COMPUTED TOMOGRAPHY PATTERNS OF ACETABULAR FRACTURES AND ASSOCIATED MECHANISMS OF INJURIES AMONG PATIENTS ATTENDING MUHIMBILI ORTHOPAEDIC INSTITUTE

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By

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A Dissertation Submitted in (Partial) Fulfilment of the Requirement for the Degree of Master of Medicine (Radiology) at

Muhimbili University of Health and Allied Sciences

October, 2024

CERTIFICATION

The undersigned certify that they have read and hereby recommend for Examination by the Muhimbili University of Health and Allied Sciences (MUHAS) a dissertation entitled ***"Computed Tomography Pattern of Acetabular Fractures and Associated Mechanisms of Injuries Among Patients Attending Muhimbili Orthopaedic Institute",*** in (partial) fulfillment of the requirements for the degree of Master of Medicine (Radiology) of Muhimbili University of Health and Allied Sciences.

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DECLARATION AND COPYRIGHT

I, **Jonathan Mathayo**, 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 a similar or any other degree award.

Signature ……. Date ……..

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DEDICATION

To my dearest love Caroline,

In every step of my academic journey, you have been my steadfast anchor, guiding light, and solid foundation through every difficulty. Your love, patience, and constancy have been the pillars upon which I've built my academic endeavours.

As I reflect on your sacrifices and unwavering faith in me, I extend my deepest gratitude to you. I dedicate this dissertation to you, my dearest, as a testament to our love and your tireless support.

Forever devoted to you,

Amor vincit omnia.

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ABBREVIATIONS

CT	Computed Tomography
MNH	Muhimbili National Hospital
MOI	Muhimbili Orthopaedic Institute
MUHAS	Muhimbili University of Health and Allied Sciences
OT	Orthopaedic and Traumatology
OTA	Orthopaedic and Traumatology Association
SPSS	Statistical Package for Social Sciences

DEFINITIONS OF KEYWORDS

Acetabulum: It is the cup-shaped cavity in the hip bone that forms the socket of the hip joint, articulating with the head of the femur (1–3).

Acetabular fracture: It is the loss of cortical continuity of a cup-shaped cavity of the hip bone, disrupting the integrity of the hip joint (1–3).

Acetabular fracture pattern: Refers to the specific configuration or arrangement of cortical discontinuity within the cup-shaped socket of the hip bone (1–3).

CT scan: It is a medical imaging technique that uses X-rays and computer processing to generate detailed cross-sectional images of the body.

Mechanism of injury: Refers to the specific way in which the injury to the acetabulum occurred, in the current context it has been categorized based on the forces involved for example motor traffic crashes, falls from heights, and sports injuries.

ABSTRACT

Background

The acetabulum plays a critical role in weight-bearing and locomotion. Acetabular fractures are increasingly prevalent, often resulting from high-impact traumas such as motor vehicle crashes. Failure to recognize or appropriately treat acetabular fractures can lead to significant long-term consequences, including chronic pain, joint deformity, instability, and the development of post-traumatic osteoarthritis. Understanding these patterns could improve diagnostic precision and refine treatment approaches. However, in Tanzania, there is limited knowledge regarding the typical patterns of acetabular fractures and any potential association between mechanisms of injuries and fracture patterns.

Objective

To determine computed tomography (CT) scan patterns of acetabular fractures and associated mechanisms of injuries among patients attending Muhimbili Orthopaedic Institute (MOI) from June 2023 to March 2024.

Material and Methods

A prospective cross-sectional study was conducted at the Department of Radiology and Medical Imaging MOI. The study included 81 patients who attended MOI with a diagnosis of traumatic acetabular fracture by X-ray radiography and later on underwent pelvic CT from June 2023 to March 2024. Statistical analysis was conducted using SPSS version 27. Continuous data were summarized with measures of central tendency and dispersion, while categorical data were presented as frequencies and percentages. Cross-tabulations and Fisher's exact tests were employed to assess the associations, with a significance threshold of $p < 0.05$.

Results

The study included 81 patients diagnosed with post traumatic acetabular fractures, with a mean age of 41.01 years (± standard deviations of 15.17 years). Notably, the majority affected were male 60 (74.1%), with motor traffic crashes being the leading cause, accounting for 70 (86.4%) of cases. Falls from heights represented 11 (13.6%) of the observed fractures, while no cases of

acetabular fractures resulting from sports injuries were reported during the study period. Posterior wall fractures were the most common pattern among patients involved in motor traffic crashes, representing 27 (38.6%) of cases. In contrast, anterior wall and anterior column fractures were more prevalent in falls from heights, each constituting 18.2% of cases. However, no significant association was found between CT scan patterns and mechanisms of injuries.

Conclusion

This study emphasizes the predominance of males as being more affected patients compared to females and motor traffic crashes as the leading cause of acetabular fractures. Posterior wall fracture was the leading pattern among all. There was no association between the CT scan pattern and the mechanism of injury.

Recommendation

It is recommended to prioritize the review of posterior wall fractures initially, given their prevalent occurrence among patients with acetabular fractures and subsequent attention should be given to other common patterns to hasten the accurate diagnosis. Furthermore, the absence of acetabular fractures resulting from sports injuries or other causes highlights potential areas for further investigation into the factors contributing to these specific injury patterns. Also, males were more affected than females, so it is recommended to put much emphasis on educating this group hence reducing this high percentage.

Keywords: Acetabular fractures, Motor traffic accidents, CT scan patterns, Mechanisms of injury.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The acetabulum, a pivotal structure in the pelvis, serves as the articulating surface for the hip joint, linking the axial skeleton to the lower limbs. They are formed by the fusion of the iliac, pubic, and ischial bones starting in the 8th week of embryogenesis with complete fusion occurring at 13-16 years of age. It plays a critical role in weight-bearing and locomotion (1–3). The global incidence of acetabular fractures, reported to be 3/100,000/year, is on the rise due to increased motor vehicle usage (4,5). In current orthopedic and traumatology practice, acetabular fractures are increasingly prevalent, often resulting from high-impact traumas such as motor vehicle crashes or low energy trauma such as falls from height. (6). Timely and accurate diagnosis and management are of vital importance due to the acetabulum's integral role in maintaining lower limb function and stability (7). Failure to recognize or appropriately treat acetabular fractures can lead to significant long-term consequences, including chronic pain, joint deformity, instability, and the development of post-traumatic osteoarthritis, necessitating invasive interventions like total hip arthroplasty (3).

Diagnostic evaluation typically begins with conventional radiography, utilizing X-ray imaging techniques, followed by more advanced imaging modalities such as computed tomography (CT) scans to enhance diagnostic accuracy and guide treatment decisions (3). The complex three-dimensional anatomy of the acetabulum, compounded by intricate fracture patterns and terminology, historically posed challenges in accurate diagnosis and classification. The pioneering work of Professor Robert Judet and colleagues in developing the Judet and Letournel classification system in the 1960s revolutionized the field, providing a standardized framework for categorizing acetabular fractures into distinct patterns (3,8,9). This classification system is used today by both Radiologists and Orthopedic surgeons worldwide, it consists of 10 types of fracture patterns of acetabular and is divided into two groups; 5 elemental/simple types and 5 associated/complex types and uses both x-ray radiography and computed tomography scan as a

mode of diagnosis (10). Five elemental types are Anterior wall fracture, Anterior column fracture, Posterior wall fracture, Posterior column fracture, and Transverse fracture. Five associated fractures are Both column fracture, T-type fracture, Anterior wall or column with hemi transverse fracture, Posterior column with posterior wall fracture and Transverse with posterior wall fracture (11). In addition to the Judet and Letournel classification, alternative systems such as the Orthopedic and Trauma Association (OTA) classification and the Harries system have been proposed. However, the widespread adoption of these systems is limited by their complexity and practical considerations (12).

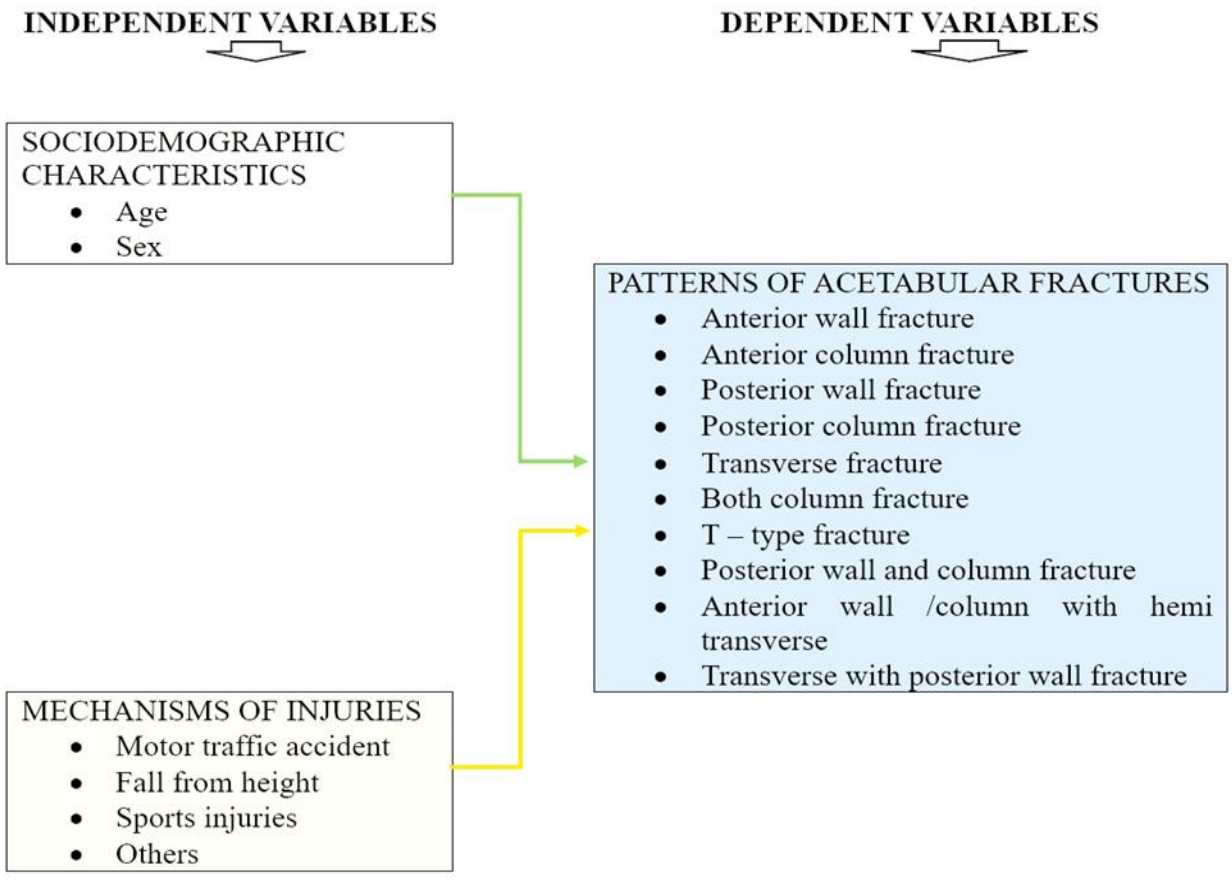
Despite advancements in classification systems, the multifaceted nature of acetabular fractures necessitates a detailed understanding and clinical experience. While certain fracture patterns predominate, accounting for a majority of cases, accurate diagnosis remains challenging due to the diversity of presentations (3,4). This study aimed to investigate acetabular fracture patterns using advanced medical imaging CT scans, and associated mechanisms of injuries in Tanzania's clinical context among patients attending at Muhimbili Orthopaedic Institute (MOI).

1.2 Problem Statement

Despite several studies done in different regions indicating the prevalence of acetabular fractures (13–15), accurately diagnosing these fractures remains challenging for both radiologists and orthopedic surgeons (3). The complexity of the Judet & Letournel classification system to both orthopedic surgeons and radiologists necessitates further investigation to identify common fracture patterns if any and their frequency. Understanding common patterns if present could improve diagnostic precision and refine treatment approaches (1,3,16). However, in Tanzania, there is limited knowledge regarding the typical patterns of acetabular fractures and any potential association between mechanisms of injuries and fracture patterns.

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1.3 Conceptual Framework



Source: Principal investigator 2023

CONCEPTUAL FRAMEWORK CLARIFICATIONS

The conceptual framework which guided this study is composed of three primary components. Social demographic factors, including age and sex (independent variables), were linked with acetabular fracture patterns (dependent variable), while other independent variables encompassed mechanisms of injury such as motor traffic crashes, falls from height, and sports-related injuries.

1.4 Rationale

This study aimed to investigate acetabular fracture patterns using advanced medical imaging CT scans, and associated mechanisms of injuries in Tanzania's clinical context among patients attending MOI and knowing the commonest acetabular fracture patterns if present. This will improve diagnostic accuracy among radiologists and orthopedic surgeons because they will concentrate first on the known common patterns and then do an overview of uncommon patterns. Also by correlating fracture patterns with injury mechanisms, we seek to deepen our understanding of these fractures' prevalence and characteristics and increase our knowledge of preventive measures.

1.5 Research Question

What are the CT scan patterns of acetabular fractures and associated mechanisms of injuries among patients attending MOI from June 2023 to March 2024 according to Judet & Letournel's classification?

1.6 Broad Objective

To determine CT scan patterns of acetabular fractures and associated mechanisms of injuries among patients attending MOI from June 2023 to March 2024.

1.6.1 Specific Objectives

1. To determine the socio-demographic characteristics of patients with acetabular fractures attending MOI from June 2023 to March 2024.
2. To identify the mechanisms of injuries of acetabular fractures among patients attending MOI from June 2023 to March 2024.
3. To identify the CT scan patterns of acetabular fractures among patients attending MOI from June 2023 to March 2024.
4. To determine the association of CT scan patterns and mechanisms of injuries of acetabular fractures among patients attending MOI from June 2023 to March 2024.

1.7 Literature Review

1.7.1 Socio-demographic characteristics among patients with acetabular fractures.

Several studies have investigated the demographic characteristics of acetabular fracture patients (1,4,6). Research conducted in the United States indicated that middle-aged individuals have the highest prevalence of acetabular fractures, with males exhibiting a significantly higher prevalence compared to females (1). Similarly, a study conducted in Nigeria found a mean age of 36.2 years for acetabular fractures, with males being more susceptible (6). Additionally, collaborative research between institutions in China and the United States revealed an average age of 40 years for acetabular fractures in China and 44 years in the United States, with the majority being males (77.0%) compared to females (23.0%) (4). A study done in Singapore demonstrated similar findings where males accounted for 79.3% and females 20.7% of patients with acetabular fractures (15). Furthermore, other studies have shown a bimodal distribution of acetabular fractures in the general population, affecting both younger and older age groups (8,17). The surge in high-energy trauma among the young population correlates with increased automobile transportation, attributed to advancements in development and technology (8,18).

1.7.2 Mechanisms of injuries of acetabular fractures.

Studies conducted in the United States, Nigeria, and Singapore consistently identify motor traffic crashes as the primary cause of acetabular fractures, followed by falls from heights (1,6,15). This pattern underscores the global prevalence of motor traffic crashes as a leading cause of high-energy trauma resulting in acetabular fractures, particularly among young individuals. Conversely, the elderly population often experiences acetabular fractures due to low-energy trauma, as observed in studies conducted in the United States and Finland (3,12,19). Additionally, falling from significant heights or landing on the greater trochanter are other notable causes of acetabular fractures, commonly observed among adults (17).

1.7.3 CT scan patterns of acetabular fractures.

The classification of acetabular fractures presents complexity, yet clinical experience and the utilization of CT scans aid in confirming the pioneering work of Judet and Letournel, thereby facilitating the process (20). While accurately characterizing acetabular fracture patterns into ten types remains challenging, research indicates the presence of common fracture patterns comprising approximately 80% of all cases (19). Notably, posterior wall fractures emerge as the most prevalent pattern (60.0%), followed by posterior column and posterior wall fractures (17.0%), both columns (10.0%), and transverse and posterior wall (5.0%) as demonstrated in a study conducted in the United Kingdom (21). These findings align with those of a study done in Singapore, where posterior wall fractures predominated (28.4%), followed by both columns (19.3%), posterior column (10.2%), and anterior wall /column and posterior hemi-transverse (10.2%) (15). Similar patterns have been demonstrated in a study done in the United States and China where posterior wall fracture is the leading (31.0%), followed by both column fractures (19.0%), and transverse posterior wall (12.0%) (4).

1.7.4 Association of CT scan patterns and mechanisms of injuries of acetabular fractures.

Published studies investigating the association between the pattern of acetabular fractures and the mechanism of injuries are limited. A study conducted in the United States attempted to explore the mechanisms of acetabular fractures and their associated visceral injuries (11). The present study seeks to examine any potential association between CT scan patterns of acetabular fractures and the mechanism of injuries. Such associations are expected to enhance the diagnostic accuracy of these fractures for both radiologists and orthopedic surgeons.

CHAPTER TWO

2.0 MATERIALS AND METHODS

2.1 Study Design

A prospective cross-sectional study was conducted at the Department of Radiology and Medical Imaging at MOI. This study encompassed the utilization of patients' medical records and diagnostic imaging data. The data obtained were then stored in the institution's database and picture archiving and communication system.

2.2 Study Population, Sample Size, And Selection

2.2.1 Study population and study area.

The study involved documentation of clinical and imaging findings of acetabular fracture patients treated at MOI who were referred for pelvic CT scans between June 2023 and March 2024. MOI is located in Ilala municipality in Dar es Salaam. The Hospital is equipped with a state-of-the-art CT facility and receives around 40 pelvic trauma patients per month for pelvic CT scans.

2.2.2 Sampling and Sample Size

Sampling strategy

Given that the population size is known and manageable, the study included a consecutive series of eligible patients diagnosed with acetabular fractures who had undergone pelvic CT at MOI from June 2023 to March 2024.

2.2.3 Sample size estimation

Sample size estimation was based on a modified version of the Taro Yamane formula, based on the attendance number of patients with acetabular fractures who underwent pelvic CT scans. A pilot study which was conducted by the principal investigator between June 2023 and July 2023

demonstrated an average attendance of 8 acetabular fractures patients per month, hence a total of 80 patients in 10 months.

Therefore;

$n = N / (1 + N (\mathscr{E})^2)$

$n = N / (1 + N (p\ e / t)^2)$

Where:

n = Sample size,

N = Population size = 80,

$\mathscr{E}$ = Adjusted margin of error = (p e / t),

e = Margin of error = 0.03,

p = Number of standard deviations that would include all possible = 2,

t = t-value for the selected alpha level of confidence level (95% confidence level) = 1.96,

Then;

$n = 80 / (1 + 80 (2x0.03/1.96)^2)$

n = 74.07

The additional 10% of those eligible for recruitment were included to cover the non-responses.

n = 81

Finally, the study included a total of 81 individuals who met the research criteria and had acetabular fractures.

2.2.4 Inclusion criteria

All adult patients aged 18 years above who attended MOI and were diagnosed with traumatic acetabular fracture by X-ray radiography and then CT scans for accuracy in diagnosis between June 2023 and March 2024.

2.2.5 Exclusion criteria

All patients who failed to consent and patients with acetabular fracture as a result of other causes like pathological causes.

2.3 Variables

The study examined the following dependent and independent variables; sociodemographic factors such as age and sex (independent variables); mechanisms of injuries such as motor traffic accidents, falls from height and sports injuries (independent variables); and CT scans pattern of acetabular fractures according to Judet and Letournel (dependent variables).

2.4 Data Collection Methods

Data from patients with acetabular fractures were collected using a structured data collection form. The information was retrieved daily from the registries and the Picture Archiving and Communication System (PACS) for all patients admitted with a diagnosis of acetabular fracture by x-ray and then CT scan for diagnostic accuracy. The pelvic CT findings were evaluated and compared in line with the study's objectives. The principal investigator interpreted all images, the images were then reviewed and verified by registered radiologists with more than 10 years of experience in musculoskeletal system imaging. Collected data were also entered into the SPSS software on a daily basis for cleaning and analysis.

2.5 Investigation Tools and Validity and Reliability Issues

2.5.1 Imaging platform

Pelvic CT imaging at MOI employed the Somatom duo-source CT scanner, equipped with a 128-slice detector made by Siemens in Munich, Germany. Skilled radiographers were responsible for overseeing the operation of the equipment.

2.5.2 Validity and reliability

To uphold the study's integrity, the data collection instruments underwent important pretesting and necessary modifications, ensuring the adoption of good data collection techniques. To ensure consistency and dependability, only comprehensive medical records were included in this study. The principal investigator evaluated all documented pelvic CT images, seeking input from an independent radiologist when uncertainties arose, guaranteeing the recording of the most precise reports.

2.5.3 Pretesting and pilot data tools

The principal investigator conducted a two-month preliminary study at MOI to assess and refine the data collection instruments utilized in this research. The pilot study involved examining sixteen patients, who accounted for 20% of the required medical records. Based on the findings related to data integrity from the pilot study, the checklist underwent careful review and necessary modifications. The insights gained from the pilot study were incorporated into the main study to ensure the effectiveness and accuracy of the data collection tools.

2.6 Data Analysis

The statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 27. Continuous data were summarized using measures of central tendency with their respective measures of dispersion. Categorical data were summarized using frequencies and percentages. Fisher's exact tests were used to assess the level of association between individual independent categorical variables and the dependent categorical variable. A significance level of less than 0.05 was considered statistically significant.

2.7 Ethical Issues

The research proposal underwent a comprehensive review and obtained ethical approval from the MUHAS Institutional Review Board (Ref. No.DA.282/298/01.C/1707). Permission to collect data was also obtained from the Executive Director of MOI. Informed consent was obtained from each study participant. The confidentiality of all information and data was strictly upheld throughout the study. Patient identities were not collected or utilized, and no identifying information was included in the data analysis. Furthermore, access to the data was restricted to the investigators alone.

2.8 Dissemination Plan

The dissertation will be submitted to MUHAS for a Master of Medicine in Radiology. Findings will be shared with key stakeholders, including MOI. Ownership will be jointly held by the university and the principal investigator. Significant discoveries will be published in reputable journals, facilitating broad access and promoting scientific progress. Additionally, the research findings will be presented at both local and international symposiums and conferences, ensuring widespread dissemination and engagement with the broader scientific and medical communities.

CHAPTER THREE

3.0 RESULTS

3.1 Sociodemographic characteristics of patients with acetabular fractures attending MOI.

The study involved 81 patients diagnosed with acetabular fractures, with a mean age of 41.01 years and an age range spanning from 18 to 80 years. The majority of patients were males, comprising 74.1%, while females constituted 25.9% of the cohort (Table 1).

Table 1: Sociodemographic characteristics of patients with acetabular fractures attending MOI, (n =81).

Variables		Frequency	Percentage
Sex	Male	60	74.1
	Female	21	25.9
Age (years): Mean = 41.01, SD = 15.17, Minimum 18, Maximum = 80			

3.2 Mechanisms of injuries of acetabular fractures among patients attending MOI.

Among the patients attending MOI, motor traffic crashes were the predominant cause of acetabular fractures, accounting for 86.4% of cases. Falls from heights represented 13.6% of the observed fractures, while no cases of acetabular fractures resulting from sports injuries were reported during the study period (Table 2).

Table 2: Mechanism of injuries of acetabular fractures among patients attending MOI, (n = 81).

Variable	Frequency	Percentage
Motor traffic crashes	70	86.4
Fall from heights	11	13.6
Sports injuries	0	0.0

3.3 CT scan patterns of acetabular fractures among patients attending MOI.

The distribution of acetabular fracture patterns among patients attending MOI indicated a predominant occurrence of posterior wall fractures (37.0%), followed by anterior wall fractures (12.3%), anterior column fractures (9.9%), posterior column fractures (8.6%), and posterior wall and posterior column fractures (8.6%). These five patterns comprised 76.4% of all cases of acetabular fractures (Table 3).

Table 3: CT scan patterns of acetabular fractures among patients attending MOI, (n = 81).

Variable	Frequency	Percentage
Posterior wall	30	37.0
Anterior wall	10	12.3
Anterior column	8	9.9
Posterior column	7	8.6
Posterior wall & posterior column	7	8.6
Transverse &posterior wall	6	7.4
Transverse	5	6.2
Both column	5	6.2
T-type	2	2.5
Anterior wall/column -hemi transverse	1	1.2

3.4 Association of CT scan patterns and mechanisms of injuries of acetabular fractures among patients attending MOI.

In this study, CT scan patterns of acetabular fractures were not significantly associated ($p > 0.05$) with mechanisms of injuries. However, patients involved in motor traffic accidents had prevalent posterior wall fractures (38.6% vs. 27.3%, $p = 0.738$). Meanwhile, patients who fell from heights had prevalent anterior wall fractures (18.2% vs. 11.4%, $p = 0.619$) and anterior column fractures (18.2% vs. 8.6%, $p = 0.297$) (Table 4).

Table 4: Association of CT scan patterns and mechanisms of injuries of acetabular fractures among patients attending MOI, (n = 81).

Variables		**Posterior wall**		**Anterior wall**		**Anterior column**	
		Pre (%)	Abs (%)	Pre (%)	Abs (%)	Pre (%)	Abs (%)
Motor traffic accidents	Yes	27 (38.6)	43 (61.4)	8 (11.4)	62 (88.6)	6 (8.6)	64 (91.4)
	No	3 (27.3)	8 (72.7)	2 (18.2)	9 (81.8)	2 (18.2)	9 (81.8)
	p-value	0.738		0.619		0.297	
Fall from heights	Yes	3 (27.3)	8 (72.7)	2 (18.2)	9 (81.8)	2 (18.2)	9 (81.8)
	No	27 (38.6)	43 (61.4)	8 (11.4)	62 (88.6)	6 (8.6)	64 (91.4)
	p-value	0.738		0.619		0.297	

Pre = Present, Abs = Absent.

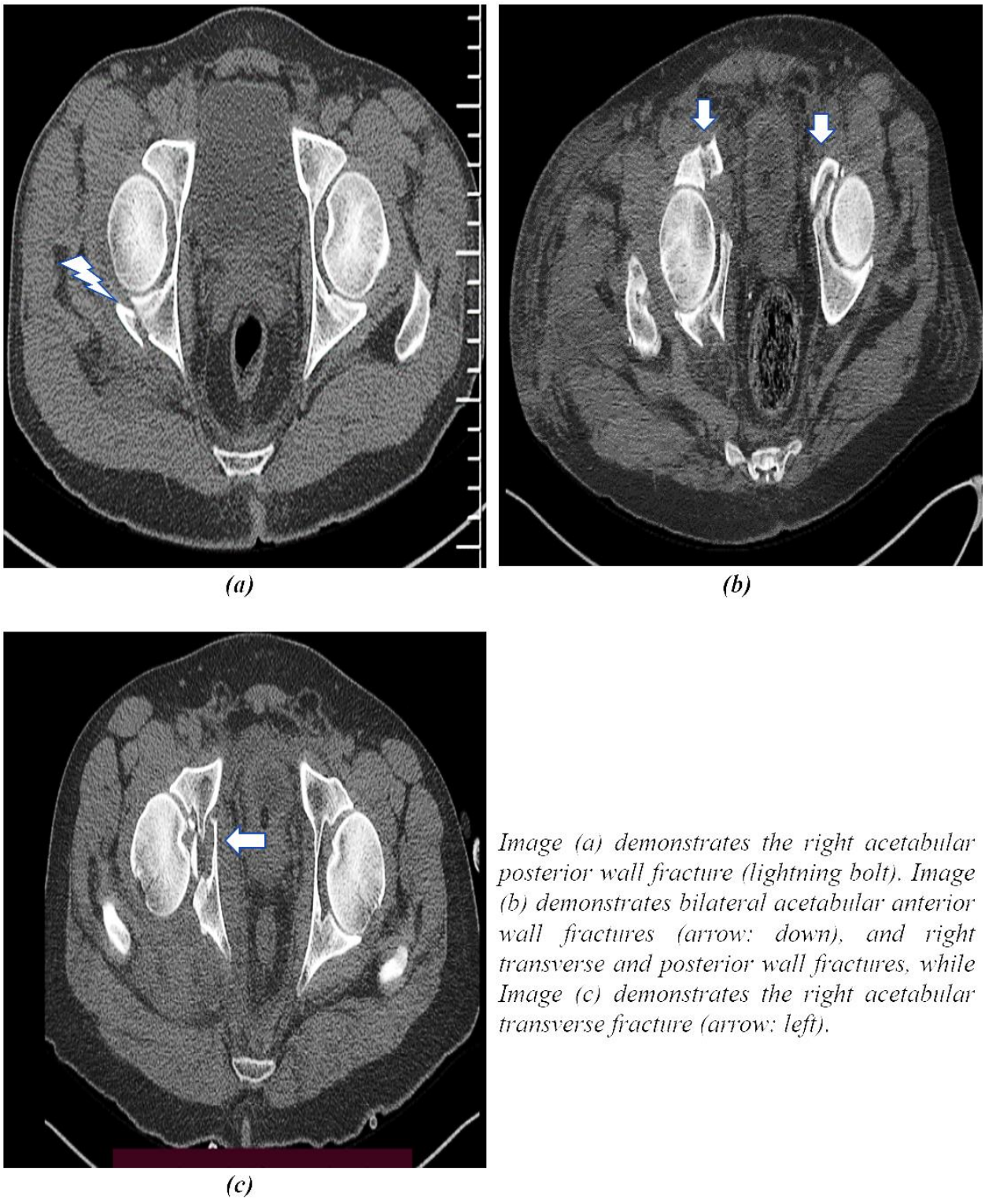


Figure 1: Representative pelvic CT scan images from patients' data demonstrating various patterns of acetabular fractures.

CHAPTER FOUR

4.0 DISCUSSION

This hospital-based prospective cross-sectional study aimed to evaluate the CT scan patterns of acetabular fractures and the associated mechanism of injuries, by assessing 81 patients with acetabular fractures who underwent pelvic CT scans. The mean age of the patients was 41.01 years. This finding is consistent with other studies conducted in the United States and Nigeria where the majority of acetabular fracture patients were middle-aged individuals with a mean age of 36.2 years (1,6). The resemblance in age distribution patterns could be attributed to the comparability in inclusion criteria. Specifically, the predominance of middle-aged individuals among patients with acetabular fractures suggests a common demographic vulnerability to this type of injury. Understanding this consistent age distribution can inform healthcare professionals about the demographic groups most at risk for acetabular fractures, facilitating targeted preventive measures, early diagnosis, and appropriate management strategies for this patient population. The age distribution in the current study displayed a normal distribution in contrast to studies conducted in the United States, which revealed a bimodal distribution characterized by peaks in both young and elderly populations (1,17).

In the present study, a higher proportion of male patients was observed among those with acetabular fractures, the same findings from prior studies conducted in the United States, China, and Singapore, where males constituted between 77.0% and 79.3% of cases (4,15). The similarity could be explained by a combination of multiple factors reflecting similarities in inclusion criteria, and sampling techniques. This finding highlights the importance of gender-specific considerations in both preventive strategies and clinical management protocols for acetabular fractures. Understanding these gender-specific trends can enhance patient care by enabling more effective risk assessment, early intervention, and rehabilitation strategies tailored to the needs of male patients presenting with acetabular fractures.

In the current study, motor traffic crashes emerged as the primary mechanism/cause of acetabular fractures, with falls from heights following closely behind. Notably, no instances of acetabular fractures stemming from sports injuries or other causes were documented. This observation mirrors findings from studies conducted in the United States, Singapore, and Nigeria, where motor traffic crashes accounted for 53.8% to 86.0% of cases, followed by falls from heights, which comprised 14.0% to 28.4% of the total (1,6,15). Understanding these common mechanisms of injury can inform public health initiatives aimed at reducing the incidence of acetabular fractures. Specifically, interventions such as improved road safety measures and fall prevention strategies may help lessen the risk of these traumatic injuries in the population. Furthermore, the absence of acetabular fractures resulting from sports injuries or other causes highlights potential areas for further investigation into the factors contributing to these specific injury patterns.

The predominant CT patterns of acetabular fractures in the current study were posterior wall fractures, followed by anterior wall fractures and anterior column fractures. Similar patterns were observed in studies done in the United States, United Kingdom, China and Singapore where posterior fractures accounted for 28.4% to 60.0% (4,15,21). In contrast to the patterns observed in the aforementioned studies, the second most prevalent pattern in the current study was anterior wall fractures, diverging from the predominance of both columns (19.3%) or posterior column and posterior wall fractures (17.0%) in those investigations. The difference could be attributed to the large sample sizes of the previous studies. This difference suggests a subtle understanding of fracture patterns that clinicians must consider when evaluating and managing acetabular fractures.

In this study, CT scan patterns of acetabular fractures were not significantly associated with the three mechanisms of injuries studied, that is motor traffic crashes, falls from heights, and sports injuries. However, patients involved in motor traffic crashes had prevalent posterior wall fractures. Meanwhile, patients who fell from heights had prevalent anterior wall fractures and anterior column fractures. It is important to highlight that there is limited existing literature directly comparing these findings.

4.1 study Limitation(S)

This cross-sectional study offers a static snapshot of data at a singular time point, thus constraining the capacity to monitor temporal changes.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Concussion

The study included 81 patients diagnosed with acetabular fractures, with a mean age of 41.01 years (± standard deviations of 15.17 years). In particular, the majority affected were male, with motor traffic crashes being the leading cause. Posterior wall fractures were most common among patients involved in motor traffic crashes. In contrast, anterior wall and anterior column fractures were more prevalent in cases of falls from heights. However, no significant association was found between CT scan patterns and mechanisms of injuries.

5.2 Recommendations

It is recommended to prioritize the review of the posterior wall initially when approaching post-traumatic acetabular fracture, given their prevalent occurrence among patients with acetabular fractures. Then subsequent attention should be given to other common patterns, such as anterior wall, anterior column, posterior column, and lastly the overview of other patterns to accelerate accurate diagnosis. Furthermore, the absence of acetabular fractures resulting from sports injuries or other causes highlights potential areas for further investigation into the factors contributing to these specific injury patterns.

It is also recommended to look thoroughly the acetabular in patient with pelvic pain with history of trauma because the study has shown many patients suffered acetabular fractures from trauma of the pelvic.

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APPENDICES

Appendix I: Investigation Tools

SWAHILI QUESTIONNAIRE

1. Namba ya mshiriki ……
2. Namba ya faili la mshiriki ……..
3. Namba ya simu ya mshiriki ……
4. Umri wa Mshiriki (miaka)……
5. Jinsia (Gender) a) Kiume
   b) Kike
6. Mahali anakotoka …….
7. Kazi ya mshikiri ……

8. Siku aliyoumia ……

9. Aina ya ajali
   a) Ajali ya barabarani
   b) Ajali ya kuanguka
   c) Ajali ya uwanjani
   d) Nyinginezo

10. Aina ya mvunjiko kweye CT scan
    a) Anterior wall #
    b) Anterior column #
    c) Posterior wall #
    d) Posterior column #
    e) Transverse #
    f) Both column #
    g) T type #
    h) Posterior column with posterior wall #
    i) Anterior column hemi-transverse #
    j) Transverse with posterior wall #

ENGLISH QUESTIONNAIRE

1. Patient/participant identification number……
2. File number of patient/participant …….
3. Mobile phone number of participant ……
4. Age of Participant (years)……..
5. Gender of the patient a) Male
   b) Female
6. Area of residence ……
7. Occupation of the patient …….
8. Day of injury ……
9. Nature of the trauma
   a) Motor traffic accident
   b) Fall from height
   c) Sports injuries
   d) Others
10. CT scan fracture pattern

    a) Anterior wall #
    b) Anterior column #
    c) Posterior wall #
    d) Posterior column #
    e) Transverse #
    f) Both column #
    g) T type #
    h) Posterior column with posterior wall #
    i) Anterior column hemi-transverse #
    j) Transverse with posterior wall #

Appendix II: Informed Consent Form

(English version)

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES (MUHAS)

DIRECTORATE OF RESEARCH AND PUBLICATION

IDENTITY NUMBER: _____

Introduction

Salutations!

My name is Jonathan Mathayo, Muhimbili University of Health and Allied Sciences (MUHAS) student with registration number HD/MUH/T.243/2021 doing a Master of Medicine in Radiology and Imaging. I am conducting research titled; CT SCAN PATTERNS OF ACETABULAR FRACTURES AND ASSOCIATED MECHANISM OF INJURIES AMONG PATIENTS ATTENDING MUHIMBILI ORTHOPAEDIC INSTITUTE (MOI).

You are kindly invited to take part in this research. Please I am asking you to read and understand well the information below before you accept or refuse to participate in this study.

PURPOSE OF THE STUDY.

The purpose of this study is to study the CT scan patterns of the acetabular (bone in the human body) fracture for a patient who has been admitted to Muhimbili Orthopedic Institute (MOI).

The result of this study will increase awareness and will help to maximize the diagnosis and treatment of acetabular fractures in the future. Also, this is part of the fulfillment of my Master of Medicine program requirement.

STUDY PROCEDURE.

Only some information will be taken from you including your social demographic data and brief information about your injury leading to this fracture. Also, some information will be taken from your file and your CT scan report. You will enquire at no cost financially or socially by participating in this study rather than your few minutes answering a few questions.

RISKS AND BENEFITS TO THE PARTICIPANTS.

No, direct risk or harm is expected to the participant. By participating in this study you will help future generations with better diagnosis and management plans when they succumb to a trauma like yours. Also even if you will not be ready to participate in this study this will not affect your treatment plan by any means.

CONFIDENTIALITY.

Information obtained from you will be strictly confidential and even your identification like your name will not appear on the questionnaire form.

PARTICIPATION WORD.

To participate in this study is completely voluntary and even refusal will not affect your treatment by any means. And even after accepting to participate, you can quit when need to do so.

CONTACTS AND QUESTIONS.

In case you have questions or doubts please contact me through;

Dr. Jonathan MATHAYO
Mobile: 0755382534
Email: jomale100@yahoo.com

PART B:

PARTICIPANT CONSENT FORM.

I have understood well what has been said to me by the investigator about the research plan and I have accepted to participate in this study. I VOLUNTARILY CONSENT TO PARTICIPATE.

Name: ……

Signature: ……

Mobile: ……

Date: ……

Appendix III: Fomu Ya Idhini

(Toleo la Kiswahili)

CHUO KIKUU CHA TIBA NA SAYANSI SHIRIKISHI MUHIMBILI (MUHAS)

KURUGENZI YA UTAFITI NA UCHAPISHAJI

NAMBA YA UTAMBUZI: _____

Utangulizi

Heshima yako!
Jina langu ni Jonathan Mathayo, mwanafunzi wa udaktari kitengo cha Radiologia na mionzi chuo kikuu cha afya na tafiti Muhimbili.Namba yangu ya usajili ni HD/MUH/T.243/2021. Ninafanya tafiti yenye kichwa; AINA ZA MIVUNJIKO YA MFUPA KWENYE KIUNO (ACETABULAR) KWA KUTUMIA KIPIMO CHA CT SCAN. Ninaomba ushiriki wako katika utafiti huu. Kabla ya kukubali kushiriki au kukataa kushiriki naomba usome kwanza kwa umakini maelezo yanayofuata hapo chini.

LENGO LA UTAFITI HUU.

Lengo langu ni kutaka kujua aina za mivunjiko ya mfupa kwenye kiuno cha binadamu (acetabular) kwa kutumia kipimo cha CT scan kwa wagonjwa waliopata mvunjiko hou na kufikishwa hospitali ya Taifa Muhimbili kwa ajili ya matibabu. Matokeo ya utafiti huu yatatumika kuongeza ujuzi zaidi kwa madaktari juu ya mivunjiko hii na itasadia kuboresha tiba zaidi kwa wagonjwa siku za mbeleni. Pia tafiti hii ni hitaji la kitaaluma ili kuweza kuhitimu shule hii ya udaktari wa ubingwa.

MCHAKATO / TARATIBU ZA UTAFITI.

Utafiti huu utahusisha maswali ambayo utaulizwa na mtafiti kuhusu taarifa zako binafsi na maelezo ya jinsi ulivyopata tatizo hili. Pia kuna baadhi ya taarifa zitachukuliwa kutoka kwenye faili lako na taarifa nyingine zitachukuliwa kutoka kwenye kipimo chako cha CT scan

ulichofanya/ utakachofanya kama sehemu ya matibabu yako hapa hospitalini.Kwa kukubali kushiriki tafiti hii hutaingia kwenye gharama zozote za kifedha au kisaikologia zaidi ya muda mchache tu wakati mtafiti anaongea na wewe.

FAIDA NA HASARA KWA MSHIRIKI.

Kwa kukubali kushiriki kwenye tafiti hii utasaidia ujuzi kuongezeka kwenye eneo hili la matibabu na hili litasaidia watu wengine siku za mbeleni. Hakuna hasara yoyote utakayopata kwa kukubali kushiriki.Vilivile kama hutakubali kushiriki haitaleta hasara yoyote kwako wala haitaathiri matibabu yako hospitalini hapa.

USIRI.

Taarifa zako binafsi katika tafiti hii ni siri na hata jina lako halisi halitaonekana kwenye matokeo ya tafiti hii hivyo usiwe na shaka lolote.

MAELEZO KWA MSHIRIKI.

Kushiriki katika utafiki huu ni jambo la hiari na kwa wewe kukubali au kukataa kushiriki katika utafiti huu hauta athiri matibabu yako kwa namna yoyote. ASANTE.

MAWASILIANO.

Kama utakuwa na swali lolote au shaka juu ya utafiti huu tafadhali wasiliana nami kwa mawasiliano haya,

Dk. Jonathan MATHAYO,

Simu: 0755382534

Barua pepe: jomale100@yahoo.com

SEHEMU B: FOMU YA KUKUBALI KUSHIRIKI.

Nimesoma na kuelewa na nimesikiliza na kuelewa nilichoambiwa na mtafiti na nimekubali kushiriki utafiti huu. NIMEKUBALI MWENYEWE KWA UELEWA WANGU NA SI KWA KULAZIMISWA.

JINA: …….

SAHIHI: ……

NAMBA YA SIMU: ……

TAREHE: ……

Appendix IV : Ethical Clearance

UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

OFFICE OF THE DIRECTOR – RESEARCH, PUBLICATIONS AND INNOVATION

In reply quote;
Ref. No.DA.282/298/01.C/1707 Date: 29/05/2023

MUHAS-REC-05-2023-1707
JONATHAN MATHAYO
School of Medicine
MUHAS.

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: "CT SCAN PATTERN OF ACETABULAR FRACTURES AMONG PATIENTS ATTENDING MUHIMBILI ORTHOPAEDIC INSTITUTE (MOI)."

Reference is made to the above heading.

I am pleased to inform you that the Chairman has on behalf of the University Senate approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 29/05/2023
EXPIRATION DATE OF APPROVAL: 29/05/2024

STUDY DESCRIPTION:
Purpose:
The purpose of this prospective cross-sectional analytical study it To determine CT scan patterns of acetabular fractures and associated etiologies among patients attending Muhimbili Orthopedic Institute (MOI).

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided:
https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%201098.pdf and in the MUHAS archives.

The PI is required to:

1. *Submit bi-annual progress* reports and final report upon completion of the study.
2. *Report to the IRB any unanticipated* problem involving risks to subjects or *others including* adverse events where applicable.
3. *Apply for renewal* of approval of ethical clearance one (1) month prior its *expiration* if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain data transfer agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Apply for and obtain material transfer agreement (MTA) from NIMR, if research materials (samples) will be shipped to a foreign country.
8. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
9. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
10. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website https://drp.muhas.ac.tz/

Dr. Nahya Salim Masoud,
Chairman, MUHAS Research and Ethics Committee

Muhimbili University of Health and Allied Sciences
DIRECTOR
Research & Publications
Box 65001

Appendix V : Introduction Letter

UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR – POSTGRADUATE STUDIES

RECEIVED
07 JUN 2023
REGISTRY
DAR ES SALAAM

In reply quote:
Ref. No. HD/MUH/T.243/2021

RECEIVED ON
02 JUN 2023
Signature:
EXECUTIVE DIRECTOR'S OFFICE

01st June, 2023

The Executive Director,
Muhimbili Orthopaedics Institute,
P.O. Box 65474,
DAR ES SALAAM

Re: INTRODUCTION LETTER

We would like to inform you that the bearer of this letter is Jonathan Mathayo with Reg. No. HD/MUH/T.243/2021 is a student at Muhimbili University of Health and Allied Sciences (MUHAS) "pursuing MMed. Radiology.

As part of his studies, he will be doing an elective research titled: "***CT Scan Pattern of Acetabular Fractures Among Patients Attending Muhimbili Orthopaedic Institute.***" he is being supervised by Dr. Zuhura Nkrumbih from MUHAS and Dr. Mechris Mango from MOI.

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.

Mr. Sebe Mohamed.
For: DIRECTOR, POSTGRADUATE STUDIES

c.c Jonathan Mathayo

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel G/Line: +255-22-2150302/8; Ext. 1015; Direct Line:+255-22-2151378;Telefax:+255-22-2150465;E-mail:dpgs@muhas.ac.tz;Web:https://www.muhas.ac.tz

Appendix Vi : Permission Letter

UNITED REPUBLIC OF TANZANIA
MINISTRY OF HEALTH

MUHIMBILI ORTHOPAEDIC INSTITUTE (MOI)

Ref.PA. 382/401/01/55 **13th June 2023**

Muhimbili University of Health and Allied Sciences

Dar -es Salaam

Tanzania.

RE: APPROVAL FOR CONDUCTING RESEARCH STUDY

Reference is made to your letter with reference number HD/MUH/T.243/2021 dated on the 01st June, 2023 for conducting research study about. ***"CT Scan Pattern of Acetabular Fractures Among Patients Attending Muhimbili Orthopaedic Institute"***

On behalf of the Management I would like to officially inform you that, your permission has been granted for your student **Jonathan Mathayo** to conduct study at Muhimbili Orthopaedic Institute (MOI).

It's my hope that your stay at MOI will be fruitful. For any clarification contact CRTM +255713764522.

Dr. Joel J Bwemelo, CRTM

For: MOI Executive Director

Cc: Director of Post Graduate studies

Cc: Supervisor

Muhimbili Orthopaedic Institute (MOI), Upanga West Plot No. 1048/2, Kalenga Street, P. O. Box 65474 - Dar es Salaam; Telephone Number +255 -022-2151298/2152937/2152938 Fax: +255 -022-2151744
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