascular technique.)

Supraclavicular approach was introduced by Kulenkampff in 1912. Since then several modification has been described. Subclavian perivascular brachial plexus block is among the supraclavicular approaches (3). The blocks aim at depositing LA into the trunk and division. The landmarks are midclavicular point, subclavian artery, first rib and pleura. The technique requires insertion of the needle towards the first rib. The approach has high risk of pneumothorax.



Figure 1.2: Ultrasound guided supraclavicular approach

Infraclavicular approach. (Coracoid technique)

The approach reach the brachial plexus from a point below the clavicle. Many descriptions on how to perform the block has been described but the basic concept involves blocking the cords of the brachial plexus in the axilla fossa .Needle is inserted 2cm below the midpoint of the inferior border of the clavicle, or needle is inserted more lateral point in the interval between the coracoid process of the scapula and the inferior border of the clavicle. The approach used as an alternative to axillary approach and supraclavicular approach (19). The technique provides analgesia and anaesthesia for forearm, wrist and hand surgery.

Axillary approach.(axillary perivascular technique)

The approach was first described by Hirschel in 1911 when he attempted to reach the level of first rib via the axilla blindly. Axillary approach aimed at depositing LA to the cords in the axilla. In axillary perivascular BPB, the axillary artery form the major landmark of brachial plexus blockade. Its terminal portion easily identified by pulsation in the axilla. The approach is indicated for analgesia and anaesthesia for forearm, wrist and hand surgery (20).

1.1.1.4: Nerve localization techniques during brachial plexus blockade.

Apart from ultrasound guided techniques for nerve localization, several other techniques are available. The techniques includes anatomical landmark, paraesthesia, peripheral nerve stimulation and ultrasound guidance.

Anatomical landmark techniques.

The techniques are based primarily on the surface anatomy and the palpation of deep structures. Several purely anatomical based techniques are still effective. However with availability of peripheral nerve stimulator and ultrasound guided techniques anatomical landmark techniques are used together with these techniques.(3)

Paraesthesia based techniques

Paraesthesia is among the methods used for identification of brachial plexus nerves. During the technique, when then needle is close to the nerve the subject may

experience a paraesthesia (a sudden tingling sensation often describes as feeling like pins and needles or like an electric shock, in the arm ,hand, or finger on the blocked limb. The techniques are safe and effective in an experienced hands (21)

Nerve stimulation.

The technique involves the connection of an appropriate block needle to the peripheral nerve stimulator and allow the emission of an electric current from the needle tip. When the needle tip is close to the targeted nerve, a contraction of the innervated muscle may be elicited. The production of evoked muscle contraction at low current levels (0.2-0.5mA) confirm needle placement in close proximity to the nerve and contraction at less than 0.2mA indicates likely intraneural needle tip placement. The technique can be used as a sole or with combination with other techniques (22).

1.1.1.5: Supraclavicular anatomy.

In the supraclavicular fossa, the brachial plexus is located lateral and superficial to the subclavian artery (17). The pleura are usually found within 1-2 cm from the brachial plexus so when manipulating the needle in this region it is important to realize that the apex of the lung is just medial and posterior to the brachial plexus for avoidance of pneumothorax (15). The supraclavicular block is performed at the distal trunk/proximal division level, where the brachial plexus is most compact. This may explain its historical reputation for providing fast onset and complete, reliable anaesthesia for the upper limb, and the nickname ‘spinal of the arm’ (3, 18, 23).

1.1.2: Basics of Ultrasound

The brachial plexus in supraclavicular region is superficially located, so during ultrasound imaging for nerve localization it requires high frequency probe with high resolution image(1). In supraclavicular fossa the divisions of the brachial plexus are visualised as a cluster of hypochoic nodules immediately cephalad and lateral to the anechoic pulsatile subclavian artery and above the first rib (24). In plane view there will be full visualization of tip and shaft of the needle, while out of plane view image appear as small dot representing cross sectional of the variable of the needle (25).

1.1.3: Phamacological consideration.

Bupivacaine is an amide local anaesthetic drug and is among commonly used drugs in supraclavicular brachial plexus blockade due to its long duration of action. Due to its characteristic of slow onset, Bupivacaine is used with Lidocaine 2% with Epinephrine for rapid onset (26). Bupivacaine acts by binding to the intracellular position of the sodium channel and block sodium influx into nerve cells, which prevents depolarization leading to impairment of generation of action potential (27). In supraclavicular brachial plexus blockade, successful block depends on volume of drugs being used (28)**.**

Several adjuvant medications including epinephrine, clonidine and dexamethasone can be added to the LA agent to potentiate the effectiveness of local anaesthesia. They are considered to prolong the duration of analgesia (29). Epinephrine has been given in conjuction with short acting local anaesthetics to improve analgesia. Clonidine is an alpha-2 adrenergic agonist that has been shown to improve the effectiveness of local anaesthetics, but Sedation and hypotension are the recognized side effects. Dexamesathone has been shown to increase the duration of sensory block and decrease opioid consumption when given with clonidine and bupivacaine (19, 30).

1.2: LITERATURE REVIEW

1.2.1. Block success

In a study done by Kapral S, 80 patients were grouped into US (Ultrasound guided blockade) and NS (anatomical landmark). At 30mins, 95% of patients in group US and 85% of group NS had a partial or complete sensory block at all nerves. US group had no block failure while 8% of NS group needed general anaesthesia. The conclusion was ultrasound guided supraclavicular blocks provide more complete blocks than anatomical landmark methods(16,17).

Also in a study done by Anahi Perlas, 510 ultrasound guided supraclavicular blocks were performed by which successful surgical anaesthesia was achieved in 94.5% of patients after a single attempt. A total of 2.8% needed local anaesthesia supplementation and 2.6% received an unplanned general anaesthesia. The study concluded that ultrasound guided supraclavicular block is associated with a high rate of successful surgical anesthesia(30). In another study done by Searle Adrian et al, 10% needed block supplementation (31).

Similar findings have been reported by B. Krutika of Egypt doing comparison of ultrasound guided blockade versus anatomical landmarks, in which block success was high in Ultrasound guided than in landmark based techniques. Out of 30 patients undergoing ultrasound guided supraclavicular blockade, 96.67% achieved surgical anaesthesia without supplementation(32). Tsuietal from Egypt also accomplished surgical anaesthesia in 94.2% of blocks(21).

1.2.2: Complications.

In a study done by Koscielniak in Copenhagen-Denmark, a high risk of inadvertent pneumothorax was reported in supraclavicular than infraclavicular approach due to proximity to the pleura (33).

Also a prospective observational study to examine risk of pneumothorax by ultrasound guided periclavicular brachial plexus blockade was done by Gauss et al of Ulm-Germany in 3366 cases whereby clinical symptoms and radiological conformation of pneumothorax were analyzed. Clinical symptoms of pneumothorax

occurred in 4 patients (0.06%).The study concluded that Ultrasound guidance offered reduced the risk of pneumothorax(6).

The reduced risk of pneumothorax was also reported by Anahi et al who documented no cases of symptoms of pneumothorax developed. Anahi study also reported low rates of other complications including symptomatic hemidiagraphramatic paresis 1%, horners syndrome 1%, unintended vascular puncture 0.4% and transient sensory deficit 0.4%. It concluded that ultrasound guided supraclavicular blockade was associated with low rate of complication(30). Ranghove et al in his study also showed no pneumothorax developed(34)

Experience of the anesthetist is an important determinant of block success and complication rate. A study by Bruce et al demonstrated a complication rate of 1% for anaesthetists who performed more than 100 blocks in their life time and complication rate of 5% for those who had performed less than 100 blocks in their life time(18).

Other complications of the block includes subclavian artery puncture, neurological complication, paresis of stellate ganglion from local anaesthesia spread, phrenic nerve injury and recurrent laryngeal nerve injury(9,35). The study done by Adrian Searse from United Kingdom with sixty outpatient, reported four patient developing Horner's syndrome while one patient had small vessels puncture(31). Dr. Dilip Kothari from India reported 6% of small vessels puncture out of 250 patients.

Local anaesthesia toxicity is one of the complication of RA blocks, and the addition of vasoconstrictors to the local anaesthetic could worsen the complication(36,37). Generally, the onset of above complications can occur immediately or delayed within 24 hours (38).

Other study done by Krutika et al in Egypt for comparison of ultrasound guided and peripheral nerve stimulator for supraclavicular brachial plexus blockade, the result shows there was no complication associated with ultrasound guided while there were 10% complications for those had peripheral nerve stimulation techniques (32). Jinjil et al reported no complications with ultrasound guided blocks (28).

1.2.3. Duration of analgesia

In the study done by PunamRaghove with 60 patients, concluded that the duration of analgesia was averaged between 258 and 366 minutes(34). Another study done by Dilip Kothari with 250 patients showed that average duration of analgesia was 180 to 200 minutes(2).

In the study done by Pande R. Of Nepal-India where by 200 patients underwent ultrasound guided supraclavicular blockade shows that, the duration of analgesia was averaged to 3.5 hours hence concluded that ultrasound guided RA prolong duration of postopp analgesia (39).

Also another study by F.Mirza of Newyork in America shows that, RA has advantage in postoperative pain relief, especially when ultrasound guided used with real time needle visualization(1). Krutika of Egypt in the study comparing Ultrasound guided and Peripheral nerve among 60 patients shows that there is a prolonged duration of analgesia in ultrasound guided than in Peripheral nerve stimulator (32).

1.2.4. Patient satisfaction

In the study done by Adrian Searle, 60 patients underwent hand surgery by ultrasound guided brachial plexus block at supraclavicular level, patient satisfaction with the block procedure was reported to be high. In this study, 84% reported excellent satisfaction and good satisfaction was observed in 16%(31).

Also the study done in Egypt by Amany El-sawy, 60 adult patients with chronic renal failure were scheduled for arteriovenous fistula (AVF) creation by ultrasound guided brachial plexus block. The study shows that 90% of patients were satisfied with the technique(24)

1.3: PROBLEM STATEMENT

Ultrasound guided supraclavicular brachial plexus blockade has been introduced at Muhimbili Orthopedics Institute since 2015. The lack of facilities and cost made ultrasound guided brachial plexus block not being a routine practice. Outcomes from ultrasound guided supraclavicular brachial plexus blockade for upper limb surgeries in our setting until now are not known by many clinicians and patients. Knowing these clinical outcomes is of paramount importance to clinicians as it will help in upgrading current patient management and hence improve patient safety.

1.4: RATIONALE

No research has been done in ultrasound guided supraclavicular brachial plexus block in our country. This study was done for the purpose of understanding clinical outcomes with ultrasound guided supraclavicular brachial plexus blockade. The study provides necessary information on the block technique and can be adopted as an alternative to general anaesthesia in upper limb surgeries. The results of this study will be used as baseline data for future studies and comparison with other studies elsewhere. Moreover, the study is a part of fulfilment of the degree of master of medicine in anaesthesiology at MUHAS.

1.5: CONCEPTUAL FRAMEWORK.

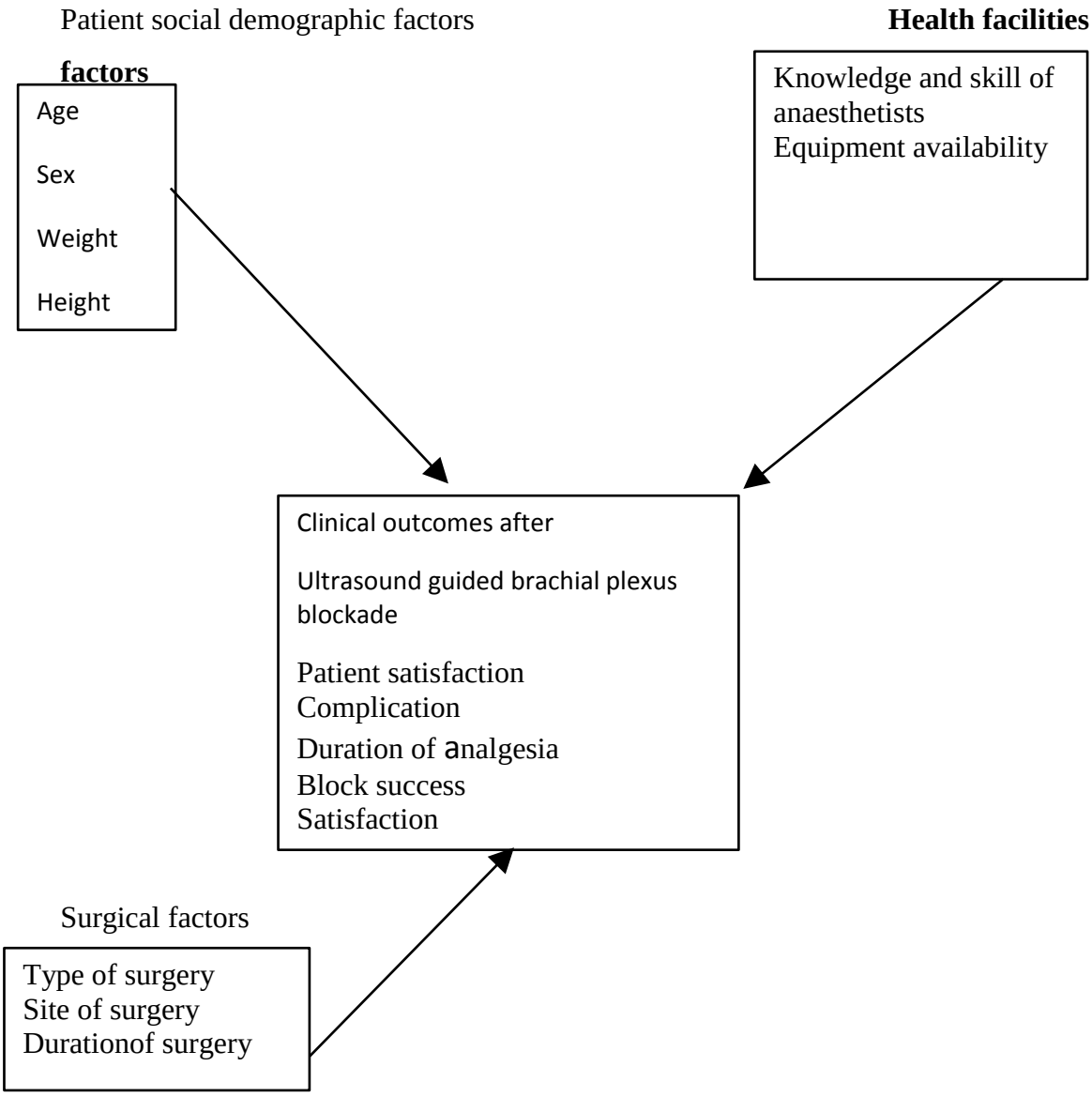


Figure 1.3: Conceptual framework.

Explanations of the conceptual framework.

Clinical outcomes after ultrasound guided supraclavicular brachial plexus blockade (block success, duration of analgesia patient satisfaction and complications) depend on several factors. Those factors are patient comorbities, age. Weight, Site of surgery, duration of surgery, equipment availability and skills/knowledge of anaesthetist. Independent variables that were studied surgical factors and patient social demographic factors.

1.6: STUDY OBJECTIVES

1.6.1: Broad Objective

To determine clinical outcomes after ultrasound guided supraclavicular brachial plexus blocks among patients undergoing upper limb surgeries at MOI, from May 2016 to May 2017

1.6.2: Specific Objectives

a) To determine block success by assessment of sensory and motor blockade among patients undergoing upper limb surgeries with ultrasound guided supraclavicular brachial plexus blockade at MOI (May 2016 to May 2017).
b) To determine proportion of patients who develop complications among patients undergoing upper limb surgeries with ultrasound guided supraclavicular brachial plexus blockade at MOI (May 2016 to May 2017).
c) To determine duration of analgesia provided by the block among patients undergoing upper limb surgeries with ultrasound guided supraclavicular brachial plexus blockade at MOI (May 2016 to May 2017).
d) To assess patient satisfaction with the block among patients undergoing upper limb surgeries with ultrasound guided supraclavicular brachial plexus blockade at MOI (May 2016 to May 2017).

CHAPTER TWO

MATERIALS AND METHODS

2.1: Type of the Study

Hospital based prospective observation cross-sectional study.

2.2: Study setting

Study was conducted at Muhimbili Orthopaedic Institute (MOI) in Dar es Salaam Tanzania. MOI is terrtiary hospital. It has 6 operation rooms whereby an average of 20 operations are being done per day. It receives patients' referred from municipal hospitals in Dar es Salaam (Amana, Mwananyamala Temeke) and self referrals from different parts of the city and nearby regions. The hospital also receive hospital and self referrals from all over the country. MOI is also a teaching hospital for undergraduate and post graduate from Muhimbili University Of health and Allied Sciences.

2.3: Study population

Study population included adult patient (age 18 years and above) of both sexes who were scheduled for upper limb surgeries by ultrasound guided supraclavicular blocks July 2016 to January 2017.

i. Inclusion criteria

- Age 18 years and above
- ASA I&II
- Signed consent form

ii. **Exclusion criteria**

- Coagulopathy,
- Infection at the local site,
- Allergic to local anaesthesia drugs,
- Active or recent neurological abnormalities
- Pregnant women
- Significant pulmonary pathology

- Multiple injuries

iii. Patient involved

All patients who fulfilled the inclusion criteria.

iv. Selection method

To all patients who were scheduled for upper limb surgery, recruitment was done to establish inclusion criteria, following by provision of information regarding the study to the patients who were met inclusion criteria and who were planned to undergo upper limb surgeries by ultrasound guided supraclavicular BPB. After which patients were required to sign the consent form for participation in the study.

2.4: Variables

- **Independent variable**

  Age

  Sex

  Height

  Weight

  Cigarette smoking

  Alcohol intake

  Education level

  Site of surgery

  Duration of surgery

  Knowledge and skills

  Equipment

- **Dependent variables**

  Complications

  Block success

  Duration of analgesia

  Patient satisfaction.

2.5: Sampling procedure.

Convenient sampling was used in which every patient who met inclusion criteria during the period of study was enrolled.

The sample size was calculated from the formula $N=Z^2P\ (1-P)/E^2$

Where,

N= sample size,

Z = (1.96)

P = proportional = 6%.

This proportional was derived from reported rate of Horner's syndrome after ultrasound guided brachial plexus block at supraclavicular level (33). A minimum sample size required to detect a clinically important event was calculated based on the above formula.

95% confidence interval was used.

E = error margin 5%

Therefore $N= (1.96)^2 \times 6(100 – 6) /(5)^2$

So the sample size in this study is 86 patients.

2.6: Data collection

The structured questionnaire designed for purpose of the study was used whereby information was collected by the principal investigator using the study tool. The information collected was included

1. Identifying data: sex, age weight, alcohol intake cigarette smoking, education level, employment, site of surgery, type of surgery, duration of surgery and ASA classification.
2. Clinical findings.(BP,HR,RR,SPO2)
3. Assessment of sensory block
4. Assessment of motor block

5. Duration of analgesia
6. Patients satisfaction
7. Complications

Block technique.

The block procedure was done by principal investigator. This was done after preparation of all requirements for general anaesthesia, regional anaesthesia and resuscitation equipment. The patient was counselled to protect the limb until full recovery of sensation and also was informed about the anticipated duration of local anaesthesia.

Equipment's and materials

- Ultrasound machine with linear transducer (7-12MHz). Phillips wegi 1 of Esaote European2010-2012.(was provided by MOI hospital)
- Sterile sleeve and gel.
- **Sterile nerve block tray (block needle 22gauge, 5cm from iv fluid giving set)**
- Bupivacaine 0.5% plain.
- 2% Lidocane with 1:200000 Epinephrine.
- Saline.
- Sterile gloves
- 20% Lipid emulsion
- Midazolam.

After arrival to the anaesthetic room:

The patient was explained about the importance of cooperation during time of block procedure and was also told that he/she would feel a different sensation like pins and needle sensation and sensation of warmth on the limb to be blocked.

The patient was positioned supine. Routine ECG, non invasive BP and pulse oxymeter monitors were applied and baseline vitals were recorded. IV access was established in the contralateral limb and intravenous fluids were started. Anxiolysis was established with Midazolam whenever needed.

At a time of procedure the head was turned to the contralateral side and the skin was

disinfected with povidone iodine. An ultrasound machine with linear high frequency probe covered with tergerdem or sterile gloves was used to scan the supraclavicular fossa. Brachial plexus was identified as a compact group of nerves (trunk and/ or division) over the first rib laterally and posterior to the subclavian artery.

After identification of subclavian artery, pleura and brachial plexus, the skin was anaesthetised with 2-4mls of lignocaine 2%. A single short technique was applied whereby a 22 gauge; 5cm short beveled needle was advanced in plane with the ultrasound beam from either medial to lateral or lateral to medial. Needle was advanced in plane with ultrasound beam until penetration of the brachial plexus sheath and then the needle tip was positioned within the sheath compartment along the nerve. At this point aspiration was done.

After negative aspiration, the local anaesthesia solution was administered incrementally ensuring expansion of brachial plexus sheath. If initially 1-2 mls of LA spread outside the sheath the needle was readjusted until proper local anaesthetic spread is visualized. The needle tip was readjusted to ensure LA spread to the third trunk.

Assessment.

Immediately after block performance clinical outcomes provided by the block were evaluated by principal investigator. Patient closely monitored in perioperative period for any complications. For any symptoms and signs of respiratory difficulties, Chest x-ray was required. Vital signs were recorded every five minutes for the first thirty minutes, then every fifteen minutes up to the end of operation and were recorded by an assistant.

Assessment of sensory blockade

Testing of sensory block was done starting from commencement of injection to the development of complete analgesia, and it was done in cutaneous nerve of distribution, that is lateral side of the forearm for musculocutaneous nerve, dorsum of the hand over the second metacarpal pharyngeal joint for radial nerve, little finger for ulnar nerve, medial thenar eminence for median nerve.

Reaction to cold sensation using cotton wool soaked in sprit was compared between the unblocked limb and blocked limb. The cold sensation difference was graded as **(**1) meaning No difference in sensation, (2) meaning some difference in sensation and (3) meaning -No sensation to blocked limb.

Assessment of motor blockade.

Assessment of motor blockade was done every five minutes up to thirty minutes to anaesthetized limb. Muscle power in nerve distribution was tested and graded using modified Bromage scale as 1) meaning normal muscle power, 2) meaning reduce muscle power, 3) meaning complete loss of muscle power. Testing involved asking the patient to flex arm for musculocutaneous nerve, extending the flexed arm and wrist for radial nerve, flex wrist and to oppose the thumb to second and third fingers for median nerve and flex fourth and fifth fingers for ulnar nerve.

Assessment of the block success

Quality of the block was graded and recorded as, 1) satisfactory block- whereby complete analgesia and muscle relaxation was achieved after the first attempt of the block, 2) unsatisfactory block – when supplement analgesia or sedation was required to achieve surgical anaesthesia to patient and 3) block failure-failure to achieve analgesia and muscle relaxation up to 30 mins, and patient underwent general anaesthesia. In this study grade 1 and 2 were regarded as successful block.

Post anaesthesia care unit

- After completion of the surgery the patient was sent to post anaesthesia care unit whereby the principal investigator continued evaluating and recording all complications arising from the patient due to drug adverse effect or the block procedure. For Pneumothorax the investigator was checking for difficulty in breathing, cough and chest pain. Other complications apart from Pneumothorax which were recorded included swelling of the block site, bruising, weakness in operating extremity, ptosis, phrenic nerve injury, local anaesthesia toxicity and others.
- The principal investigator also recorded the duration of analgesia (Time from

block success to the time whereby the patient first request for additional analgesia), persistence or absence of analgesia was tested for reaction to cold sensation and by using the patient awareness to pain every 30 minutes after onset of complete analgesia. Pain assessment was done using visual analogue scale (VAS) at recovery 00hrs and at time of breakthrough analgesia.

The principle investigator also assessed the patient comfortability during nerve block, comfort ability during surgery, comfort ability with pain relief and comfort ability of having awake surgeries again. This was done using standardized questions scored in five point likert scales. The response was recorded as 1 for disagree strongly, 2 for disagree, 3 for undecided, 4 for agree and 5 for agree strongly. The response agree strongly and agree regarded as comfortable, undecided regarded as neutral and disagree strongly and disagree regarded as discomfort.

-

All patients were followed up to 24 hours.

2.7: Data management and analysis.

Data entry, cleaning and coding were done using a computer software Statistical Package for Social Science (SPSS) version 20.0. Data was analysed by using the same software.

Continuous variables were expressed as means and standard deviations. Association between independent and dependent variables was done using independent t-test for continuous variables and chi-square test for categorical variables. Difference was considered statistically significant with a P value of <0.05.

2.8: Ethical consideration

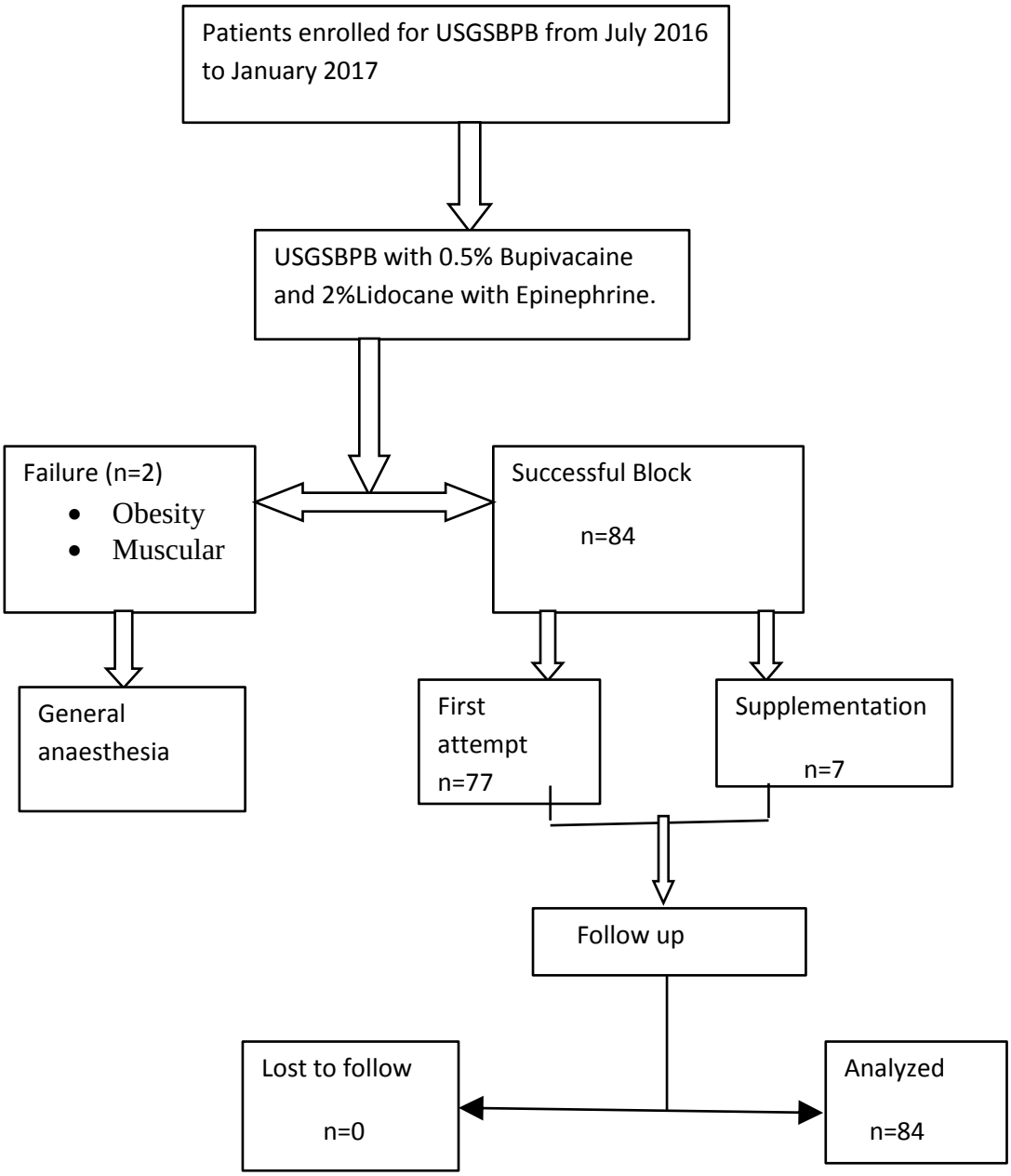
The study was done after obtaining Ethical clearance from MUHAS higher degree ethical committee of research and publication committee. During study the investigator was introducing herself to each individual patient and gives explanation on what the study was about before asking the patient to participate in the study. Only patients who gave consent were enrolled for the study. Patient interview was

conducted in a private room with only the investigator and the patient. All the examinations, tests and investigation methods was the ones usually done for any patient during preoperative visit. The investigator was supervised by specialists in the field who was available to guide and assist in case of any problem. The patients' information and results of any test performed was handled confidentially. There was 20% intralipid for resuscitation in case of local anaesthesia toxicity.

The patients in the study were ASA I and II, Patients were handled in the same way as routinely handling without exposing them to any additional risk. Any problem which was raised from any patient was immediately attended by senior specialist.

CHAPTER 3: RESULTS

Figure 3.1: Study flow diagram



A total of 86 patients underwent ultrasound guided supraclavicular brachial plexus block in this study. Among them male and female patients were 49 and 37 respectively. The surgical procedures performed were open reduction and internal fixation, reconstruction, implant removal, and others. Most procedure (47.7%) done was ORIF.

Table 3.1: Demographic and surgical data

	Demographic criterion	
1	Age (mean±SD)	37.76 ±16.83 years
2	-Male -Female	49 (56.9%) 37 (43.1%)
3	Weight (mean±SD)	63.59±16.06 Kg
4	Height (mean±SD)	164.22±6.32 cm
5	BMI (mean±SD)	23.79±4.92
6	Duration of surgery (mean±SD)	73.81±21.41 mins
7	Smoking (%)	17 (19.77%)
8	Education status/level -Primary Education -Secondary -University -Others	 26 (30.2%) 32 (37.2%) 12 (13.9%) 16 (18.7%)
9	None employed (%)	42 (48.8%)
10	Duration of analgesia(mean±SD)	211.73± 24.79 mins

The computed mean age found to be 37.76 ±16.83 years. The youngest participant was aged 18 years and the oldest was 85 years. Males were 49 (56.9%) and female were 37 (43.1%). The mean weight, height, BMI and duration of surgery were 63.59±16.06kg, 164.22±6.32cm, 23.79±4.92 and 73.81±21.41mins respectively. Smokers were 17(19.77%). The commonest education level attained was secondary level 32 (37.2%) and non-employed were 42 (48.8%).

Table 3.2: Block characteristics.

Block characteristics		n=86
1	Onset time sensory block(mean±SD)	6.46± 1.62 mins
2	Onset time motor block (mean±SD)	17.06± 2.88 mins
3	Block success (%) -Success after 1 attempt (%) -Supplementation (%) -Failure (%)	84 (97.6%) 77 (89.5%) 7 (8.1%) 2 (2.4%)
4	Duration of analgesia(mean±SD)	211.73± 24.79 mins

The mean and standard deviation of Onset time sensory block, Onset time motor block and duration of analgesia were 6.46± 1.62, 17.06± 2.88 and 211.73± 24.79 respectively. The block success was 84(97.6%) whereby success after first attempt, supplementation and failure were 77 (89.5%), 7 (8.1%) and 2 (2.4%) respectively.

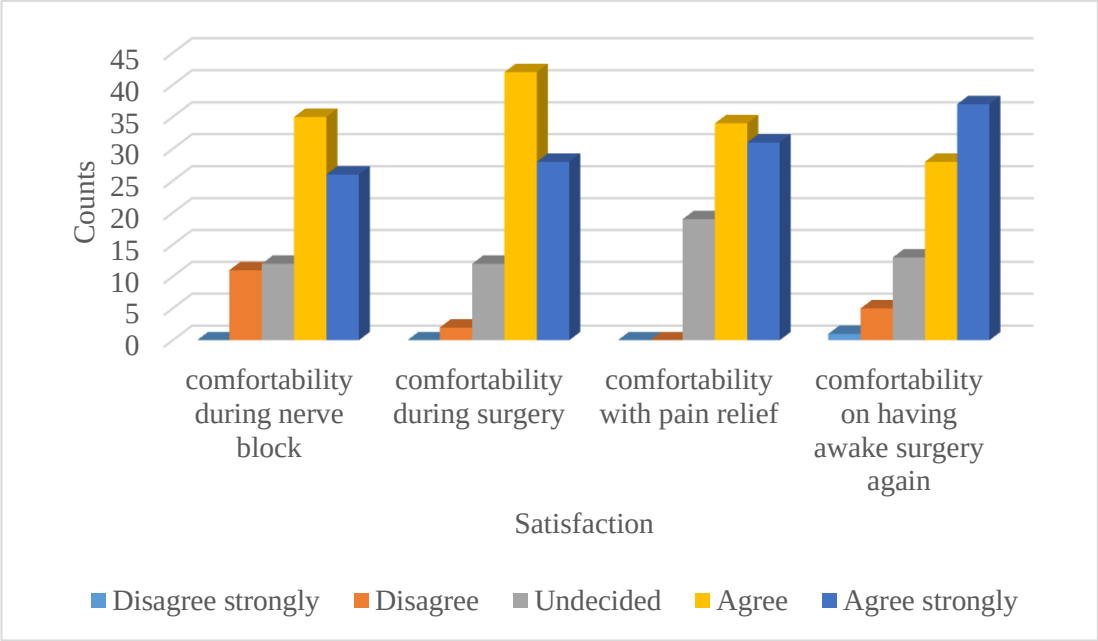


Figure 3.2: Satisfaction

Results from figure above shows that most patients were comfortable with the block. Agree and strongly agree respondents were 61 patients for comfortable during nerve block, 70 patients for comfortable during surgery, 65 patients for comfortable with pain relief and 65 patients for comfortable with awake surgery again.

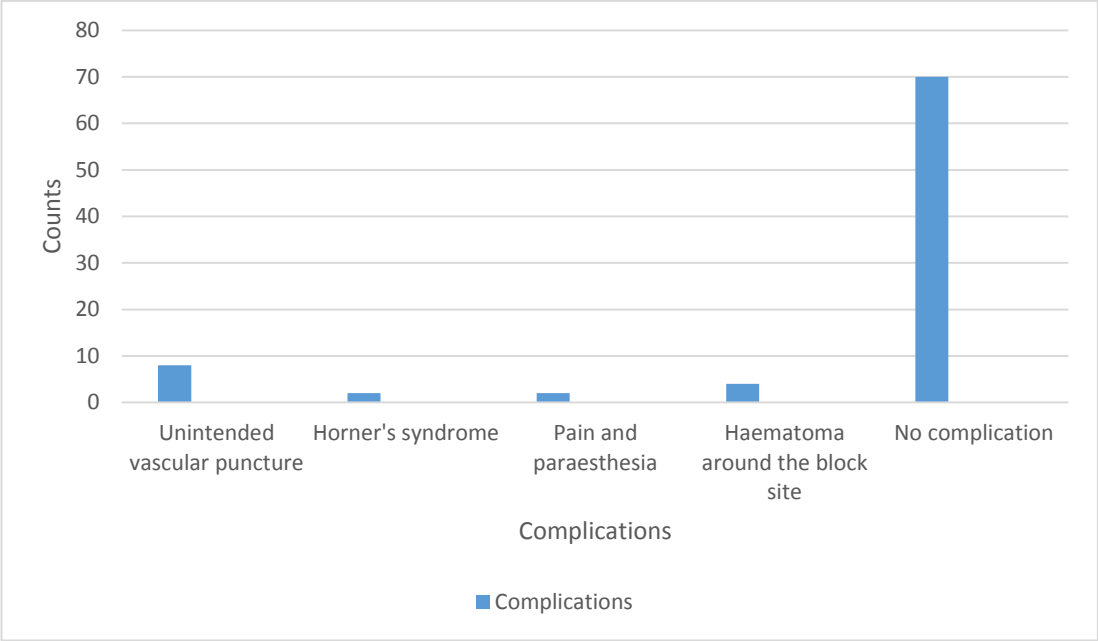


Figure 3.3: Complications

Most of the patients had no complications which were 70 patients. Complications which occur included unintended vascular puncture (8 patients), horner's syndrome (2 patients), pain and paraesthesia (2 patients) and hematoma at injection site (4 patients).

Table 3.3: Block success with BMI and sex.

		Block success (n =86)			p-values
		Satisfactory n =77	Unsatisfactory n =7	Failure n =2	
BMI	Underweight	12 (15.6%)	0 (0.00%)	0 (0.00%)	0.021
	Normal	40 (51.9%)	1 (14.3%)	0 (0.00%)	
	Overweight	19 (24.7%)	3 (42.9%)	1 (50%)	
	Obese	6 (7.8%)	3 (42.9%)	1 (50%)	
SEX	Male	47 (61.0%)	2 (28.6%)	0 (0.00%)	0.065
	Female	30 (39.0%)	5 (71.4%)	2 (100%)	

The results from above table indicate a statistically inverse proportion between block success and participants BMI. In normal weight satisfactory blocks were 51.9%, unsatisfactory blocks were 14.3% and there was no failed block, whereas in obese patients satisfactory blocks were 7.8%, unsatisfactory blocks were 42.9% and failure were 50%. So as BMI increases the block success decreases and this was statistically significant with p -value of 0.021. Patient's gender did not significantly affect block success which was mostly satisfactory with males (61.0%) than females (39.0%), with a p value of 0.065.

Table 3.4: Complication with BMI and Sex

		Complication n=18	No complication n=68	P value
BMI	Underweight	0 (0%)	12 (100%)	0.00
	Normal	4 (9.8%)	37 (90.2%)	
	Overweight	5 (21.7%)	18 (78.3%)	
	Obese	9 (90%)	1 (10%)	
SEX	Male	6 (12.2%)	43 (87.8%)	0.02
	Female	12 (32.4%)	25 (67.6%)	

The results from table above shows highly statistically significant association between complication and BMI with a p value of <0.001. Complications increases as BMI increased. Also above results shows statistically significant association between complications with sex with a p value of 0.02. With more females (32.4%) experiencing complication than males (12.2%).

Table 3.5: Mean duration of analgesia with type of procedure.

		Mean duration of analgesia (mins)	P-value
PROCEDURE DONE	Open reduction/internal fixation	216.76±24.42	0.278
	Reconstruction	203.72±22.37	
	Implant Removal	208.58±27.96	
	Others/soft tissue	211.73±20.9	

The table above show that the mean duration of analgesia with type of procedure is not statistically significant with a p-value of 0.278.

CHAPTER 4

DISCUSSION

Supraclavicular brachial plexus block is very common peripheral nerve block used for providing anaesthesia for upper limb procedures of arms and forearms. The use of ultrasound guidance has made the procedure safe, minimally invasive, small amount of local anaesthetic can be used with more accurate needle placement. This avoids the complications of pneumothorax, arterial puncture and direct nerve damage.

Clinical outcomes after ultrasound guided supraclavicular brachial plexus were studied to 86 patients from May 2016 to May 2017.

4.1 Block success

In this study the block success rate was 97.6%, of which 89.5% were successful after the first attempt and 8.1% were successful after supplementation. There were 2.4% failures. This results compare well with results from a study done in 2009 by Kapraetal for ultrasound guided brachial plexus blocks whereby 95% of patients had partial or complete block in all nerves (43). The results also correlate with results from study done by Anahi Perlas with 510 ultrasound guided supraclavicular brachial plexus blocks whereby successful surgical anaesthesia was achieved in 94.5% of patients after single attempt, 2.8% needed supplementation and 2.6% received unplanned general anaesthesia (32). A study by B Krutika, also had similar results. Out of 30 patients who underwent USGSBPB 96.67% achieved surgical anaesthesia without supplementation (34). Tsuietal from Egypt also achieved surgical anaesthesia in 94.2% in his study by ultra sound guided supraclavicular brachial plexus blockade (23). From above results it shows that ultra sound guided technique in supraclavicular brachial plexus blockade has a high success rate.

In our study block success was significantly associated with Body Mass Index with a P value of 0.021. This association also was statistically significant in study done by Bruce etal on USGBPB with a P value of 0.04(19). During the current study it was noted that a successful block was more difficult to obtain in obese than in non-obese patients .Obese patients were more likely to fail. All two failed blocks were in obese

patients with BMI of more than 30 kg/m^2. One failed patient we could not visualize the brachial plexus during ultrasound scanning. In obese and muscular patients the target region were at a greater depth so there was poor resolution of structures resulting in missing target region during injection of the local anaesthetic drug.

In this study seven patients were given supplemental analgesia to achieve surgical anaesthesia after the block. Most of them had larger height and weight so obesity contributed to the unsatisfactory blocks. Another reason could be due to missing corner pocket which is located close to the pleura, an area that could not be reached due to fear of pneumothorax.

4.2 Complications

In this study there were no serious complications like pneumothorax, intravascular injection and nerve injuries. Kapraetal also observed the same findings in his study of an ultrasound guided supraclavicular blocks (43). In our study 70 patients out of 86 patients had no complications. All complications occured were transient and resolved within 24 hours. The documented complications in this study were unintended vascular puncture 8(9.3%) patients, haematoma around the block site 4(4.7%) patients, Horner's syndrome 2(2.3%) patients and pain and paraesthesia 2(2.3%) patients. The results correlate with the results from Anahi Perlas study done on 510 consecutive cases by USGSBPB which shows that no cases of symptomatic pneumothorax developed, horners syndrome 1%, unintended vascular puncture and sensory deficit 0.4% (32). Study done by Adrian Searle from united kingdom correlate with this study, out of 60 patients 4 patients develop Horner's syndrome, one patient had small vessel puncture, no major complication developed (33). B Krutika in his study results shows no complication in ultrasound guided supraclavicular brachial plexus blockade and 10% complications in landmark technique. (34) Jinjiletal report no complications in his study in USGSBPB (30).

Complications with BMI in this study was highly statistically significant with p value <0.001.The results correlate with results from study done by Bruce which reported that, ultra sound guided supraclavicular brachial plexus blocks associated with significant complications in patients with BMI more than 30kg/m^2 with p value

0.001(19). Obesity results in poor resolution of structures including blood vessels and nerves. In obese patients these structures are located in an increased depth compared to non-obese patients, thus rising risk for technique related complications like unintended vascular puncture, haematoma formation, pain and parasthesia, phrenic nerve injuries, pneumothorax, horner's syndrome and intravascular injection in these candidates.

Unintended vascular puncture was most observed complication in this study. Vessels were punctured during block procedure. This was noticed during aspiration and colourdoppler was used at that juncture and successfully blocks performed after. The challenge was in approaching the inferior trunk and hence increase risk of vessel puncture. Anahi etal also report difficulties in approaching the inferior trunk with complication rate (32). In this study all patients with unintended vascular puncture were either muscular or obese.

Haematoma around the block site occured in 4 patient but resolves spontaneously within 24 hours. The needles used for blocks were not a standardized block needles so probably contributed to the occurrence of these haematomas. Also all 4 patients were overweight hence probably we punctured sublavian artery itself, transverse cervical arteries or dorsal scapular. Identity of the punctured vessel was not recorded. Two patient develops Horners syndrome and both of them had no any special characteristics. Also two patients had pain or paraesthesia, one patient was elderly and the procedure done was wrist reconstruction, and other patient was diabetic for 5yrs on medication. Pain and paraesthesia increases post op neurological symptoms (19). Thus early diagnosis and treatment is important to prevent permanent nerve injuries.

The study also shows there is association of complication with sex. Association was statistically significant with p value 0.02. Complication occured more in female than males. This could be related to obesity, as most females were obese and also females displayed less cooperation during nerve block due to fear of needles as compared to males, which could contribute to this association.

Pneumothorax was not found in any of the patients in this study. Ultrasonography

significantly decrease the risk of pneumothorax and predict resurge in blocks. No patient developed chest discomfort after surgery. Smoking was regarded as risk factors for patients with mild chest discomfort during surgery. Jeonetal in her study shows correlation between smoking and hemidiaphragmatic paresis (44).

Possible reasons for complications occurrence despite the use of ultrasound guided during blocks might relate to specific patient characteristics like larger weight and height, abnormal anatomy, access that was used inplane or outplane, lateral to medial or medial to lateral. Lateral to medial access has less risk of vessels puncture (32). Others possible reason is poor resolution ultrasound which was more of concern in our study. The ultrasound used had relatively poor resolution so we were experiencing difficulties in nerve location especially in obese patients. Another reasons could be patient cooperation, operator skills and experience. Lentersetal demonstrate that complication rate is strongly and inversely correlate to the block performed. Anaesthesiologist who performed more than 100 block noted mean complication rate of 1% while for those who had performed less 100 blocks mean complication rate was 5%, p=0.0015(45).

4.3 Duration of analgesia

In this study the mean duration of analgesia was 211.73=24.79 minutes. Mean duration of analgesia was not statistically significant with type of procedure p value 0.278.

The mean duration of analgesia of this study consisted with mean duration from study done by Pande etal from Nepal, which was 3.5hrs (210 minutes) (41) and 180 to 200 minutes from Dr Dilip study (2). Also the study done from Punam Ranghove to 60 patients with USGSBPB the mean duration ranges from 258 to366 minutes (36). The mean duration was higher in Punam Ranghove's study compared to this study probably due to use of clonidine which prolongs more duration of analgesia.

Ultrasound guided region analgesia prolong duration of analgesia, it reduces opiods use and patients prevented from opioids side effect during early postoperative course. These side effects are constipation, itching respiratory failure and dependency. Also it improves the patient satisfaction with analgesia so improves postoperative course.

4.4 Patient satisfaction

This study found that most patient were satisfied during nerve block 61(72%), higher satisfaction with analgesia 65(77%) and most patient were positive on having awake surgery again 65(77%). Adrian etal reported higher patient satisfaction with the block whereby 84% reported excellent and 16% reported good satisfaction. Also study by Amary Sawy on 60 patients, 90% were satisfied with the technique (26).

CONCLUSION:

In this study the block success rate was high. The block provide very good analgesia that extends for longer time postoperatively. Patients were satisfied with the block and no serious complications were observed. So, if there is no contraindication, the technique offers the best choice for upper extremity procedures especially to patients with cormobities like chronic renal failure and hypertension where general anaesthesia is associated with increased risk.

RECOMMENDATION:

Ultrasound guided supraclavicular block should be routinely done to patients undergoing upper limb procedures in Tanzania. All anaesthetic providers should attain skills and knowledge through training and be able to do ultrasound guided supraclavicular brachial plexus blocks routinely.

STUDY LIMITATION

- Only adult patients were included in this study due to lack of resources for paediatrics.
- Only 86 patients included in this study due to limited resources and limited time. Larger number of patients will give better power to complications like local anaesthesia toxicity and pneumothorax which are less with the use of ultrasound.

REFFERENCES

1. Mirza F, Brown AR. Ultrasound-Guided Regional Anesthesia for Procedures of the Upper Extremity. Anaesthesiol Res Pract. 2011; 2011:1–6.
2. Dr. Dilip K. Supraclavicular brachial plexus block. Indian J Anaesth. 2003; 47(4):287–8.
3. Hanumanthaiah D, Vaidiyanathan S, Garstka M, Szucs S. Ultrasound guided supraclavicular block. J AssocAnaesth Gt Britain Ireland. 2013; 15(3):224–9.
4. Raju PKBC, Grant CRK. Practical aspects of. Anaesth Intensive Care Med [Internet]. Elsevier Ltd; 2016; 17(4):171–4. Available from: http://dx.doi.org/10.1016/j.mpaic.2015.12.010
5. Coventry DM, Chb MB. Brachial plexus blockade. 2002; 2(2):33–6.
6. Gauss A, Tugtekin I, Georgieff M, Keipke D, Gorsewski G. Original Article. J AssocAnaesth Gt Britain Ireland. 2014; 69:327–36.
7. Griffin J, Nicholls B. Ultrasound in regional anaesthesia. J AssocAnaesth Gt Britain Irel. 2010; 65:1–12.
8. Landblad M. Ultrasound-guided regional anesthesia in children and adults Aspects on central and peripheral blocks. 2012.
9. Macfarlane A. Ultrasound Guided Supraclavicular Block. J NYSORA. 2009; 12:6–10.
10. Sites BD, Brull R. Ultrasound guidance in peripheral regional anesthesia : philosophy, evidence-based medicine, and techniques. CurrOpinAnaesthesiol. 2006; 19:630–9.
11. Plunkett a R, Brown DS, Rogers JM, Buckenmaier CC. Supraclavicular continuous peripheral nerve block in a wounded soldier: when ultrasound is the only option. Br J Anaesth [Internet]. 2006; 97(5):715–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16914462
12. Marhofer P. Current concepts of ultrasound in regional anaesthesia. J EurSocAnaesthesiol. 2012; 1:1–4.
13. Sadowski M, Tułaza B, Łysenko L. Renaissance of supraclavicular brachial plexus block. 2014; 46(1):37–41.

14. Liu G, Chen Z, Jia H, Dai Z, Zhang X. The technique comparison of brachial plexus blocks by ultrasound guided with blocks by nerve stimulator guided. 2015; 8(9):16699–703.
15. Perias A. Ultrasound guided supraclavicular block. Anaesthesiol Res Pract. 2009; 34:171–6.
16. Dunitz M. Brachial Plexus Injuries. 2nd ed. Gilbert A, editor. Paris: Taylor and France e-library; 2003. 12-17 p.
17. Aitkenhead A. Text book of Anaesthesia. Spain. Harcourt Publiishers Limited; 2001. p. 1689–99.
18. Russon K, Pickworth T. Upper limb blocks. J AssocAnaesth Gt Britain Irel. 2010; 65(1):48–56.
19. Bruce BG, Green A, Blaine TA, Wesner L V. Brachial Plexus Blocks for Upper. : 38–47.
20. Satapathy AR, Coventry DM. Axillary Brachial Plexus Block. 2011; 2011.
21. Harclerode Z, Michael S. AXILLARY BRACHIAL PLEXUS BLOCK LANDMARK TECHNIQUES TUTORIAL OF THE WEEK 165. North Gen Hosp. 2010 ;(January):1–8.
22. Anish KA. Brachial Plexus Block, a Comparison of Nerve Locator versus Paresthesia Technique. IOSR J Dent Med Sci. 2014; 13(1):6–10.
23. Tsui BCH, Doyle ÆK, Chu K, Pillay ÆJ, Dillane D. Case series : ultrasound-guided supraclavicular block using a curvilinear probe in 104 day-case hand surgery patients ´ rie de cas : bloc supraclaviculaire e ´ choguide ´ avec unesonde Se ´ aire chez 104 patients pour unechirurgie d ' un jour curviline de la main. 2009; 46–51.
24. Zaragoza-lemus G. Peripheral nerve block guided by ultrasound. 2008; 31(4):282–97.
25. Ranganath A, Srinivasan KK, Iohom G. Ultrasound guided axillary brachial plexus block. 2014; 16(3):246–51.
26. Talaat N. Ultrasound-guided supraclavicular versus infraclavicular brachial plexus nerve block in chronic renal failure patients undergoing arteriovenous fistula creation Ultrasound-guided supraclavicular versus infraclavicular brachial plexus nerve block in chroni. Egypt J Anaesth. 2014 ;(September).

27. Beecroft C. Systemic toxic effects of local anaesthetics. Anaesth Intensive Care Med [Internet]. Elsevier Ltd; 2016; 17(4):179–81.
28. Gupta PK, Hopkins PM. Effect of concentration of local anaesthetic solution on the ED 50 of bupivacaine for supraclavicular brachial plexus block †. Br J Anaesth. 2013; 111(March):293–6.
29. Parrington S. decadron_and_mepivacaine.pdf.
30. Jinjil K, Bhatnagar V, Swapna P, Tandon U. Original article Comparative evaluation of Alpha two agonists Dexmedetomidine with Clonidine as adjuvants to 0 . 25 % Ropivacaine for Ultrasound Guided Supraclavicular Block : A randomised double-blind prospective study. 2015 ;(April):20–31.
31. Thomas LC, Graham SK, Osteen KD, Porter HS, Nossaman BD. Comparison of Ultrasound and Nerve Stimulation Techniques for Interscalene Brachial Plexus Block for Shoulder Surgery in a Residency Training Environment : A Randomized, Controlled, Observer-Blinded Trial. Ochsner J. 2011; 11:246–52.
32. Anahi P etal. Ultrasound-Guided_Supraclavicular_Block.pdf. 2009. p. 171–6.
33. Searle A, Niraj G. Ultrasound-guided Brachial Plexus Block at the Supraclavicular Level : A New Parasagittal Approach. 2010; 1(April):19–22.
34. Krutika B. SUPRA-CLAVICULAR BRACHIAL PLEXUS BLOCK : ULTRA- SONOGRAPHY GUIDED TECHNIQUE OFFER ADVANTAGE OVER PERIPHERAL NERVE STIMULATOR. Natl J Med Res. 2013; 3:241–4.
35. Koscielniak-Nielsen Z. A comparison of ultrasound-guided supraclavicular and infraclavicular blocks for upper extremity surgery. J ActaActaAnaesthesiol Scand. 2009; 53:620–6.
36. Raghove P, Singh K, Taxak S, Ahlawat M, Hooda S. Comparison of Ultrasound Guided Technique with Conventional Landmark Technique for Supraclavicular Brachial Plexus Nerve Block in Patients Undergoing Upper Limb Surgery. 2016; 5(1):1–4.
37. Liu SS, Yadeau JT, Shaw PM, Wilfred S, Shetty T, Gordon M. Incidence of unintentional intraneural injection and postoperative neurological complications with ultrasound- guided interscalene and supraclavicular nerve

blocks *. J AssocAnaesth Gt Britain Irel. 2011; 66:168–74.

38. Dale MC, Checketts MR. Complications of regional anaesthesia. 2015; 175–8.
39. Mclure HA, Rubin AP. Review of local anaesthetic agents. J Minerva Anestesiol. 2005; 71:59–74.
40. Bacha UQ, Bashir H, Hassan R, Muneer K, Ara M. Immediate Onset Pneumothorax after Classical Approach to Supraclavicular Brachial Plexus Block- A Case Report. Indian J ClinAnaesth. 2015; 2(September):184–7.
41. Pande R, Pande M, Bhadani U, Pandey CK, Bhattacharya A. Supraclavicular brachial plexus block as a sole anaesthetic technique in children : an analysis of 200 cases. 2000; 55:798–810.
42. Chazapis M, Kaur N, Kamming D. Improving the Peri-operative care of Patients by instituting a ' Block Room ' for Regional Anaesthesia. BMJ QualImprov Rep. 2014; 3:1–4.
43. Williams SR, Chouinard P, Harris P, Ruel M, Boudreault D. Ultrasound Guidance Speeds Execution and Improves the Quality of Supraclavicular Block. J AnesthAnalg. 2003; 97:1518–23.
44. Jeon DG, Kim SK, Kang BJ, Kwon MA, Song JG, Jeon SM. Comparison of ultrasound-guided supraclavicular block according to the various volumes of local anesthetic. Korean J Anaesthesiol. 2013; 64(6):494–9.
45. Lenters TR, Davies J, Iii FAM. The types and severity of complications associated with interscalene brachial plexus block anesthesia : Local and national evidence. 2007; 98195:379–87.
46. Johns R. SQB Methods Fact Sheet 1: Likert Items and Scales. 2010; 1:1–11.
47. Initiative TN, Control P. Wong-Baker FACES Pain Rating Scale. 2009; 3.

APPENDICES

Appendix 1(a): Informed Consent Form (English version)

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

DIRECTORATE OF RESEARCH AND PUBLICATIONS MUHAS

INFORMED CONSENT FORM

ID-NO…….....

Consent to Participate in a Study

Greetings! My name is Dr. Getruda Mwang'amba; I am working on this research with the objective of determining clinical outcomes after ultrasound guided supraclavicular brachial plexus blocks in patients undergoing upper limb surgeries at MOI from July 2016 to January 2017.

Purpose of the study

The study is conducted in partial fulfillment of the requirements for the degree of Master of Medicine in anaesthesia of MUHAS. This study is aiming to determine the duration of analgesia from the block, to asses patents satisfaction with the block, to determine block success by assessment of motor and sensory blocks and also to determine the proportional of complications developed.

You are being asked to participate in this study because your information will help to evaluate the block and compare the benefit with GA, Also your information will help for improving patient safety in our setting. The result of this study can be used as baseline data for comparison with other studies on Ultrasound guided blocks. . Kindly please be honest and true for betterment of the results that could lead to better intervention and recommendations for future.

What Participation Involves

If you agree to join the study, you will be interviewed in order to answer a series of questions in the questionnaire prepared for the study and you will required to sign consent form.

Confidentiality

I assure you that all the information collected from you will be kept confidential. Your name will not be written on any questionnaire or in any report/documents that might let someone identify you. Your name will not be linked with the research information in any way. All information collected on forms will be entered into computers with only the study identification number. Confidentiality will be observed and unauthorized persons will have no access to the data collected.

Right to Withdraw and Alternatives

Taking part in this study is voluntary. You can stop participating in this study at any time, even if you have already given your consent. Refusal to participate or withdrawal from the study will not involve penalty.

Benefits

The information you provide will help to raise awareness on presence and efficiency of ultrasound guided supraclavicular block.

Whom to Contact

If you ever have questions about this study, you should contact the Principal Investigator, **Dr. Getruda Mwang'amba, Phone no: 0754-620120**, of Muhimbili University of Health and Allied Sciences, P. O. Box 65001, Dar es Salaam.

If you ever have questions about your rights as a participant, you may call:

Chairperson of the Senate Research and Publications Committee, P. O. Box 65001, Telephone: 255 22 2152489 Dar es Salaam and Dr. Mbanga who is the supervisor of this study by phone no: +255754288644.

Signature…….....

Do you agree?

Participant agrees ……..Participant does NOT agree …….

I ……..... have read the contents in this form. My questions have been answered. I agree to participate in this study.

Signature of participant……

Signature of Research Assistant……...

Date of signed consent……..…

Appendix 1 (b): Informed Consent Form (Kiswahili version)

CHUO KIKUU CHA SAYANSI ZA AFYA MUHIMBILI

KURUGENZI YA TAFITI NA UCHAPISHAJI

FOMU YA RIDHAA

Namba ya utambulisho:.....

Ridhaa ya kushiri kwenye utafiti

Habari! Ninaitwa Dr Getruda Mwang'amba nafanya utafiti wenye lengo la kutathmini matokeo kwa wagonjwa wa naofanyiwa upasuaji wa mkono kwa kupewa ganzi kwa msaada wa ultrasound.

MadhumuniyaUtafiti

Utafiti huu unafanyika katika kutimiza sehemu ya matakwa ya shahada ya uzamili ya matibabu kitengo cha usingizi (Anaesthesia) Chuo Kikuu cha Afyana Sayansi ya Tiba Muhimbili. Unaombwa kushiriki katika utafiti huu ili tuweze kupata matokeo ambayo yatatusaidia kujua kwa undani njia hii ili kujua faida zake kulinganisha na njia zingine. Matokeo ya utafiti yataweza kutumika kama mwongozo watafiti zinginezo zijazo na pia yatasaidia kuboresha huduma zaganzi.

Jinsiyakushiriki

Ukikubali kushiriki katika utafiti huu, utasailiwa ili kuweza kujibu maswali toka kwenye dodoso lililoandaliwa na utajaza form ya ridhaa ya kushiri

Usiri

Taarifa zote zitakazokusanywa kupitia dodoso zitaingizwa kwenye ngamizi kwa kutumia namba za utambulisho .Kutakuwa na usiri na hakuna mtu yeyote asiyehusika atakayepata taarifa zilizokusanywa. Uhuru wa kushiriki na haki ya kujitoa;

Kushiriki kwenye utafiti huu ni hiari.

Nani wa kuwasiliana naye?

Kama una maswali kuhusiana na utafiti huu, wasilianana:

Mtafiti mkuu wautafiti huu, Dr. Getruda Mwang'ambawa Chuo Kikuu cha Afyana Sayansi ya Tiba Muhimbili, S. L. P. 65001, Dar es Salaam, Simu: 0754-620120.

Mwenyekiti wa kamati ya Utafitina Uchapishaji, S.L.P 65001, Simu: 255 22 2152489 Dar es Salaam

Au msimamizi wa utafiti huu Dr. Fredrick Mbanga. (Simu: +255754288644)

Sahihi: ..... (Kama umekubali kushiriki

Weka sahihi).

Mshiriki amekubali ……..... Mshiriki hajakubali.....

Mimi..... nimesomama elezo ya fomu hii nimeielewa na nimekubali kushiriki katika utafiti huu.

Sahihi ya mshiriki……

Sahihi ya mtafiti msaidizi……

Tarehe ya kutia sahihi kwenye utafiti.....

RESEARCH TOOL.

A: **Pre-anesthetic evaluation form: (**Clinical survey)

PATIENT ID. NO:	
DATE	
AGE (YRS)	
SEX	
WEIGHT (KG)	
HEIGHT(CM)	
BMI	
ASA PHYSICAL STATUS	
CIGARETE SMOKING	a) Yes b) No
ALCOHOL	a) Yes b) No
EDUCATIONAL LEVEL	a) Primary b) Secondary c) University d) Others
OCCUPATIONAL	a) Employed -Public -Private b) Non employed c) Student
SURGICAL	a) Procedure:

PROCEDURE	b) Site of surgery:							
PHYSICAL EXAMINATION (FOR 30MINS)	VITAL SIGNS	Before Block	5 (mins)	10 (mins)	15 (mins)	20 (mins)	25 (mins)	30 (mins)
	PR							
	BP							
	RR							
	SPO2							
PHYSICAL EXAMINATION (AFTER 30 MINS)	VITAL SIGNS	45 (mins)	60 (mins)	75 (mins)	90 (mins)	105 (mins)	120 (mins)	End of Surgery
	PR							
	BP							
	RR							
	SPO2							
DURATION OF SURGERY	Start time: End time:							

B. OBSERVATIONAL CHECKLIST (**Clinical survey**)

I. ASSESSMENT OF SENSORY AND MOTOR

a) SENSORY (Tick where appropriate)

GRADE

TIME(MIN)	NERVES	1.NO DIFFERENCE	2.SOME DIFFERENCE	3. NO SENSATION
0	I. MCS II. ULNAR III. MEDIAN IV. RADIAL	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……
10	I. MCS II. ULNAR III. MEDIAN IV. RADIAL	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……
20	I. MCS II. ULNAR III. MEDIAN IV. RADIAL	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……
30	I. MCS II. ULNAR III. MEDIAN IV. RADIAL	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……

DURATION FOR SUCCESSFUL BLOCK (MIN)……

b) MOTOR(Tick where appropriate)

GRADE

TIME (min)	NERVES	1.NORMAL POWER	2.REDUCED POWER	3. COMPLETE LOSS OF POWER
0	V. MCS VI. ULNAR VII. MEDIAN VIII. RADIAL	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……
10	V. MCS VI. ULNAR VII. MEDIAN VIII. RADIAL	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……
20	V. MCS VI. ULNAR VII. MEDIAN VIII. RADIAL	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……
30	V. MCS VI. ULNAR VII. MEDIAN VIII. RADIAL	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……	I…….. II…….. III…… IV……

DURATION FOR SUCCESSFUL MOTOR BLOCKADE (MIN)…….

II. BLOCK SUCCESS(Tick where appropriate) (clinical survey)

Satisfactory	Unsatisfactory	Failure

III. DURATION OF ANAELGESIA(min)

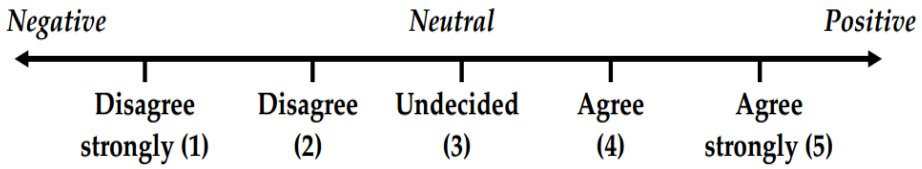
Block success time	First analgesia request

IV. PATIENT SATISFACTION(Tick where appropriate) (Questionnaire)

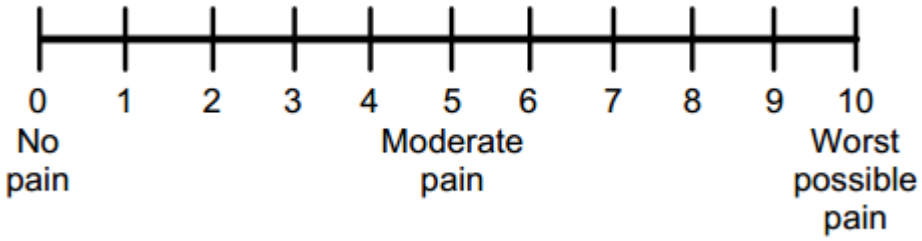
PATIENTS QUESTIONNAIRE RESPONSE	Disagree strongly (1)	Disagree (2)	Undecided (3)	Agree (4)	Agree strongly (5)
Were you comfortable during the nerve block?					
Were you comfortable during surgery?					
Were you comfortable with pain relief					
Would you have awake surgery again?					

V. SATISFACTION SCALE

(Five point Likert scale (46))



VI. VISUAL ANALOGUE SCALE(Tick where appropriate)



(47)

	Recovery (00 time)	Breakthrough analgesia time
NO PAIN (0)		
MILD PAIN (1-4)		
MODERATE PAIN (5-7)		
WORST PAIN (8-10)		

VII. COMPLICATIONS(Tick where appropriate)(Clinical survey)

a) Intra-opp complications……..…
……
……
……

b) Recovery complications……..…
……
……

c) Ward complications……
……
……

COMPLICATION
DIB
COUGH
CHEST PAIN
DRUG SIDE EFFECT
HEMATOMA AROUND THE BLOCK SITE
HORNER'S SYNDROME (PTOSIS,MIOSIS,UNHIDROSIS)
MUSCLE WEAKNESS
HEMIDIAPHRAGMATIC PARESIS
UNINTENDED VASCULAR PUNCTURE(BLOOD ASPIRATION)