PROPORTION, INDICATIONS AND COMPLICATIONS OF COMPLEX PRIMARY TOTAL HIP ARTHROPLASTY AT MUHIMBILI ORTHOPEDIC INSTITUTE

JANUARY 2015 – DECEMBER 2019

JOHN NKINDA, (MD)

Mmed (Orthopaedic and Traumatology) Dissertation
The Muhimbili University of Health and Allied Sciences

October, 2021

..

Muhimbili University of Health and Allied Sciences

Department of Orthopaedic and Traumatology

SCHOOL OF MEDICINE

PROPORTION, INDICATIONS AND COMPLICATIONS OF COMPLEX PRIMARY TOTAL HIP ARTHROPLASTY AT MUHIMBILI ORTHOPEDIC INSTITUTE JANUARY 2015 – DECEMBER 2019

By

John Nkinda

A Dissertation Submitted in (Partial) Fulfilment of the Requirements for the Degree of Master of Medicine (Orthopaedics and Traumatology)
The Muhimbili University of Health and Allied Sciences

October, 2021

CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled ″Proportion, indications and complications of complex primary total hip arthroplasty at Muhimbili Orthopaedic Institute January 2015 to December 2019″, in (partial) fulfillment of the requirement for the degree of Masters of Medicine (Orthopaedics and Traumatology) of Muhimbili University and Allied Sciences.

_____

Dr. Billy Thompson Haonga (MD, Mmed, FCS, ECSA)
(Supervisor)

_____

Date

DECLARATION AND COPYRIGHT

I, John Nkinda declare that, this dissertation is my original work and that it has not been presented and will not be presented to any other university for similar or any other degree award

Signature …… **Date ……..**

ACKNOWLEDGEMENT

First and foremost, I would like to express my thanks to Almighty God for granting me physical and mental health throughout my study period.

I would also wish to humbly extend my sincere gratitude to my supervisor and mentor, Dr. Billy Thomson Haonga for his patience, advice, and intellectual guidance throughout my postgraduate training as well as the development of this work.

Thanks to the executive director of MOI Dr. Respicious Boniface for allowing me to conduct my study within the institute. I also thank MUHAS and MOI academic staff for their valuable inputs and cooperation in the preparation of this work. To my fellow postgraduate students, no words can be enough to express my appreciation for their kindness and cooperation throughout my training.

Special thanks to my lovely wife, Tulizo Josia Mbwilo for her tender support. She was always there taking good care of the family in my absence. Thanks to my daughter Tumpale and sons Lugano and Hezron, they were the source of happiness throughout this tough period of my studies. My father Hezron Tuvulile Nkinda, my mother Josephine Joseph Konga and my father in-law Josia Job Mbwilo. May God bless them for their prayers and encouragement.

DEDICATION

This work is dedicated to;

My parents; Mr. Hezron Tuvulile Nkinda and Mrs. Josephine Joseph Konga

My father in-law; Mr Josia Job Mbwilo

My lovely wife; Tulizo Josia Mbwilo

My daughter; Tumpale

My sons; Lugano and Hezron

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBBRIVIATIONS

AVN	Avascular Necrosis
CT	Computed Tomography
DDH	Developmental Dysplasia of Hip
FAI	Femoral Acetabular Impingement
FNF	Femoral neck fractures
HD	Hip dislocation
HIV	Human Immunodeficiency Virus
IRB	Institute Review board
LCPD	Leg-Calve-Perthes disease
MOI	Muhimbili Orthopaedic Institute
MRI	Magnetic Resonance Imaging
MUHAS	Muhimbili University of Health and Allied Sciences
OA	Osteoarthritis
ON	Osteonecrosis
RA	Rheumatoid arthritis
SCD	Sickle Cell Disease
SPSS	Statistical Package for the Social Sciences
THA	Total Hip arthroplasty
THR	Total Hip replacement

DEFINITION OF TERMS

Complex total hip replacement	A complex primary THR is defined as primary THA in hips with compromised bony or soft-tissue states
Primary total hip replacement	Primary total hip replacement is a surgical procedure done to a virgin hip involving replacing both acetabular and femoral head with prosthetic implants.
Total hip replacement	Total hip replacement is a surgical procedure involving replacing both acetabular and femoral head with prosthetic implants.

ABSTRACT

Background

Complex primary total hip arthroplasty surgeries are becoming more common in our settings. They involve hips with compromised bony and soft tissue states. These surgeries are technically demanding and may accompany several intraoperative challenges including prolonged duration of surgery as well as excessive blood loss. Neither in Tanzania nor in East Africa, the proportion and indications of complex primary total hip replacement are known.

Objective: To determine the proportion and indications of complex primary THR at MOI between January 2015 and December 2019.

Methodology: This was a cross-sectional retrospective hospital-based study, conducted at Muhimbili Orthopedic Institute (MOI**).** Records of 374 patients who underwent primary total hip replacement between January 2015 and December 2019 were reviewed. Information on socio-demographic characteristics, diagnosis, duration of surgery, and intraoperative blood loss were extracted. Data analysis was done using SPSS version 20 computer software.

Results: A total of 181(48%) out of 374 patients underwent primary THA within a specified period had complex primary THA. The average age was 55 years (16 to 95 years) with the male being 100(55.25%) and females 81(44.75%). Femoral neck fractures constituted the majority 79(43.7%) of the indications of complex primary THA followed by avascular necrosis 77(42.5%) and other indications were neglected hip dislocation 9(5.0%), implant failure 8(4.4%), giddlestone 3(1.7%), bone cyst 2(1.1%), acetabular fracture 2(1.1) as well as femoral acetabular impingement 1(0.6%). Mean duration of surgery in complex primary THA was 139.96 minutes and average intraoperative blood loss was 770.58

Conclusion; Complex primary THA surgeries are frequently done in our settings. Common indications of complex primary total hip arthroplasty are femoral neck fractures

and avascular necrosis. Because of altered anatomy, there is prolonged duration of surgery and increased intraoperative blood loss in complex primary THA surgeries. Detailed preoperative planning should be done to minimize the complications associated with complex primary THA

CHAPTER ONE

1. INTRODUCTION

Total hip replacement (THR) has been recommended in the treatment of both primary and secondary hip arthritis and results in generally good outcome(1). Because of increased rates of THR all over the world(2), complex primary THR is becoming more frequent(3). Studies show a wide range of indications and patterns of complex primary THR surgeries(3–5). Total hip replacement surgeries in complex hips are technically demanding and associates with a wide range of complications(6–9). Therefore, proper preoperative preparation is required.

1.1 Background

A complex primary THA can be defined as primary THA in patients with compromised bony or soft-tissue states(5). A complex hip includes but not limited to dysplastic hip, ankylosed hip, prior hip fracture, acetabular protrusion, skeletal dysplasia, and previous bony procedures about the hip(3,5).

The following are examples of some of the complex hips

Developmental Dysplasia of Hip (DDH)

DDH is a spectrum of anatomical abnormalities of the hip joint in which the femoral head has an abnormal relationship with the acetabulum. Most studies report an incidence of 1 to 34 cases per 1,000 live births and differences could be due to different diagnostic methods and timing of evaluation(10). Some children may have a normal femoral-acetabular relationship at birth and only later go on to develop a dysplastic hip(11).

The diagnosis of hip dysplasia has traditionally been based on the radiographic evaluation. Radiography has been used as the mainstay for the diagnosis of hip dysplasia because of its lower cost and easy accessibility. Computed Tomography (CT) scan and Magnetic

Resonance Imaging (MRI) can also be employed. Management depends on severity and age at which the diagnosis is made(13).

Ankylosed hip

Hip ankylosis is a partial or complete hip joint stiffness. Ankylosis of the hip can occur spontaneously or be acquired surgically(5). Patients with ankylosed hip may present with pain, functional disability, leg length discrepancy, and osteoarthritis of other adjacent joints (especially the lumbar spine and knees) due to the deformity(14). Proper physical examination and imaging help in the diagnosis. Treatment options for ankylosed hip include arthrodesis as well as total hip replacement.

Protrusio acetabuli

Protrusio acetabuli (Protrusion of acetabular) is a hip joint deformity in which the medial wall of the acetabulum invades into the pelvic cavity, with associated medial displacement of the femoral head. The gradual deepening of the acetabular cavity is caused by primary idiopathic and secondary neoplastic, infectious, metabolic, inflammatory, traumatic, and genetic disorders(15). Diagnosis is made based on an anteroposterior radiograph of the pelvis that demonstrates a center-edge angle greater than 40 degrees and medialization of the medial wall of the acetabulum past the ilioischial line (Kohler's line). Treatment involves triradiate fusion (occasionally combined with intertrochanteric osteotomy) for the skeletally immature patient. report that in early phases corrective valgus osteotomy of the proximal femur would have a place for reducing the degree of the protrusion. For patients with more advanced arthritis, total hip replacement with lateralization of the cup to a normal position provides a predictable long-term solution(16).

Hip Fractures

A hip fracture is a break occurring at the top of the femur, close to the hip. Hip fractures are usually caused by force. In people with healthy bones, a strong force is required to fracture the bone, but in people with conditions such as osteoporosis, a small amount of

force can cause a hip fracture (known as 'minimal trauma fracture')(17). The average age of patients with hip fractures is over 80, and nearly 80% are women. Injuries have a multifactorial origin, and they reflect an increased tendency to fall, loss of protective reflexes, and reduced bone strength(18). Most hip fractures are readily diagnosed by a history of a fall that led to a painful hip, inability to walk, or an externally rotated limb, and plain radiographs of the hip that confirm the diagnosis. Magnetic resonance imaging is currently the investigation of choice in fractures that cannot be picked by plain radiography(19). According to Garden Intracapsular fractures are classified into four types depending on the displacement on radiographic findings(20). Prosthetic replacement is generally preferred in older patients with displaced fractures(Garden types 2 and 3)(18).

Avascular necrosis of femoral head (AVN)

Avascular necrosis also defined as Osteonecrosis (ON), or aseptic necrosis, is characterized as bone cell death that follows an impairment of the blood flow to the bone from a traumatic or non-traumatic origin(21). A study done by Petek et al revealed that there about 10000 to 20000 new cases of AVN are being reported each year in the United States. The average age of the affected patients is 47 years and there is a male to female ratio of 3:1(21). Risk factors for femoral avascular necrosis are smoking, alcohol, trauma, and corticosteroids and others are idiopathic(22). Others are systemic lupus erythematosus, coagulation disorders, HIV, hemoglobinopathy, metabolic disorders, chemotherapy, radiation, and pregnancy(23). The diagnosis of ON is primarily based on imaging findings. Nevertheless, a careful history should be taken to screen for potential risk and/or prognostic factors. However, the onset of the disease is insidious and the symptoms and signs are usually minimal and nonspecific until it becomes advanced. Therefore, a high index of suspicion may contribute to an early diagnosis(23). MRI is considered the imaging method of choice with the highest sensitivity and specificity compared to plain radiographs, computed tomography, or scintigraphy

There are more than 16 classifications of ON, however, Ficat and Arlet are the one will be used in this study. Treatment of ON depends on the severity of the condition and THR is recommended in the treatment of stages 3 and 4.

Ficat and Arlet classification

Stage	Findings
1	Normal radiograph
2	Normal femoral head sphericity. Some signs of bone remodeling such as cysts or osteosclerotic regions
3	Subchondral collapse or flattening of the femoral head
4	Degenerative changes are seen in the acetabulum with narrowing of the joint space

1.2 Problem statement

Total hip arthroplasty is now becoming a common procedure in our setting and it also involves complex hips. Complex primary total hip arthroplasty apart from being a technique demanding procedure also associates with intraoperative complications such as prolonged duration of surgery as well as increased intraoperative blood loss. Globally, studies are showing variation in proportion and indications of complex primary total hip arthroplasty. However, in our setting little is known on the magnitude and pattern of primary complex total hip arthroplasty. Inadequate local data on complex primary total hip arthroplasty not only hinders surgeons from proper preoperative planning but also limits the institute to procure required prosthesis and poses difficulties to laboratory personnel in proper preparation for required perioperative blood transfusion hence jeopardized surgical outcome.

1.3 Rationale

The proportion and indications of complex total hip replacement at MOI is not known. Therefore, the results of this study will give general knowledge on the profile of complex primary total hip arthroplasty. Results of this study will also enlighten the operating team and MOI management on common indications of complex primary THA hence help in proper perioperative preparations as well as in procuring required prostheses for better surgical outcomes. The results of this study will give a baseline for further studies.

1.4 Conceptual framework

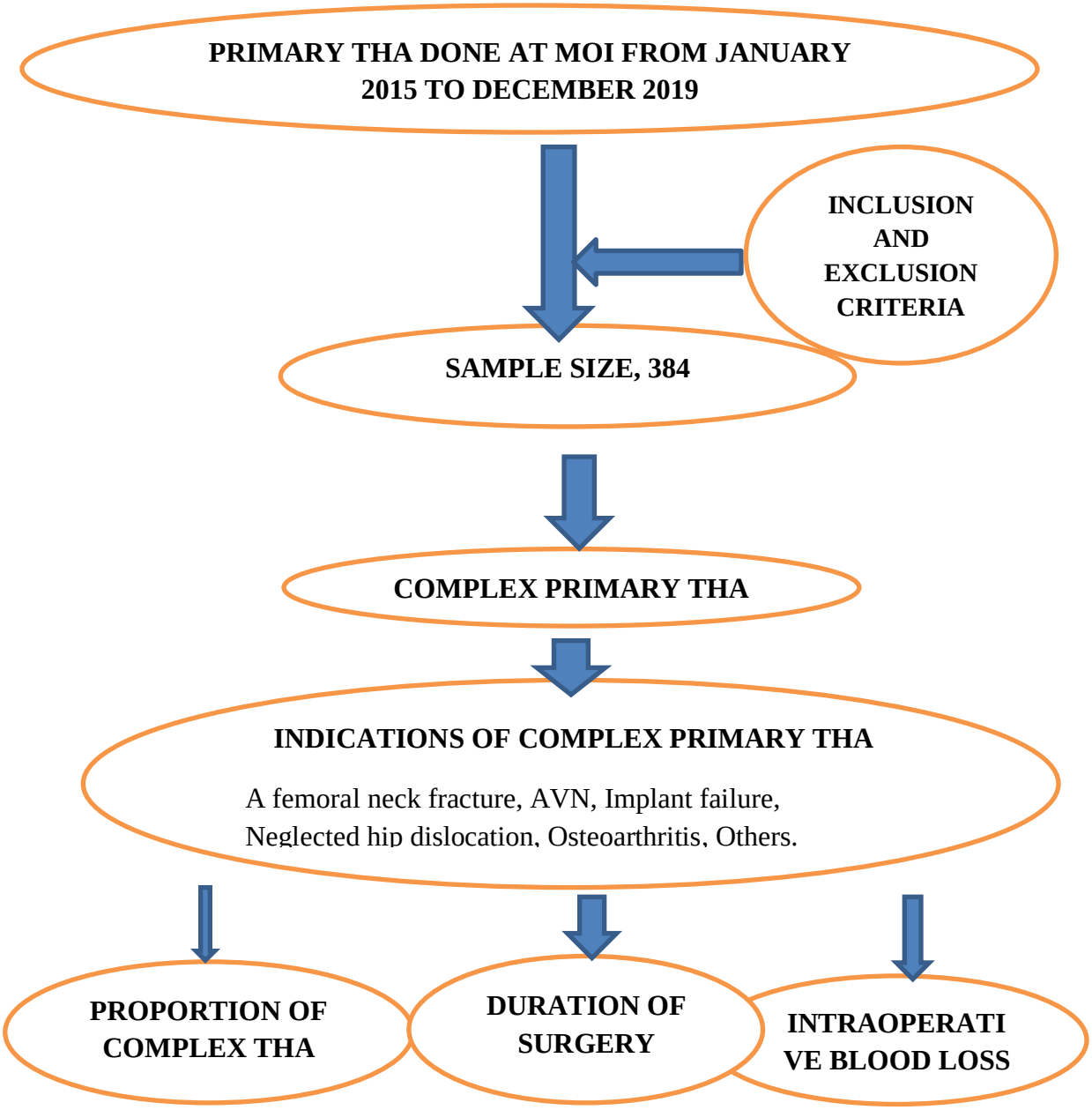


Figure 1: A conceptual framework

Showing different indications of complex primary THA and their effects on the proportion of complex THA as well as how they can influence the duration of surgery and the intraoperative blood loss. Complex primary THA is being reported to be associated with prolonged duration of surgery as well as increased intraoperative blood loss.

1.5 Research Questions

i. How common are complex primary total hip replacement surgeries at Muhimbili Orthopaedic Institute?

ii. What are the indications of complex primary total hip arthroplasty surgeries at Muhimbili Orthopaedic Institute?

iii. How complex primary total hip arthroplasty affects the duration of surgery and intraoperative blood loss?

1.6 Objectives

1.6.1 Broad objective

To determine the proportion, indications and complications of complex primary total hip arthroplasty at Muhimbili Orthopaedic Institute between January 2015 and December 2019.

1.6.2 Specific objectives

i. To describe demographic characteristics of patients undergoing complex primary total hip arthroplasty at Muhimbili Orthopaedic Institute
ii. To establish the proportion of complex primary total hip arthroplasty at Muhimbili Orthopaedic Institute
iii. To determine the indications of complex primary total hip arthroplasty at Muhimbili Orthopaedic Institute
iv. To determine the duration of surgery in complex primary total hip arthroplasty at Muhimbili Orthopaedic Institute
v. To determine intraoperative blood loss in complex primary total hip arthroplasty at Muhimbili Orthopaedic Institute

CHAPTER TWO

2 LITERATURE REVIEW

Demographic characteristics

Demographic characteristics of patients undergoing complex primary total hip arthroplasty slightly vary from one study to another. A study done in Australia by Biant et al shows the mean age of patients at the time of surgery is 52.6 years (23 to 81) and male to female ratio is almost 1:1(24). On other hand, Anyaehie et al are pointing out that the age of patients undergoing complex primary total hip arthroplasty ranges from 18 to 76 with a mean of 44.6 years. It is also pointing out that the male to female ratio is 1:1 with the left hip more common 57.6% than the right hip 42.4%(3).

However, there are no studies from either East Africa or Tanzania which show demographic characteristics of patients undergoing complex primary THA surgeries.

From reviewed studies, there is variation in age distribution among patients undergoing complex primary total hip replacement. On the other hand, studies are showing that there is no sex difference as far as complex primary total arthroplasty. Data from this objective will help in knowing the age and sex distribution among patients undergoing complex THA at MOI.

The proportion of complex primary THA

The proportion of complex primary total hip arthroplasty greatly varies from place to place. A descriptive study conducted by Lee et al in Korea shows that out of 818 primary total hip arthroplasty done 786(96%) involved complex hips(25). On the other hand, a study done by Anyaehie et al at a tertiary institution in Nigeria is showing that the proportion of complex primary total hip arthroplasty is 43.4%(3).7.

The literature review has shown beyond doubt that complex primary total hip arthroplasty surgeries are common worldwide. Yet, little is known about East African countries as it has been rarely reported. The need to know the proportion of total hip arthroplasty in our

settings is obvious, as we don't have any study done not only in Tanzania but also East African. Knowing its magnitude in our country will be used as a key towards finding solutions for improving services. Data on this objective will also be used as a baseline for further studies.

Indications of complex primary THA

Lee et al in his study done in Korea reported that AVN of the femoral neck is the commonest 365(44.6%) indication of complex primary THA followed by Post-traumatic arthritis 84(10.3%), Leg-Calve-Perthes disease (LCPD) 71(8.7%), then DDH and Femoral Acetabular Impingement (FAI) each contributing 52(6.7%), Rheumatoid arthritis(RA) 41(5%) and others 82(10.3%)(25). According to Biant et al, the commonest indication for complex primary THR in Australia is DDH contributing 27(49%) of cases. Other indications are ON of hip 6(11%), OA with anatomical abnormality 5(10%), and others 2(4%)(24). A study done in Nigeria by Anyaehie et al AVN of the head of the femur from SCD is the most common (23.7%) indication of complex primary THA. Old unreduced hip dislocation and old hip fracture non-union are the second most indications each contributed 10.2% and other indications contributed 18.7%(3). Generally AVN as one of the cause of complex hips appears to be among top three indications of primary THA in majority of the studies(26–28)

There is a variation of indications of complex primary total hip arthroplasty from one study to another. However, the literature on indications of complex primary THA from either East Africa or Tanzania is not available. Data from this objective will help surgeons to know common conditions that result in complex hips among patients attending at MOI. This will also help the institute while planning procurement of surgical instruments and prostheses as some of the conditions may need special implants.

Duration of surgery in complex primary THA

Altered anatomy as it appears in complex hips puts surgeons into technique difficulties hence the prolonged time of surgery. While Miao et al in their study done in China shows

an average duration of primary THA of just 89 minutes(29), Anyaehie et al reported an average time of complex primary THA to be 188 minutes(120 – 300 minutes)(3). On other hand, a study done by Kingori et al in Kikuyu hospital Kenya is showing that an average primary THA surgery takes between 60 minutes and 90 minutes but complex primary THA takes up to 210 minutes(30). Study done by Clarke et al on total replacement of the hip for avascular necrosis in sickle cell disease also showed an average duration of surgery to be prolonged to three hours and twenty minutes(31). The same effect reported by Mathews et al and Morice et al in which an average duration of surgery in conversion of failed intramedullary hip screw fixation total hip arthroplasty resulted into prolonged duration of surgery up to 166 minutes and 110 respectively (32)(33).

Studies are showing that complex primary total hip arthroplasty is associated with prolonged duration of surgery. Unfortunately, we don't have a trend in our settings. Data on this objective will help surgeons to establish a proper perioperative plan on how to tackle possible intraoperative challenges so that duration of surgery can be kept to a minimum possible.

Blood loss in complex primary THA

Total hip arthroplasty is known to be among the top on the list is causing excessive intraoperative blood loss(34). Intraoperative blood loss in complex THA is more serious than normal THA. A study done by Anyaehie et al on complex THA shows means intraoperative blood loss of 1600ml(3). While Ugbeye et al reported a mean intraoperative blood loss in primary THA to be 1222.7 ml(7), Alberth et al did a study in Sweden which shows that an average intraoperative blood loss among patients undergoing THA is 720 ml(35). A study done in China by Miao et al shows a mean total blood loss of 1155+/-377ml(29).

Generally, studies show an increase in intraoperative blood loss among patients undergoing complex primary total hip replacement. This is due to a compromised state of bone and

soft tissues. Findings from this objective will help the operating team to be well prepared for possible perioperative and intraoperative blood transfusions.

CHAPTER THREE

3 METHODOLOGY

3.1 Study design

Hospital-based retrospective cross-sectional study.

3.2 Study area

The proposed study was conducted at Muhimbili Orthopedic Institute (MOI) in Dar es Salaam, Tanzania. MOI is the largest Orthopedics and trauma referral center in Tanzania, which offers both Orthopedics and Neurosurgery services. Recently MOI have a capacity of 360 beds (64 privates and 296 general) and 9 operating rooms. In the department of Orthopedics and Traumatology, there are two firms (firm A and firm B) that carry out THA surgeries. Total hip arthroplasty surgeries are being done at MOI since 2004. MOI has 5 arthroplasty surgeons and THA are done in a minimum of four days per week.

3.3 Study population

All patients who underwent primary THA from January 2019 to December 2019

3.3.1 Inclusion criteria

Patient who underwent primary total hip arthroplasty within a specified period of time

3.3.2 Exclusion criteria

Patients with missing one or more of the following information in their records. Age, sex, diagnosis, duration of surgery, and blood loss.

3.4 Sampling technique

Convenient sampling involved all patients who underwent primary THA and registered in the theater total hip registry from January 2015 to December 2019.

3.5 Sample size

From a pilot study done at MOI from December 2018 to March 2019, the proportion of complex primary THA was 43.4%. In considering the study power of 95%, a random likely error is estimated to be 5%, thus the sample size of was calculated from Fischer's formula;

$$n = \frac{Z^2 p(1-p)}{e^2}$$

Where;

n =Sample size

p =Proportion = 0.43

e =Margin of tolerable error 0.05

Z =Confidence level 1.96

$$n = \frac{1.96^2\ 0.43(1-\ 0.43)}{0.05^2}$$

$$= 384$$

384 patients who met the study criteria were to be enrolled in the study.

3.6 Data collection process

Data extraction forms were used as data collection tools. Records of 374 patients who underwent primary THA between January 2015 and December 2019 were reviewed. Information on socio-demographic characteristics (age, gender, and side operated), diagnosis, duration of surgery, and intraoperative blood loss were extracted from THA theater registry. Data analysis was done using SPSS computer software version 20.

3.7 Dependent variables

The proportion of complex THA, duration of surgery, and intraoperative blood loss

3.8 Independent variables

Age, sex, and indications of primary total hip arthroplasty

3.9 Data Management

Data extraction forms were coded before data entry then entered into Microsoft excel on daily basis.

3.10 Data Analysis

Data analysis was done using SPSS software version 20. Continuous variables like duration of surgery and intraoperative blood loss of patients were expressed as mean ± SD (standard deviation) and comparison was done using the T-test, *P*-value of <0.05 was regarded as significant.

3.11 Ethical consideration

Ethical clearance was obtained from the Muhimbili University of Health and Allied Sciences (MUHAS) Institute review board (IRB) before study commencement. Permission to conduct the study was requested from MOI administration.

CHAPTER FOUR

4 RESULTS

4.1 Social-demographic characteristics

A total of 374 patients' records who underwent primary total hip arthroplasty between January 2015 and December 2019 were reviewed. Of 374 patients who met inclusion criteria, 181 had complex primary THA. The mean age at the time of surgery was 55 and most 70(38.67%) primary total hip arthroplasty surgeries were done to patients at the age group of 55 to 74 years. Although male to female ratio was almost 1:1, male operated more 100(55.25%) than female. (Table 1)

Table 1: Social-demographic characteristics of patients who had complex primary THA from the year 2015 to 2019. (n = 181)

Variable	Frequency	Percentage
Gender		
Male	100	55.25
Female	81	44.75
Age group		
15 to 34	45	24.86
35 to 54	40	22.1
55 to 74	70	38.67
75 and above	26	14.36

4.2 The proportion of complex primary THR

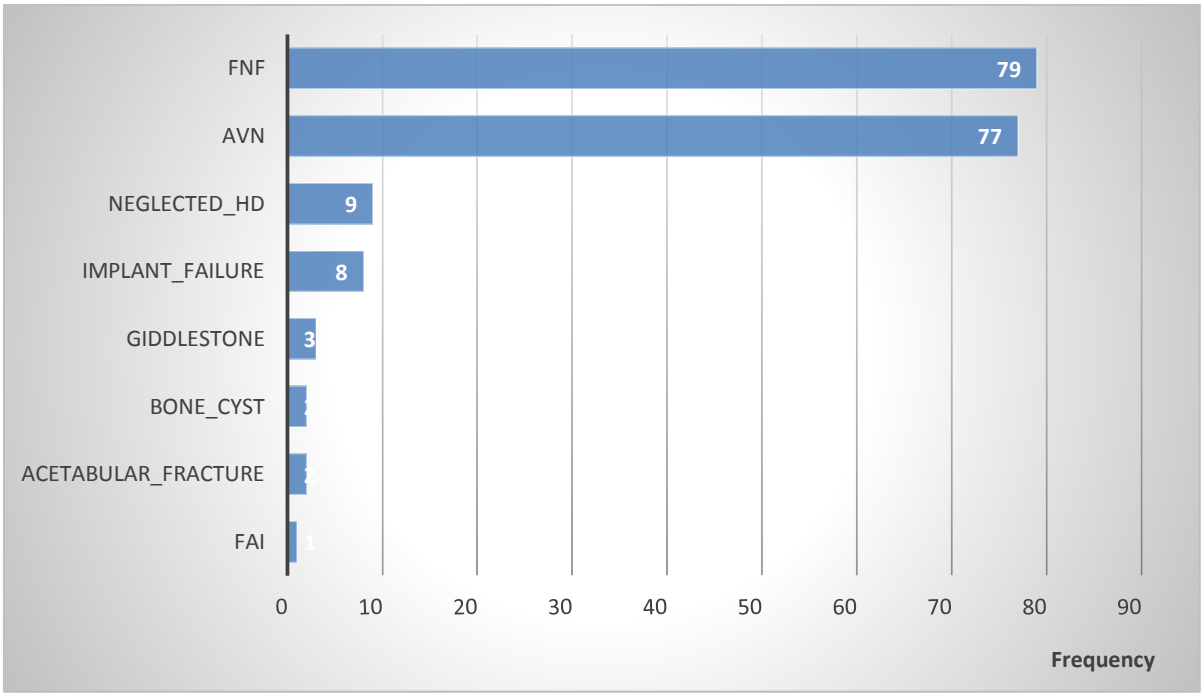
One hundred and eighty-one complex primary total hip replacement surgeries were done. This constitutes 48% of the total 374 primary total hip arthroplasty done within the specified period. Complex total hip arthroplasty surgeries were common among males 100(55.3%) compared to females 81(44.7%). The majority of patients 70(38.7%) who

underwent complex primary total hip arthroplasty aged between 55 and 74 years and there were only 26(14.4%) complex primary total hip arthroplasty done on patients aged 75 years and above.

4.2.1 Indications of complex primary THR

Common indications for complex primary total hip arthroplasty are femoral neck fractures 79(43.7%) and avascular necrosis 77(42.5%). Femoral acetabular impingement contributes the least of all. Other indications are as shown in *Figure 1* below. Femoral neck fractures and avascular necrosis are common in males [41(52.00%) and 40(52.00%)] than in female [38(48.00%) and 37(48.00%)] respectively. While avascular necrosis is common among patients aged 15 to 34 years, femoral neck fractures are common among patients aged 55 to 74 years. (Table2).

Figure 2: Indications of complex primary total hip arthroplasty among patients operated on from the year 2015 to 2019. (n = 181)



FNF- Femoral Neck Fractures, AVN – Avascular Necrosis, HD – Hip Dislocation, FAI- Femoral Acetabular Impingement

Table 2: Distribution of common indications of total hip arthroplasty with respect to gender and age, AVN (n=77), FNF (n=79)

Variable	AVN n (%)	FNF n (%)	Others n (%)	P-value
Gender				
Male	40(52.00)	41(52.00)	19(76.00)	0.08
Female	37(48.00)	38(48.00)	6(24.00)	
Age group				
15 to 34	31(40.26)	8(10.13)	6(24.00)	<0.001
35 to 54	18(23.38)	16(20.25)	6(24.00)	
55 to 74	23(29.87)	39(49.37)	8(32.00)	
75 and above	5(6.49)	16(20.25)	5(20)	

4.2.2 Duration of surgery in complex primary THR

The mean duration of complex primary total hip arthroplasty surgeries was 139.96 minutes and that of non-complex total hip arthroplasty was 124.61 minutes (p-value < 0.002). (Table 3)

4.2.3 Blood loss in complex primary THR

Mean blood loss in complex and non-complex primary total hip arthroplasty was 770.58 milliliters and 673.40 milliliters respectively. (Table 3). An average blood loss among males and female was 768.99 and 662.74 milliliters respectively.

Table 3: The mean and median of both duration of surgery and blood loss for complex and non-complex THA.

Variable	Mean (SD)	Median (IQR)	Min - Max	P value
Duration in minutes				
Complex	139.96(54.37)	130(100 - 164)	54 - 350	0.002
Non-Complex	124.61(43.46)	117(90 - 148)	60 - 295	
Blood loss in milliliters				
Complex	770.58(424.99)	700(500- 1000)	200 - 3000	0.003
Non-Complex	673.36(426.23)	500(400- 800)	150 - 3800	

CHAPTER FIVE

5 DISCUSSION

5.1 Social demographic characteristics

This study shows the mean age of patients who underwent complex primary total hip arthroplasty to be 55 years with the male to female ratio being 1:1. These findings are similar to those published by Biant et al(24) whereby the mean age of patients at the time of surgery was 52.6 years with the male to female ratio being 1:1. Although Anyaehie et al reported a male to female ratio of 1:1 similar to this study, the mean age at the time of operation was relatively smaller (44.6 years)(3). The difference in this mean age could be due to extremes (16 to 95) in age distribution in this study. No bilateral complex primary THA identified on this study

5.2 The proportion of complex primary THA

The proportion of complex primary total hip arthroplasty is 48%. This proportion corresponds with a study done by Anyaehie et al in which the proportion of complex primary total hip arthroplasty was reported to be 43.4%(3). On other hand, Lee et al reported a large (496%) proportion of complex primary total hip arthroplasty(25). This difference could be due to geographical differences in the study settings.

5.2.1 Indications of complex primary THA

Although there are some variations of indications, in this study it was found that femoral neck fracture and AVN are top on the list. These findings correlates with studies done by Lee et al and Anyaehie et al in which AVN was also found to be the common cause of complex hip(3)(25). In his study, Anyaehie et al reported that femoral neck fractures were the second most common cause of complex hip. This difference could be due increased use of motorbike and other vehicles in developing countries as time goes. Other studies are also pointing out that AVN is in top three of the indications of total hip arthroplasty(26–28). In their study on total joint replacement in Sub-Saharan Africa, Peter et al reported

avascular necrosis as a frequent indication for total hip replacement and this was associated with increased HIV prevalence in this region(36)(37).

5.2.2 Duration of surgery in complex primary THA

Complex hips have altered anatomy which causes intraoperative difficulties hence prolonged duration of surgery. Miao et al(29) and Kingori et al(30) reported an average duration for normal THA to be 89 minutes and less than 90 minutes respectively which is relatively shorter duration. In this study mean duration of surgery for complex primary total hip arthroplasty was 139.96 minutes. According to Anyaehie et al(3) and Kingori et al(30) the average duration for complex primary total hip arthroplasty is even higher (188 minutes and 210 minutes respectively) than what is observed in this study.

This finding is consistent with other studies, study done by Clarke et al on total replacement of the hip for avascular necrosis in sickle cell disease showed an average duration of surgery to be prolonged to three hours and twenty minutes(200 minutes) (31). This was pointed out to be due to the fact that patients with sickle cell disease have a smaller bone marrow canal which needs time to prepare.

Failed implants after hip fracture fixation are not uncommon, and it is among the causes of complex hips which at times needs total hip arthroplasty. Mathews et al in their study they pointed out that conversion of failed intramedullary hip screw fixation to total hip arthroplasty resulted into prolonged average duration of surgery of up to 166 minutes(32). These findings are in consistent with what is found in this study.

5.2.3 Intraoperative blood loss in complex primary THA

Average intraoperative blood loss during complex primary total hip arthroplasty surgeries was higher than that of non-complex primary total hip. These findings correlates with that reported by Anyaehie et al whereby intraoperative blood loss in complex primary total hip arthroplasty was high (1600 milliliters) compared to its counterpart(3). Findings from this study is also consistent with the study done in China by Miao et al whereby an average

total blood loss in total hip arthroplasty was 1155(377) and was reported to be influenced by the indications for the surgery(29). Apart from technical intraoperative difficulties, complex primary total hip arthroplasty also reported to be associated with prolonged duration of surgery which in turn contributes into increased intraoperative blood loss(29)(31).

From their study on evaluation of intra- and post- operative blood loss in total hip arthroplasty Ugbeye et al reported an average high intraoperative blood loss of 1222.7 milliliters(7). Although they didn't show the indications for those operations, they pointed out that prolonged duration of surgery was associated with increased blood loss. This high intraoperative blood loss could be due to the fact that they included a significant number of patients who had complex hips. Mean intraoperative blood loss in prosthetic hip replacement reported by Ma et al(38) is more less similar to what is found in this study because their replacement were done to patients with complex hips.

In their study, Flordal et al found that during total hip arthroplasty, women had a 27% lower mean blood loss ($P < 0.001$) than men(39). These findings correspond with what is seen in this study whereby average blood loss among female was lower 662.74 milliliters than that observed in males 768.99 milliliters. (p – value < 0.02). Similar findings reported by Miao et al whereby gender had influence on intraoperative blood loss with male being at risk of increased blood loss(29).

CHAPTER SIX

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSION

Complex primary total hip surgeries are not uncommon in our setting. The common indications of complex primary total hip arthroplasty are femoral neck fractures and avascular necrosis. Because of altered anatomy, complex primary total arthroplasty surgeries are associated with prolonged duration of surgery and increased intraoperative blood loss.

6.2 RECOMMENDATIONS

Detailed preoperative planning should be done to minimize the duration of surgery and intraoperative blood loss.

A prospective study should be done to evaluate details of indications of complex total hip arthroplasty as well as to determine other intraoperative complications during complex primary total hip arthroplasty surgeries.

CHAPTER SEVEN

7 STUDY LIMITATIONS AND MITIGATIONS

7.1 Study Limitations

Improper documentation of accurate diagnosis and indication for primary THR on operating theater documents and patients' medical records.

7.2 Mitigation

More than one theater documents (theater THA registry, patients' files and anesthetic records) were reviewed to supplement for missing information in one of the registries.

REFERENCES

1. Evans JT, Evans JP, Walker RW, Blom AW, Whitehouse MR, Sayers A. Articles How long does a hip replacement last ? A systematic review and meta-analysis of case series and national registry reports with more than 15 years of follow-up. 2016;393(10172):647–54.
2. Katchy AU, Katchy SC EH, I E. Total Hip Replacement for Management of Severe Osteoarthritis in a Developing Country: A 5‐ year Assessment of Functional Outcome in 72 Consecutive Hip. NigerJOrthopTrauma. 2018;17(1):46–52.
3. Anyaehie UE, Eyichukwu GO, Nwadinigwe CU, Katchy AU. Complex primary hips for total hip replacement surgery at a tertiary institution in Nigeria. Sicot-J. 2018;4:22.
4. Uwatoronye NC, Ego AU, Amaechi KU. Total hip replacement in Nigeria: A preliminary report. Kuwait Med J. 2012;44(4):291–6.
5. Sathappan SS, Strauss EJ, Ginat D, Upasani V, Di Cesare PE. Surgical challenges in complex primary total hip arthroplasty. Am J Orthop (Belle Mead NJ). 2007;36(10):534–41.
6. Otterberg ET, Garvin KL. Technical considerations in difficult primary total hip arthroplasty. Surg Technol Int. 1994;3:549–54958.
7. Ugbeye ME, Lawal WO, Ayodabo OJ, Adadevoh IP, Akpan IJ, Nwose U. An evaluation of intra-operative and post-operative blood loss in total knee arthroplasty at the National Orthopaedic Hospital, Lagos. Niger J Med. 2016;25(2):159–63.
8. Stockton DJ, O'Hara LM, O'Hara NN, Lefaivre K a., O'Brien PJ, Slobogean GP. High rate of reoperation and conversion to total hip arthroplasty after internal fixation of young femoral neck fractures: a population-based study of 796 patients. Acta Orthop. 2019;90(1):21–5.

9. Ozan F, Uzun E, Gürbüz K, Koyuncu Ş, Altay T, Kayali C. Total hip arthroplasty in the developmental dysplasia of the hip using transverse subtrochanteric osteotomy. J Orthop. 2016;13(4):259–63.

10. Weinstein SL, Mubarak SJ, Wenger DR. Developmental hip dysplasia and dislocation: Part II. Instr Course Lect. 2004;53(February 2004):531–42.

11. Lucas GN. Developmental dysplasia of the hip. Sri Lanka J Child Heal. 2018;47(1):1–2.

12. Bicanic G, Barbaric K, Bohacek I, Aljinovic A, Delimar D. Current concept in dysplastic hip arthroplasty: Techniques for acetabular and femoral reconstruction. World J Orthop. 2014;5(4):412–24.

13. Yang S, Cui Q. Total hip arthroplasty in developmental dysplasia of the hip: Review of anatomy, techniques and outcomes. World J Orthop. 2012;3(5):42–8.

14. Plessis L. Bilateral ankylosis of the hip: A case report. SA Orthop J. 2013;12(2):42–5.

15. Chueire AG, Rejaili WA, Santos AF Dos. Protrusio acetabuli (Otopelve). Acta Ortopédica Bras. 2002;10(4):52–7.

16. Zhen P, Li X, Zhou S, Lu H, Chen H, Liu J. Total hip arthroplasty to treat acetabular protrusions secondary to rheumatoid arthritis. J Orthop Surg Res. 2018;13(1):1–7.

17. Louise M. Hip fracture incidence and hospitalisations in Australia 2015–16 [Internet]. Canberra: Australian Institute of Health and Welfare; 2018. 40 p. Available from: https://www.aihw.gov.au/reports/injury/hip-fracture-incidence-in-australia-2015-16

18. Joseph D.Z. Review Article: Review Article. N Engl J Med. 1996;334(23):369–73.

19. Birge SJ, Morrow-Howell N, Proctor EK. Hip fracture. Clin Geriatr Med. 1994;10(4):589–609.

20. RS G. the Structure and Function of End of the Femur. Bone. 1961;43B:576–89.

21. Petek D, Hannouche D, Suva D. Osteonecrosis of the femoral head: Pathophysiology and current concepts of treatment. EFORT Open Rev. 2019;4(3):85–97.

22. Narayanan A, Khanchandani P, Borkar RM, Ambati CR, Roy A, Han X, et al. Avascular Necrosis of Femoral Head: A Metabolomic, Biophysical, Biochemical, Electron Microscopic and Histopathological Characterization. Sci Rep [Internet]. 2017;7(1):1–16.

23. Choi HR, Steinberg ME, Y. Cheng E. Osteonecrosis of the femoral head: Diagnosis and classification systems. Curr Rev Musculoskelet Med. 2015;8(3):210–20.

24. Biant LC, Bruce WJM, Assini JB, Walker PM, Walsh WR. The anatomically difficult primary total hip replacement: Medium- to long-term results using a cementless modular stem. J Bone Jt Surg - Ser B. 2008;90(4):430–5.

25. Lee WY, Hwang DS, Noh CK. Descriptive epidemiology of patients undergoing total hip arthroplasty in Korea with focus on incidence of femoroacetabular impingement: Single center study. J Korean Med Sci. 2017;32(4):581–6.

26. Lisenda L, Mokete L, Nwokeyi K, Gureja YP, Lukhele M. Development of a lower limb arthroplasty service in a developing country : Lessons learned after the first 100 cases (joints). Acta Orthop Belg. 2016;82(3):570–8.

27. Davies PSE, Graham SM, Maqungo S, Harrison WJ. Total joint replacement in sub-Saharan Africa: a systematic review. Trop Doct. 2019;49(2):120–8.

28. Graham SM, Howard N, Moffat C, Lubega N, Mkandawire N, Harrison WJ. Total Hip Arthroplasty in a Low-Income Country. JBJS Open Access. 2019;4(4):e0027.

29. Miao K, Ni S, Zhou X, Xu N, Sun R, Zhuang C, et al. Hidden blood loss and its influential factors after total hip arthroplasty. J Orthop Surg Res. 2015;10(1):1–5.

30. Kingori J, Gakuu L. Total hip replacements at Kikuyu Hospital, Kenya. East African Orthop J. 2011;4(2):44–7.

31. Clarke J. TOTAL REPLACEMENT OF HIP WITH AVASCULAR NECROSIS IN SICKLE CELL DISEASE. J Bone Jt Surg. 1989;71(3).

32. Exaltacion JJF, Incavo SJ, Mathews V, Parsley B, Noble P. Hip Arthroplasty After Intramedullary Hip Screw Fixation. J Orthop Trauma. 2012;26(3):141–7.

33. Morice A, Ducellier F, Bizot P. Total hip arthroplasty after failed fixation of a proximal femur fracture: Analysis of 59 cases of intra- and extra-capsular fractures. Orthop Traumatol Surg Res [Internet]. 2018;104(5):681–6.

34. Carling MS, Jeppsson A, Eriksson BI, Brisby H. Transfusions and blood loss in total hip and knee arthroplasty: A prospective observational study. J Orthop Surg Res. 2015;10(1):1–7.

35. Alberth G, Kettisen J LB. Blood loss in prosthetic hip replacement is not influenced by the AB0 blood group. Eur J Surg. 2001;169(9):652–5.

36. Davies PSE, Graham SM, Maqungo S, Harrison WJ. Total joint replacement in sub-Saharan Africa : a systematic review. Trop Doct. 2019;49(2):120–8.

37. Mehta P, Nelson M, Brand A, Boag F. Avascular necrosis in HIV. Rheumatol Int. 2013;33(1):235–8.

38. Ma H yang, Lu Q, Sun J yang, Du Y qiao, Shen J min, Gao Z sen, et al. One-Stage Total Hip Arthroplasty with Modular S-ROM Stem for Patients with Bilateral Crowe Type IV Developmental Dysplasia. Orthop Surg. 2020;12(6):1913–22.

39. Flordal PA NG. Blood loss in total hip replacement. A retrospective study. Arch Orthop Trauma Surg. 1991;111(1):34–8.

Appendix I: Data extraction form.

Research; **PROPORTION, INDICATIONS AND COMPLICATIONS OF COMPLEX PRIMARY TOTAL HIP REPLACEMENT AT MUHIMBILI ORTHOPAEDIC INSTITUTE;**

JULY 2015 - JUNE 2020

1.0 Form number ……

2.0 Patient ID ……

3.0 Age; ……

4.0 Sex;

(1) Male
(2) Female

5.0 Hip operated

(1) Right
(2) Left

6.0 Indication of THR

(1) Femoral neck fracture
(2) AVN
(3) Implant failure
(4) Neglected hip dislocation
(5) Others (Specify) ……

7.0 Duration of operation …… minutes

8.0 Intraoperative blood loss …….milliliters

9.0 Other intraoperative challenges …….

Appendix II: Ethical clearance letter

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES

P.O. Box 65001
DAR ES SALAAM
TANZANIA
Web: www.muhas.ac.tz

Tel G/Line: +255-22-2150302/6 Ext. 1015
Direct Line: +255-22-2151378
Telefax: +255-22-2150465
E-mail: dpgs@muhas.ac.tz

Ref. No. HD/MUH/T.176/2018
IRB#: MUHAS-REC-07-2020-397

13th August 2020

John Nkinda,
MMed. Orthopaedics and Traumatology,
School of Medicine,
MUHAS.

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED "PROPORTION AND INDICATIONS OF COMPLEX PRIMARY TOTAL HIP ARTHROPLASTY AT MUHIMBILI ORTHOPEDIC INSTITUTE JANUARY 2015-DECEMBER 2019. "

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has, on behalf of the Senate, approved ethical clearance for the above-mentioned study. Hence you may proceed with the planned study.

The ethical clearance is valid for one year only, from **13th August, 2020 to 12th August, 2021.** In case you do not complete data analysis and dissertation report writing by **12th August, 2021,** you will have to apply for renewal of ethical clearance prior to the expiry date.

Dr. Emmanuel Balandya
DIRECTOR OF POSTGRADUATE STUDIES

cc: Director of Research and Publications
cc: Dean, School of Medicine, **MUHAS**

Appendix III: Introductory letter

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES

P.O. Box 65001
DAR ES SALAAM
TANZANIA
Web: www.muhas.ac.tz

Tel G/Line: +255-22-2150302/6 Ext. 1015
Direct Line: +255-22-2151378
Telefax: +255-22-2150465
E-mail: dpgs@muhas.ac.tz

Ref. No. HD/MUH/T.176/2018

13th August, 2020

The Executive Director,
Muhimbili Orthopaedics Institute,
P.O. Box 6714,
DAR ES SALAAM

Re: INTRODUCTION LETTER

The bearer of this letter is John Nkinda, a student at Muhimbili University of Health and Allied Sciences (MUHAS) pursuing MMed. Orthopaedics and Traumatology.

As part of his studies he intends to do a study titled: "**PROPORTION AND INDICATIONS OF COMPLEX PRIMARY TOTAL HIP ARTHROPLASTY AT MUHIMBILI ORTHOPEDIC INSTITUTE JANUARY 2015-DECEMBER 2019.**"

The research has been approved by the Chairman of University Senate.

Kindly provide him the necessary assistance to facilitate the conduct of his research.

We thank you for your cooperation.

Ms. Victoria Mwanilwa
For: DIRECTOR, POSTGRADUATE STUDIES

cc: Dean, School of Medicine, **MUHAS**
cc: John Nkinda