COMPUTED TOMOGRAPHY PATTERNS, SCORE AND OUTCOME OF INTRACEREBRAL HEMORRHAGE AMONG PATIENTS ATTENDING MUHIMBILI ORTHOPEDIC INSTITUTE AND MUHIMBILI NATIONAL HOSPITAL-MLOGANZILA

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MMed (Radiology) Dissertation.

Muhimbili University of Health and Allied Sciences

October, 2024

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

SCHOOL OF MEDICINE

RADIOLOGY DEPARTMENT

COMPUTED TOMOGRAPHY PATTERNS, SCORE AND OUTCOME OF INTRACEREBRAL HEMORRHAGE AMONG PATIENTS ATTENDING MUHIMBILI ORTHOPEDIC INSTITUTE AND MUHIMBILI NATIONAL HOSPITAL-MLOGANZILA

By

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A Dissertation Submitted in Partial Fulfilment of the Requirements for the Degree of Master Medicine in Radiology and medical imaging of Muhimbili University of Health and Allied Sciences

October, 2024

CERTIFICATION

The undersigned certify that they have read and here by recommend for acceptance of dissertation entitled "**Computed tomography patterns, score and outcome of intracerebral hemorrhage among patients attending Muhimbili Orthopedic Institute and Muhimbili national hospital-Mloganzila"** in partial fulfillment of the requirements for the degree of Master of Medicine in Radiology and Medical imaging of Muhimbili University of Health and Allied Sciences.

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Date

DECLARATION AND COPYRIGHT

I, **Isangya Lameck**, declare that this dissertation entitled ‘‘**Computed tomography patterns, score and outcome of intracerebral hemorrhage among patients attending Muhimbili Orthopedic Institute and Muhimbili national hospital-Mloganzila**’’ is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

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ACKNOWLEDGEMENT

First and foremost, I want to express my sincere gratitude to the Almighty God, who gives us stability and success and who has made it possible for me to finish this task.

I want to convey my profound gratitude to Dr. Mboka Jacob, my research supervisor and Dr Joel Bwemelo my co supervisor, who always encouraged me to finish this study. I will never forget their wise counsel, trustworthiness, and generosity in making time for me.

I would like to express my sincere gratitude to the Muhimbili orthopedic institute and MNH-Mloganzila Executive Directors, all staff members at from these Hospital, for their cooperation in enabling me to perform my study without interference.

Special thanks to my parents and family members for their prayers, emotional and financial support during this time.

Last but not least, I would like to express my gratitude to the Radiology and imaging department and the MMED Radiology class of 2021/2024 for their significant contributions. It was a genuine pleasure to learn from each member and acquire the necessary abilities at each stage.

DEDICATION

I would like to express my gratitude to my parents, Mr. and Mrs. Lameck Nyabasi, my all-time carrier coach Dr. Aingaya Jackson Kaale, and Dr. Ally Mwanga, their consistent psychological spiritual and emotional support has been crucial during the composition of this dissertation. I also want to thank my co-supervisor, Dr. Joel Bwemelo (M.D., MMED.) and my best friend Frank K. for constantly inspiring me and setting a good example while believing in my talents.

ABSTRACT

Background: Intracerebral hemorrhage (ICH) is life threatening form of stroke and is characterized bleeding into the brain parenchyma, it is associated with high mortality rates, and poor recovery outcomes. The mortality rate is nearly 50% within the first month and only 20% of the patient survived can live independently. There is significant increase in number of patients with ICH due to rise in number of non-communicable diseases. With all this early outcome assessment is important in order to optimize the treatment options of these patients.

Objective: The main purpose of this study was to investigate the computed tomography patterns, ICH score and 30days outcome of intracerebral hemorrhage among patients attending Muhimbili orthopedic institute and Muhimbili national hospital.

Methodology: This was a hospital-based prospective cross-sectional conducted at Muhimbili National Hospital (MNH)-Mloganzila and Muhimbili Orthopedic Institute (MOI) from September 2023 to March 2024. We analyzed data from 142 patients with ICH to evaluate CT patterns, severity score (ICH score) and possible predictors of 30day mortality by considering clinical, radiological and treatment parameters. Data from this study was analyzed using Statistical Package for Social Sciences (SPSS) version 23. Data was compared using cross tabulation and chi square statistical test was used to check for the association between the independent variables and 30- day mortality outcome (p value <0.05). Univariate and multivariate logistic regression was used to check for the magnitude and direction of the association for the variable shown to be statically significant. Kaplan Meier survival curve was done for two ICH categories to check for their association with 30days mortality rate.

Results: A total of 142 patients with ICH were studied. The mean age of the patients was (55±11) years, with a predominance of males (60%). Nearly all patients had hypertension (96%), a notable proportion had diabetes mellitus (14%) and 4% were smokers. Most ICHs were supratentorial (93%), primarily located in the basal ganglia (52%). A majority of patients (63%) had hematoma volumes >30cm^3, and 66% exhibited hydrocephalus. Mortality rate in this study was 46%. Higher mortality rates

were associated with larger hematoma volumes ≥30cc (p value<0.001), midline shift (p value<0.001), hydrocephalus (p value<0.001), higher ICH scores (≥3) (p value<0.001), presence of underlying lesion (p value<0.001) older age (>55 years) (p value<0.01), male gender (p value <0.03) and the presence of underlying lesions (aneurysms). The mortality rate in patients with ICH score of 4 was 100%. Patients with higher ICH scores (≥3) had poor 30-day survival probability (0.25) (P<0.0001).

Conclusion. Majority (96%) of patients with spontaneous ICH are hypertensive and male are more affected as compared to female. Most of ICH are supratentorial in location. ICH is associated with high 30-days mortality (46%), it is almost 100% in patients with ICH score of 4. ICH score at admission, larger hematoma volumes, midline shift hydrocephalus, older age, male gender and the presence aneurysms are strong predictors of 30‑ day mortality in patients with spontaneous ICH**.**

Recommendation: ICH score should be used for risk stratification to aid in patient management decision-making. There is a need for more studies with a bigger sample size to elicit the causes of death of patients on the EVD placement and also explore causes of high mortality (100%) in patients with an ICH score of 4 in our settings.

TABLE OF CONTENTS

CERTIFICATION i
DECLARATION AND COPYRIGHT ii
ACKNOWLEDGEMENT iii
DEDICATION iv
ABSTRACT v
LIST OF TABLES x
LIST OF FIGURES xi
LIST OF ABREVIATIONS xii
DEFINITION OF KEY TERMS xiii
CHAPTER ONE 1
1.0 INTRODUCTION 1
1.1 BACKGROUND 1
1.2 PROBLEM STATEMENT 3
1.3 HYPOTHESIS 3
1.4 CONCEPTUAL FRAME WORK 4
1.5 RATIONALE 5
1.6 RESEARCH QUESTION 6
1.6.1 Broad question: 6
1.6.2 Specific questions: 6
1.7 OBJECTIVES 6
1.7.1 BROAD OBJECTIVE 6
1.7.2 SPECIFIC OBJECTIVES 6
CHAPTER TWO 7
2.0 LITERATURE REVIEW 7
2.1 Sociodemographic characteristics of patients with ICH 7
2.1.1 Age and sex 7
2.1.2 Factors associated with ICH 7
2.2 Intracerebral haemorrhage patterns and location 9
2.3 Intracerebral haemorrhagic volume measurement. 9
2.4 Intracerebral haemorrhagic score 10
2.5 The 30-day mortality outcome of patients with ICH 10
2.6 Relationship between ICH score and patient outcomes 11

CHAPTER THREE 12
3.0 METHODOLOGY 12
3.1 Study design 12
3.2 Study area 12
3.3 Study population 12
3.4 Inclusion and Exclusion criteria 12
3.4.1 Inclusion criteria 12
3.4.2 Exclusion criteria 12
3.5 Sampling and sample size estimation 13
3.5.1 Sampling strategy 13
3.5.2 Sample size estimation 13
3.6 Data collection tools and techniques 13
3.6.1 Data collection tool 13
3.7 Data analysis 15
3.8 Description of study variables 16
3.8.1 Independent variables 16
3.8.2 Dependent Variables 16
3.9 Ethical consideration and Approval 16
3.10 Validity and Reliability 16
CHAPTER FOUR 17
4.0 RESULTS 17
4.1 Sociodemographic characteristics of the study Participants 17
4.2 CT Scan Patterns and ICH score of patients with ICH attending MOI and MNH-Mloganzila 19
4.3 The associated factors of 30days mortality Following Intracerebral Haemorrhage in patients admitted at MOI and MNH-Mloganzila. 22
4.4 Predictors of 30days mortality Following Intracerebral Haemorrhage in patients admitted at MOI and MNH-Mloganzila. 24
4.5 The relationship between ICH score and 30 day outcomes of patients with ICH on CT at MOI and MNH-Mloganzila from September 2023 to March 2024. . 27
CHAPTER FIVE 29
5.0 DISCUSSION 29
5.1 Discussion 29
CHAPTER SIX 32

6.0 CONCLUSION AND RECOMMENDATIONS 32
6.1 Conclusion 32
6.2 Recommendations 32
7.0 REFERENCE 34
APPENDIXES 37
Appendix I. Consent Form (English Version) 37
Appendix II: Consent Form (Swahili Version) 39
Appendix III: Analysis of variables 41
Appendix IV: Data collection Form 43
Appendix V: Ethical clearance 47
Appendix VI: Introduction letter 49
Appendix VII: Permission letter 50

LIST OF TABLES

Table 1: Component of the ICH score 15

Table 2: Sociodemographic characteristics of patients with ICH on CT at MOI and MNH –Mloganzila. 17

Table 3: CT scan patterns and ICH score of patients with ICH attending MOI and MNH-Mloganzila 19

Table 4: The associated factors of 30days mortality Following Intracerebral Haemorrhage in patients admitted at MOI and MNH-Mloganzila. 23

Table 5. Predictors of 30days mortality Following Intracerebral Haemorrhage in patients admitted at MOI and MNH-Mloganzila. 25

LIST OF FIGURES

Figure 1: Conceptual framework 5

Figure 2: Age categories of ICH patients admitted at MOI and MNH 18

Figure 3: Risk factor of the patient with ICH at MOI and MNH. 18

Figure 4: Supratentorial (Basal ganglia ICH): 20

Figure 5: Ellipsoid volumetric measurement. 21

Figure 6: Kaplan Meier survival probability curve showing of high risk and low risk ICH score categories. 27

Figure 7: Kaplan Meier survival curve shows death probability of the patient following EVD placement. 28

LIST OF ABREVIATIONS.

ACR American college of radiology.

cm Centimetre

CT Computed tomography

EVD External ventricular drainage.

FUNC Functional

GCS Glasgow coma scale

HDC Hydrocephalus

ICH Intracerebral haemorrhage.

IPH Intraparenchymal haemorrhage.

IVH Intraventicular haemorrhage

MNH Muhimbili National hospital

MOI Muhimbili orthopaedic institute

SAH Subarachnoid haemorrhage.

SPSS Statistical Package for the social science.

DEFINITION OF KEY TERMS

ICH	Bleeding into the brain parenchyma.
ICH score:	Clinical prognostic model of predicting mortality rate among patient with intracerebral hemorrhage.
30days mortality outcome:	Hospital metric for measuring ICH related mortality after the incidence.
Infratentorial:	Brain region below tentorium cerebelli
Neurologic examination:	Series of test and observation that aim on assessing function of the brain, spinal cord and peripheral nervous system.
Supratentorial:	Brain region above the tentorium cerebelli

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND

Intracerebral haemorrhage, refers to bleeding or accumulation of blood within the brain parenchyma and is the most devastating and least treatable form of hemorhahic stroke.(1) It accounts for 10–20% of all strokes and is more fatal than ischaemic stroke.(2–4) The mortality rate is almost 50% within the first month, and only 20% of the patients are able to live independently at 6 months from onset. ICH is associated with severe disability among survivors.(2,3,5,6) It is widely considered to be fatal hence withdrawal of care commonly occurs early in the hospital course, a situation that can worsen the condition in those individuals whose prognosis may not be as worse as initially judged.(7,8) Withdrawal of care is the most potent predictor of death in ICH,(7–9). Accurate diagnosis and prediction of ICH outcome is fundamental in management decision making.(10)

The risk of haemorrhagic stroke in Sub Saharan Africa (SSA) is on the rise. Its incidence varies between 25 and 250 per 100,000 person-years while the prevalence ranges from 15 to 1460 per 100,000 people.(11,12) several factors have been linked with causing ICH. These include, but not limited to, hypertension, diabetes mellitus, arteriovenous malformation, amyloid angiopathy, aneurysm rupture, tumor, coagulopathy, infections, and head trauma.(13) The leading cause of death and disability in SSA, resulting from ICH, is an underlying cardiovascular disease.(14) Other significant risk factors are cigarette smoking, moderate to heavy alcohol consumption, male sex and old age.(13,14) The risk of ICH is significantly increased by chronic liver disease because of resulting coagulopathy and thrombocytopenia.(13,14) The risk of developing ICH increases after age fifty-five, and after 70 years, the relative risk is 7 times than those below.(13) Glioblastoma, lymphomas, metastasis, meningioma, pituitary adenoma, hemangioblastoma and metastases to the brain are the tumours that are more likely to bleed and cause ICH.(13)

Computer Tomography (CT) scan has been an integral component for establishing a diagnosis of ICH. Compared to other imaging modalities such as Magnetic Resonance Imaging (MRI), CT is considered as the gold standard for the diagnosis of ICH since MRI is assumed to have low sensitivity for intracranial blood.(1,13) However, studies indicate that, the accuracy of an early MRI evaluation may be the same as that of a CT scan in detecting bleeding, particularly micro bleeds.(1,12)

CT scan findings have been used to classify ICH into two major categories, namely primary (spontaneous) and secondary.(1) Primary classification is based on location of ICH while secondary classification is based on the underlying causes.Regardless of the causes and location, ICH may be regarded as; hyper acute (<12hrs), acute (12hrs-2days), early sub-acute (2days-8days), late sub-acute(8days-1month), (>1months).(1)

Examples of the commonest non traumatic intracerebral haemorrhage location are basal ganglia, thalamic haemorrhage pontine haemorrhage some with intraventicular extension and very minimal cerebellar haemorrhage can occur. (1)

There was a study done by Hemphill JC et al among 152 ICH patients to predict the patient's outcome, based on clinical examinations and radiological assessment through which, ICH score was created. (15) The score is made up of of a basic neurological examination. (2 points for GCS score of 3 to 4, 1 point for GCS score of 5 to 12, and 0 points for GCS score of 13 to 15), age (1 point for ≥80 years and 0 point for <80 years), ICH volume (1 point for ≥30 mL and 0 points for <30 mL), presence of IVH (1 point), and infratentorial origin (1 point).(15) The ICH score consistently causes an increase in 30-day mortality .(15)

Despite having many studies on intracerebral hemorrhage globally and SSA, yet there is a limited information on the CT patterns, score and outcome of ICH patients in our settings. This study will add information from SSA, particularly Tanzania, to existing body of knowledge regarding the magnitude of ICH, its patterns as detected by CT scan, patient outcomes and how the ICH score relates with patient outcomes. The established CT patterns, the use of ICH score and its relationship with patient

outcomes, will assist at developing appropriate protocols, which will guide accurate management interventions.

1.2 PROBLEM STATEMENT

Intracerebral hemorrhage (ICH) is considered as the most lethal subset of stroke to patients.(11,16) There is increase in number of non-traumatic ICH patients due to rise in number of non-communicable diseases especially cardiovascular disease according to American heart of association (AHA). The global mortality rate is 50% within 30 days. This necessitates accurate diagnosis and stratification of these patients in order to study their patterns and outcome. However Tanzania, there is a lack of published data on non-traumatic ICH Patterns, the use of ICH score .We do not know the burden of ICH patient in Tanzania.

1.3 HYPOTHESIS

Null hypothesis

There is no association between the CT pattern, ICH score and 30 days' mortality outcome among patient with intracerebral hemorrhage.

1.4 CONCEPTUAL FRAME WORK

Figure. Outlines the study's conceptual framework, illustrating the connections between independent and dependent variables. It highlights how various factors related to intracerebral hemorrhage (ICH) p—such as the location and volume of the hemorrhage—and patient characteristics (age, sex, Glasgow Coma Scale score, hypertension, diabetes mellitus, and anticoagulant use) serve as independent variables that significantly predict the ICH score and patient outcomes (the dependent variable). The study focused on evaluating the location and size of the hemorrhage through CT scans. It is important to note that a conceptual framework may not capture all the complexities and relationships involved

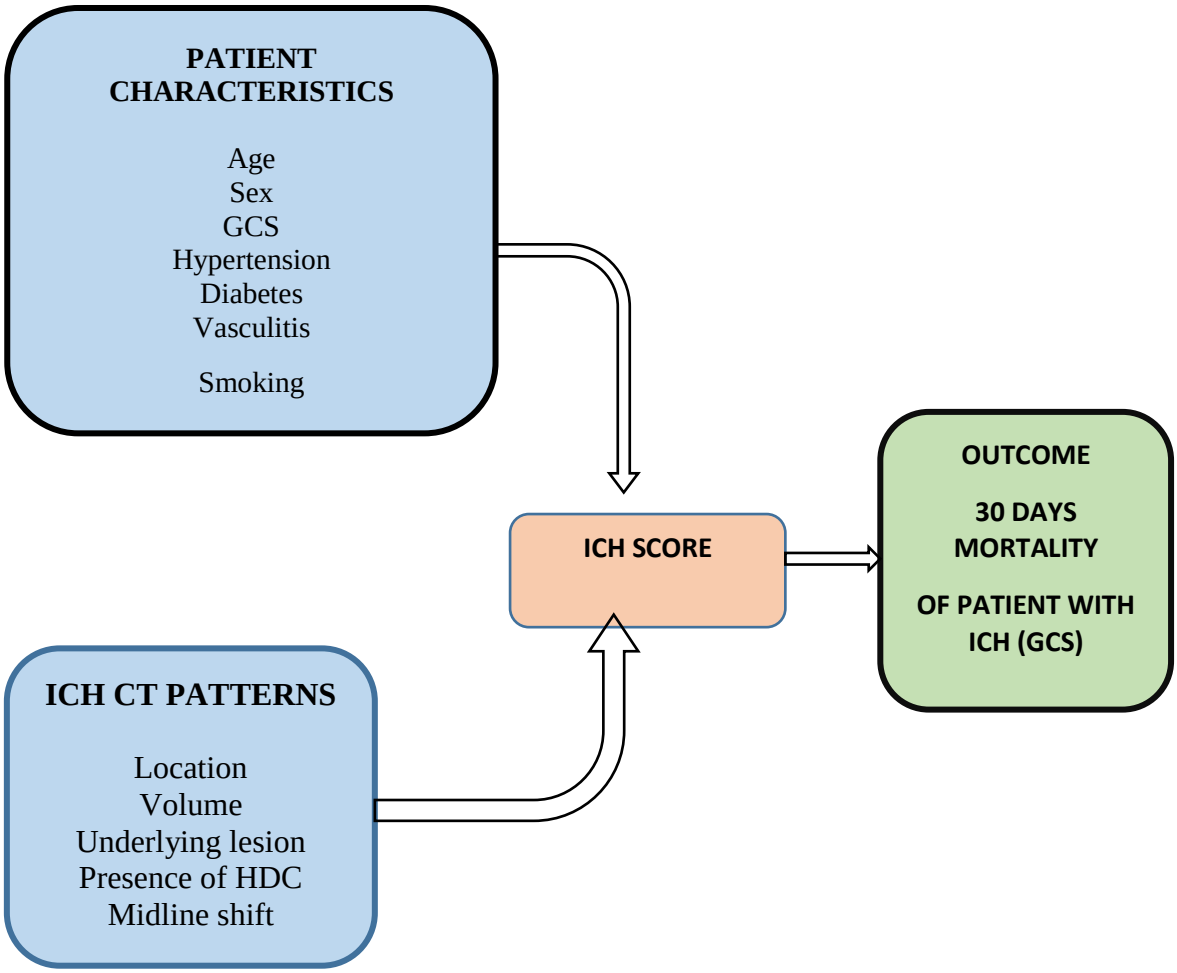


Figure 1: Conceptual framework

1.5 RATIONALE

The results of this study aimed on improving the understanding of ICH through CT imaging, enhance prognostic accuracy. Ultimately, contribute to better management strategies for patients with ICH. The study could have an impact on future research in this area.

1.6 RESEARCH QUESTION

1.6.1 Broad question:

Can CT pattern together with ICH score predict the 30-days mortality outcome of patient with intracerebral hemorrhage at MOI and MNH –Mloganzila?

1.6.2 Specific questions:

i. What are the sociodemographic characteristics of patients presenting with ICH at MOI and MNH-Mloganzila?

ii. What are the CT patterns and ICH score of patients with ICH attending MOI and MNH-Mloganzila from September 2023 to March 2024?

iii. What is the ICH score of patients presenting with ICH at MOI and MNH-Mloganzila?

iv. What is the relationship between ICH score and outcome of the patients at MOI and MNH-Mloganzila?

1.7 OBJECTIVES

1.7.1 BROAD OBJECTIVE

To determine Computed Tomography patterns, score and outcome of intracerebral haemorrhage among patients attending Muhimbili Orthopedic institute (MOI) and Muhimbili National Hospital-Mloganzila.

1.7.2 SPECIFIC OBJECTIVES

i. To determine sociodemographic characteristics of patients with ICH on CT at MOI and MNH -Mloganzila from September 2023 to March 2024.

ii. To determine CT patterns and ICH score of patients with ICH attending MOI and MNH-Mloganzila from September 2023 to March 2024.

iii. To determine the 30-day mortality outcome of patients with ICH on CT at MOI and MNH-Mloganzila from September 2023 to March 2024.

iv. To determine the relationship between ICH score and outcomes of patients with ICH on CT at MOI and MNH-Mloganzila from September 2023 to March 2024.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Sociodemographic characteristics of patients with ICH

According to Journal of stroke there is modifiable and non-modifiable risk factors for intraparenchymal haemorrhage the modifiable risks include hypertension, current smoking, excessive alcohol consumption, use of antiplatelet agents or sympathomimetic drugs such as amphetamine and cocaine.(13,17,18) The non-modifiable risk factors include Male gender, cerebral amyloid angiopathy, and chronic kidney disease.(13,18) There is a group of other risk factors which are include multiparity, poor working environment and long sleep duration.(13,17,18)

2.1.1 Age and sex

ICH has shown to be associated with an increased age. A retrospective cohort study in the Netherlands reported an incidence rate of 5.9 per 100,000 in the 35-54 age group, 37.2 in 55-74 age group, and 176.3 in 75-94 age group.(13) Systematic review studies have also provided similar reports noting a ten-fold increase in the risk of the incidence of ICH in persons aged 85 years and above compared to those aged 45 – 54 every year.(17)

There have also been differences in the incidence of ICH between men and women. An international study on the epidemiology of ICH reported that ICH occurred less commonly in women, the incidence being 15% lower in women.(17) Another study reported similar findings with the annual incidence of men and women shown to be, respectively, 5.9 vs. 5.1 among those aged 35-54 years, 37.2 vs. 26.4 in those aged 55-74 years, and 176.3 vs. 140.1 in the 75-94 age category.(19)

2.1.2 Factors associated with ICH

Hypertension

Hypertension is reported to be the major risk factor for ICH. A meta-analysis of cohort studies reported that persons who are hypertensive have a 3.5 times risk of developing ICH compared to persons who are normotensives.(17,20) Mitlu *et al* showed that

among patient with cerebral haemorrhage, 94% of patients had hypertension, either at the time of admission or in the preceding several months or years.(21) The remaining, 6% of people had systolic pressure readings between 90 - 150 mm Hg but no history of hypertension. In 4% of instances, the greatest blood pressure during hospitalization was over 300 mm systolic, and in 3% of cases, the highest diastolic reading was 220 mm Hg. Systolic pressure was 200-290 mm Hg in 59%, 160-190 mm in 20%, and 90-150 mm in 17% of individuals with documented hypertension. On admission, the diastolic pressure was 110-190 mm in 58% of cases and 40-100 mm in 39% of cases.(21)

Anticoagulant

The prevalence of oral anticoagulation-associated intracerebral haemorrhage (OAC-ICH) is rising as warfarin use is increasing and treated patients are living longer. According to recent population research, the frequency of OAC-ICH is now comparable to that of subarachnoid haemorrhage.(17,18,22) although it can happen in the brainstem, OAC'-ICH are most usually found in deep or lobar regions of the brain. These haemorrhages are more severe than spontaneous hematomas and at least 50% of the time they can be fatal.(18,22) The direct mechanical rupture of brain tissue in OAC-ICH patients is the primary cause of brain injury, but secondary damage may also result from the action of substances including thrombin, glutamate, cytokines, heme, iron, and matrix metalloproteinase, which are chemically toxic.(17,22)

Oral contraceptives

A meta-analysis of observational studies suggests that the use of oral contraceptive causes slight increase in the risk of ICH and subarachnoid haemorrhage.(23) Two independent reviewers derived relative risk (RR) estimations from each trial to evaluate the risk of subarachnoid haemorrhage among users of oral contraceptives to those who don't use them. By type of study design, outcome measure (mortality versus incidence), exposure measure (current versus ever use), prevalent oestrogen dose used, and control for smoking and hypertension, study heterogeneity was evaluated. Subarachnoid haemorrhage caused by oral contraceptive use generally had a summary RR of 1.42.(17,23).

2.2 Intracerebral haemorrhage patterns and location

In an organized hematoma, several computed tomographic (CT) patterns of recurrent haemorrhage were seen. When haemorrhage was contained within a late-organizing hematoma, a hyper dense, clearly defined mass with little contrast enhancement but no surrounding edema was seen.(11,24) When the new haemorrhage manifested within an early-organizing hematoma, a "target" sign of a ring-enhancing mass was seen. The CT appearance revealed that a potential tumoral haemorrhage may have occurred when a fresh haemorrhage appeared outside of a solid-enhancing organized hematoma.(24) These small recurrent hematomas frequently develop in deep-seated, crucial organs including the brainstem, thalamus, and basal ganglia, where inappropriate care under an assumed diagnosis without tissue pathology may have serious consequences.(11,24)

2.3 Intracerebral haemorrhagic volume measurement.

The volume of bleeding can be measured using a variety of methods. Unfortunately, these procedures frequently involve intricate calculations, demand specialized tools, or cannot be quickly completed at the patient's bedside. discovered that the straightforward formula ABC/2, which takes less than a minute to measure and calculate, may precisely estimate the volume of intraparenchymal bleeding.(25) For all bleeding locations, the measurements show a strong correlation with the volumes estimated using planimetric techniques. Planimetric and ABC/2 measurements showed a very strong (R2=.96) correlation. All bleeding areas had good correlation between measures made by a single reader using the ABC/2 method and planimetric measurements.(25)

The CT slice with the greatest amount of bleeding was found for the bedside ABC/2 technique. On this slice, the haemorrhage's biggest diameter (A) was measured.(25,26) The second measurement was the biggest diameter 90° to A on the same slice (B).(25,26) finally, a calculation was made to determine approximately how many 10-mm slices contained the ICH (C). By comparing each CT slice with a haemorrhage to the CT slice with the greatest haemorrhage on that scan, C was computed.(25,26)

2.4 Intracerebral haemorrhagic score

The ICH Score is a clinical grading system that enables risk stratification when ICH is present. The standardization of clinical treatment regimens and clinical research studies in ICH may be enhanced by the adoption of a scale like the ICH score.(10,15) The GCS score of 3 to 4 (=2 points), 5 to 12 (=1), 13 to 15 (=0), age 80 years (=1), Infratentorial origin (=1), no (=0), ICH volume 30 cm3 (=1), 30 cm3 (=0), and intraventricular hemorrhage (=1), no (=0) were added to determine the ICH.(15).Various radiological parameters, such as hematoma volume, midline shift, Infratentorial location, intraventricular extension, and the development of hydrocephalus, also predict functional prognosis after intraparenchymal haemorrhage.

According to American heart association journal Patient with ICH has been categorized into various group of which those with score of 3 and above have associated high risk (>60%) mortality rate and those scoring 1 and 2 have a lower risk. (15)

2.5 The 30-day mortality outcome of patients with ICH

To predict the prognosis of patients with intracerebral hemorrhage, numerous scoring systems have been developed and improved; three of these systems have received widespread clinical acceptance and are well-validated. The ICH score, which ranges from 0 to 6, was developed to assess 30-day mortality. The FUNC score, which ranges from 0 to 11, was developed to predict functional independence after 90 days. The 30-day outcome and death are predicted by the intracerebral hemorrhage grading scale (ICHGS), which has a range of 5 to 13 points.(27,28)

The location and extent of the hemorrhage, the patient's age, the presence of other medical conditions, along with other factors can all affect how the spontaneous ICH manifests clinically. However, intracerebral hemorrhage can have significant adverse consequences. According to American heart of association, the 30-days mortality rate for patient with ICH score of 1, 2, 3 and 4 is 13%, 26%, 72% and 97% respectively. Mortality rate is 100% in patients with ICH score of 5. (15)

2.6 Relationship between ICH score and patient outcomes

The ICH score is one such scale that has been researched and validated for use in the treatment of individuals with intra cerebral hemorrhage. It has been proven to be a good clinical scale in various studies performed worldwide that can predict the patient's outcome. It has been independently demonstrated that each of the five components that make up the ICH score is related to the patient's outcome.(28)

The study done by Diaa A. Safatli et al, indicated that GCS score upon admission, together with baseline haemorrhage volume and location, are significant predictors of 30-day death in patients with primary main ICH. A patient is considered to be in a high-risk patient category if their entrance GCS was less than 11, and if their ICH volume was greater than 32 ml supratentorial and 21 ml infratentorial. The 30-day mortality is correctly predicted by the ICH score and ICH GS.(29) Chih-Wei Wang et al.'s study on the relationship between 30-day mortality and ICH score showed that there was a positive correlation between the two, i.e., with a higher ICH score, the 30-day mortality was also higher, regardless of the size of the hematoma.(30) The global mortality rate is 50% within 30 days. This necessitates accurate diagnosis and stratification of these patients in order to study their patterns and outcome. However Tanzania, there is a lack of published data on ICH Patterns, the use of ICH score .The burden of ICH patient in Tanzania is not well known.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study design

This was a hospital-based prospective cross-sectional study, carried out at Muhimbili National Hospital-Mloganzila and Muhimbili Orthopedic Institute. The study was conducted among patients attending MOI and MNH presenting with ICH whose ICH patterns was obtained using brain CT scan was being analyzed between September, 2023 to March 2024.

3.2 Study area

This study was conducted at Muhimbili National Hospital - Department of Neurology-Mloganzila and Muhimbili Orthopaedic Institute - Department of Neurosurgery. MNH and MOI are located in Upanga area, within Ilala Municipality in Dar es Salaam region. The two have a combined admission capacity of more than 1362 beds (MNH – 1000 bed capacity and MOI – 362 bed capacity).(31) The two facilities are the most specialized in the country, with MNH being the national referral hospital and MOI being the top hospital in orthopedic and neurosurgery hospital in Tanzania. The hospitals have readily available CT machines and Picture Archive and Communication (PAC) system which enabled this study to be conducted and produced reliable data.

3.3 Study population

This study was carried out among patients who have non-traumatic intracerebral haemorrhage (ICH) on CT at Muhimbili National hospital (Mloganzila) and Muhimbili orthopedic institute**.**

3.4 Inclusion and Exclusion criteria

3.4.1 Inclusion criteria

All patients with non-traumatic ICH on CT attending MNH-Mloganzila and MOI with CT data.

3.4.2 Exclusion criteria

1. Patients with traumatic ICH.

3.5 Sampling and sample size estimation

3.5.1 Sampling strategy

This study utilized convenient sampling technique to obtain participants who were included in the study. Patients with ICH on CT and meeting inclusion criteria were recruited into the study until a sample size is reached. Convenience sampling technique involves selecting patients who are readily available and willing to participate. It was practical practical for this study because time was limited.

3.5.2 Sample size estimation

Sample size was calculated using survival analysis formula with a log rank test set at

$p < 0.0001$

$$n = \frac{2(Z+P1)^2 \times (P1\{1-P1\} + P2\{1-P2\})}{(P1-P2)^2} \times \frac{1}{f}$$

Where:

Z score=1.96

Desired power =80%

P1=Expected survival probability in non-intervened group-50%

P2=Expected survival probability in intervened group- 80%

f= Expected Censoring rate was set at 0.6

$$n = \frac{2(1.96+0.8)^2 \times (0.5(0.5) + 0.6(0.4)) \times 1/0.6}{(0.5-0.6)^2}$$

Sample size was estimated to be 138 participants**.**

3.6 Data collection tools and techniques

3.6.1 Data collection tool

Data collection was made using a four-sectioned structured data collection tool; patient demographics, patient clinical characteristics, radiographic findings (CT pattern)

ICH score and 30 days' mortality outcome and Individual ICH score. The patient were then categorized as high ICH score (>or equal to 3) and low ICH score (<3). For the

patients whose clinic was dew and did not show up for their appointment the next of kin whose numbers was recorded in the file were contacted for follow up.

Section 1: Demographic characteristics

The following information were collected in this section: age of the patient, and sex. The next of kin whose number is recorded in the patient file was asked to give this information, those who meet the criteria but are have no next of kin will not be included in the study.

Section 2: Patient clinical characteristics

The following data were collected under this section; GCS score, Body, Diabetes, hypertension, smoking or vasculitis.

Section 3: Imaging

The 64 slice CT scanner was used to acquire the images, this is the recommended machine for imaging the brain and cardiac and it provide good details in vascular and brain even in a minimal scanning time GE Optima 660, 0.625slice thickness, Z axis matrix with a detector coverage of 40mm and 0.5sec tube rotation was used.

Section 4: CT findings

In this section, CT scan findings was recorded. Image evaluation was done by a PI and a senior radiologist/neuroradiologist. Final diagnosis was reached after the finding were verified by a senior radiologist/neuroradiologist to avoid bias. CT findings such as location of ICH, ICH volume, midline shift, presence of hydrocephalus, underlying lesion and intraventricular hemorrhage (IVH) extension were then recorded.

Section 5: ICH score and patient outcome

In this section, the ICH score and 30-day mortality patient outcome was calculated and patient outcome documented, respectively. The patient were categorised into two categories where as those with Above or equal to 3 were labelled as high risk patient score and less than 3 as low risk patients.(15) Follow up of patients was done in the ward and outpatient clinics. Only patients whose clinic was dew time and did not show

up for their appointment the next of kin whose numbers are recorded was contacted for follow up. The two ICH score categories were, <3 and≥3. The total ICH Score is the sum of the points of the various characteristics.(15)

Table 1: Component of the ICH score

Component	ICH score
GCS score	
3 - 4	2
5 - 12	1
13 - 15	0
ICH volume (cm^3)	
≥30	1
<30	0
Intraventricular extension	
Yes	1
No	0
Infratentorial origin of ICH	
Yes	1
No	0
Age	
≥80	1
<80	0

3.7 Data analysis

Data obtained in this study was analysed using Statistical Package for Social Sciences (SPSS) version 23. Analysis was grouped into descriptive and analytical part.in descriptive part Mean and standard deviation was used because the variable was normally distributed. The categorical variables were then summarised using frequency and percentage. Analytical part (p value<0.05)

Data were compared using cross tabulation and chi square statistical test was used to check for the association between the independent variables and 30- day mortality outcome. Univariate and multivariate logistic regression was used to check for the

magnitude and direction of the association for the variable shown to be statically significant. Kaplan Meier survival curve was done for two ICH categories to check for their association with 30days mortality rate. Data was then presented using table and figure.

3.8 Description of study variables

3.8.1 Independent variables

Independent variables included all demographic variables, clinical characteristics and radiological findings as detailed above.

3.8.2 Dependent Variables

Dependent variables in this study was ICH score and patient outcome

3.9 Ethical consideration and Approval

To perform the study, ethical clearance and approval was obtained from Muhimbili University of Allied and Heath Sciences (MUHAS) – Institutional Review Board (IRB) and MNH research committee, respectively. Ref.No. DA282/298/01.C/1759. The study volunteers all were provided with informed consent. There was no risks imposed and no direct/immediate benefits to study participants. Subjects' confidentiality was observed through the use of codes and not names on the data collection tool. All completed questionnaires were kept under lock and key by the Principal Investigator.

3.10 Validity and Reliability

Validity issue: All tools used were standardized to assure validity. The checklist developed for this study was evaluated to make sure they are user-friendly and capture all the necessary data. To make sure that participants understand and submit accurate information, the surveys was translated into Swahili.

Reliability issue: To make sure that the processes and data used in this study was reliable, All CT findings were reviewed by experienced Radiologist/Neuroradiologist and the clinical outcome of the patients were all confirmed by the senior neurologist and neurosurgeon and the findings were documented in the tool provided.

CHAPTER FOUR

4.0 RESULTS

4.1 Sociodemographic characteristics of the study Participants

A total of 142 patients with intracerebral haemorrhge (ICH) were recruited from September 2023 to March 2024 at Muhimbili Orthopedic Institute (n= 94; 66%) and Muhimbili National Hospital – Mloganzila (n=48;34%). The mean age was (55±11) years old. *Most of the affected patients were 40 to 50 years of age.* Males were predominant, accounting for 60% (86/142) of all the study participants. More patients were from MOI (94/142, 66%). Almost 96% of patients had hypertension, with 14% (20/142) reported to have diabetes mellitus, and only 4% were smoking cigarettes. *(Table 2, Figures 2& 3).*

Table 2: Sociodemographic characteristics of patients with ICH on CT at MOI and MNH –Mloganzila.N=142

Variables	Frequency	Percentage
Age (Mean/Median)	Mean/SD=54.8/11.7	
Age Categories		
30-40	13	9.1
40-50	40	28.0
50-60	41	28.7
60-70	34	23.8
70-80	11	7.7
80+	3	2.1
Gender		
Male	86	60.0
Female	56	40.0
Risk factors		
Hypertension	137	95.8
Diabetes Mellitus	20	14.0
Smoking	5	3.5
Others*	2	1.4
30 days Mortality		
Yes	65	45.8
No	77	54.2

Note: Other risk factors described in this study was HIV vasculitis

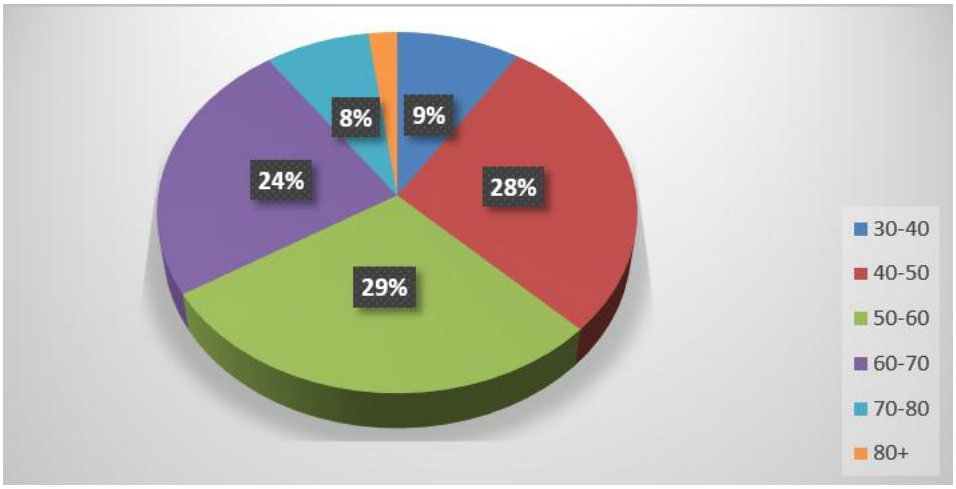


Figure 2: Age categories of ICH patients admitted at MOI and MNH (shows majority were aged between 50-60 years old by 29%)

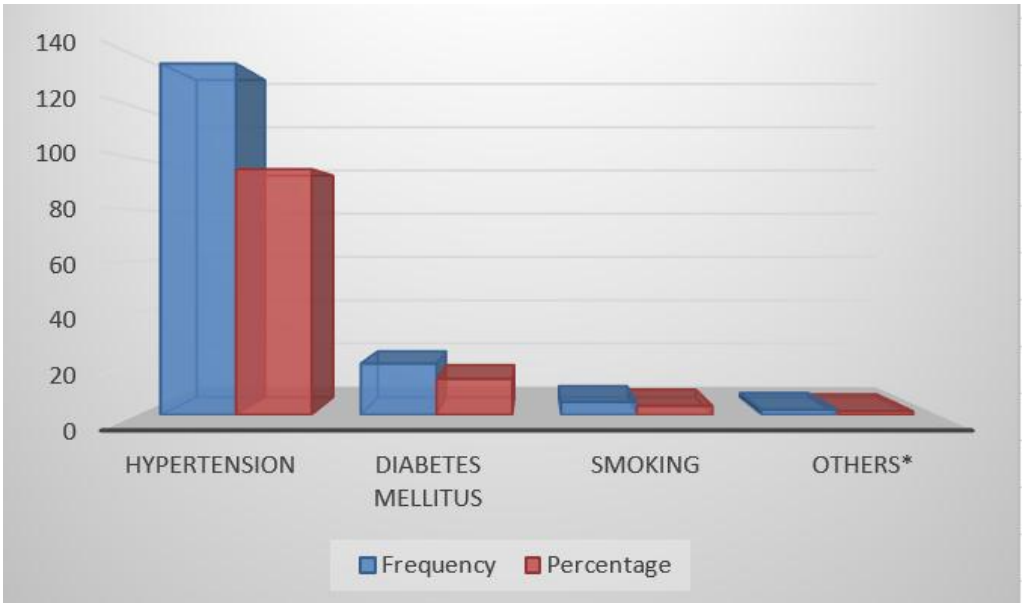


Figure 3: Risk factor of the patient with ICH at MOI and MNH. (Shows majority being the in the hypertensive group.)

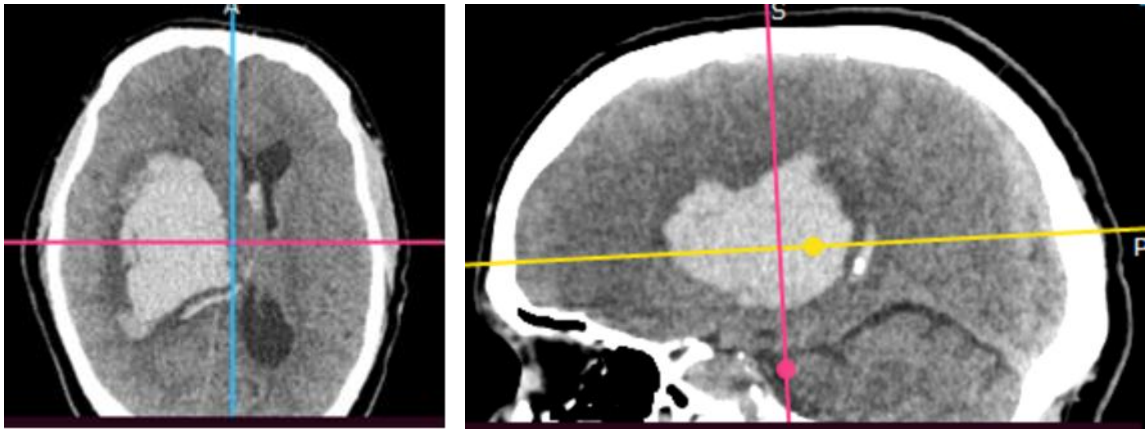
4.2 CT Scan Patterns and ICH score of patients with ICH attending MOI and MNH-Mloganzila

The majority of the bleedings were found supratentorial, accounting for 93% (133/142) of the study population. They were primarily located at the Basal ganglia in 52% (74/142), followed by lobar areas (temporal, parietal, occipital, and frontal) in 25% (35/142) and the Thalamus in 22% (31/142). 15/142 (11%) bleeds were located infratentorial, primarily at the pons in 5% (7/142) and the Cerebellum in 5% (7/142). The majority of patients had a bleed volume greater than 30cm^3, accounting for 63% (89/142), with 43% (61/142) having midline shift, and all participants having an extension of bleed to the ventricles. Hydrocephalus was observed in 66% (94/142) of the patients. 22% (31/142) of the patients had underlying lesions, mainly aneurysms. (*Table 2*) 46% (66/142) of patients had an ICH score of 3, followed by 27% (39/142) of patients having a score of 2, with only 5% and 1% having scores of 4 and 5, respectively. (*Table 3*)

Table 3: CT scan patterns and ICH score of patients with ICH attending MOI and MNH-Mloganzila N=142

Variable	Frequency (%)
ICH Location	
Primary location	
Basal Ganglia	74 (51.7)
Lobar	35 (24.5)
Thalamus	31 (21.7)
Cerebellum	7 (5.0)
Pons	7 (5.0)
Tentorium division	
Supratentorial	127 (89.0)
Infratentorial	9 (6)
Supra & infra	6 (4)
Hematoma Volume category (cm3)	
<30	53 (37.0)

≥30	89 (63.0)
Midline shift	
Yes	61 (43.0)
No	81 (57.0)
HDC	
Yes	94 (66.0)
No	48 (34.0)
Underlying Lesion (Aneurysm)	
Yes	31 (22.4)
No	111 (77.6)
ICH Score	
0	10 (7.0)
1	19 (13.3)
2	39 (27.3)
3	66 (46.2)
4	7 (5.0)
5	1 (0.7)



ganglia ICH): Axial and sagittal reformatted non contrasted CT scan of the brain at the level of the basal ganglia showing a right basal ganglia ICH with significant midline shift, surrounding edema and intraventricular extension to the ipsilateral lateral ventricles and evident contralateral ventriculomegally**.**

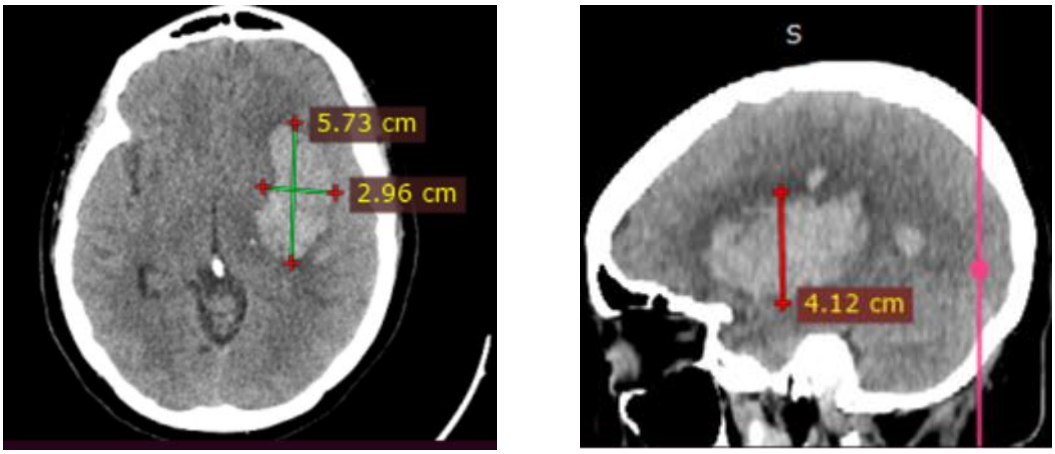


Figure 5: Ellipsoid volumetric measurement. (Axial and sagittal reformatted non contrasted CT scan of the brain at the level of the basal ganglia showing a left basal ganglia ICH without significant midline shift, no intraventricular extension. It was measuring (5.73x2.96x4.12) *0.52 =34.9cc)

4.3 The associated factors of 30days mortality Following Intracerebral Haemorrhage in patients admitted at MOI and MNH-Mloganzila.

The 30-day mortality in this study, was **46% at** MOI and MNH-Mloganzila**.**

Significant higher proportional of mortality were observed in Patients with hematoma volume more than 30cm3 accounting (60%,53/89 versus 23%,12/53 p=<0.001), Patients with midline shift (71%,43/61 versus 27%,22/81 p=0.001), patient with Hydrocephalus (60%,56/94 versus 19%, 9/48 p=0.001), patients with underlying aneurysm lesion accounting (52%, 16/31 versus 44%,49/111 p=0.01) and patient with ICH score 3 and above (70% 46/66, p=<0.001). Patients with Intracerebral bleed to the infratentorial region primarily to the pons had higher mortality rate accounting (71%, 5/7 p=0.2), but this observation was not statistically significant. Significant association was also observed in patients with hematoma to the Basal ganglia (51%,40/74 *p*=0.04), whereas presence of hematoma at the thalamus was associated with low proportional of mortality (25%,8/31 p=0.001). (*Table 2*)

Surgical intervention for hematoma evacuation had significant higher proportional rate of mortality compared to non-surgical management (80%,8/10 versus 43%,57/132 p=<0.001). However, there was no statistical significance difference between placement of an EVD and the mortality rate (49.4%, 38/77 versus 42%, 27/65 p=0.40). Significant association was also observed among patients with older age of 55years old and above compared to the younger one (58%,36/62 versus 36%, 29/80 p=0.01). (*Table 4*)

Table 4: The associated factors of 30days mortality Following Intracerebral Haemorrhage in patients admitted at MOI and MNH-Mloganzila. N=142

Variable	30 days Mortality n (%)	*p* Value
ICH Location		
Basal Ganglia	40 (51.1)	0.04
lobar	17 (48.6)	0.80
Thalamus	8 (25.8)	0.01
Cerebellum	3 (43.0)	0.80
Pons	5 (71.4)	0.20
Supratentorial	62 (46.6)	0.50
Infratentorial	8 (53.3)	0.50
Hematoma Volume category (cm3)		<0.001
<30	12 (22.6)	
≥30	53 (60.0)	
Midline shift		<0.001
Yes	43 (70.5)	
No	22 (27.2)	
HDC		<0.001
Yes	56 (60.0)	
No	9 (18.8)	
Underlying Lesion (Aneurysm)		0.01
Yes	16 (51.6)	
No	49 (44.1)	
ICH Score		<0.001
0	0 (0.0)	
1	0 (0.0)	
2	11 (28.2)	
3	46 (70.0)	
4	7 (100.0)	
5	1 (100.0)	
Hematoma Evacuation		0.04
No	57 (43.2)	
Yes	8 (80.0)	
EVD		0.40
No	27 (41.5)	
Yes	38 (49.4)	
Medical intervention		0.04
No	46 (52.6)	
Yes	19 (34.5)	

Age Categories (years)		0.01
<55	29 (36.3)	
≥55	36 (58.1)	
Gender		0.20
Male	43 (50.0)	
Female	22 (40.0)	

4.4 Predictors of 30days mortality Following Intracerebral Haemorrhage in patients admitted at MOI and MNH-Mloganzila.

Significantly independent predictors for 30-day mortality were observed in patients with hematoma volumes greater than 30cm^3 (OR=1.5, 95%CI 1.0, 2.3, p=0.05), midline shift (OR=7.3, 95%CI 3.1, 17.5, p=<0.001), presence of hydrocephalus (OR=6.5, 95%CI 2.7, 15.5, p=<0.001), ICH scores equal to or more than 3 (OR=7.0, 95%CI 1.6, 29.0, p=0.01), older age above 55 years old (OR=2.4, 95%CI 1.2, 4.8), and presence of underlying lesions such as aneurysms (OR=2.4, 95%CI 1.1, 6.4, p=0.05). Low risk was significantly observed in patients who underwent surgical intervention for hematoma evacuation (OR=0.2, 95%CI 0.04, 0.9, p=0.04). Higher risk was observed in patients without EVD (OR=1.4, 95%CI 0.7, 2.7, p=0.35), but this statistic was not significant. (*Table5*)

Table 5. Predictors of 30days mortality Following Intracerebral Haemorrhage in patients admitted at MOI and MNH-Mloganzila.N=142

Variable	OR* (95% CI)	*p* Value
ICH Location		
Basal Ganglia	0.4 (0.2-0.8)	0.02
Lobar	1.1 (0.5-2.4)	0.76
Thalamus	0.2 (0.05-0.4)	<0.001
Cerebellum	0.6 (0.13-2.9)	0.54
Pons	1.4 (0.25-7.9)	0.69
Supratentorial	0.8 (0.5-1.2)	0.40
Infratentorial	1.2 (0.4-3.4)	0.70
Hematoma Volume category (cm3)		
<30	1	
>30	1.5 (1.0-2.3)	0.05
Midline shift		
Yes	7.3 (3.1-17.5)	<0.001
No	1	
HDC		
Yes	6.5 (2.7-15.5)	<0.001
No	1	
Underlying Lesion (Aneurysm)		
Yes	2.4 (1.1-6.4)	0.05
No	1	
ICH Score		
0	-*	
1	-	

2	1	
3	7.0 (1.6-29.0)	0.01
4	-**	
5	-	
Hematoma Evacuation		
No	1	
Yes	0.2 (0.04-0.9)	0.04
EVD		
No	1.4 (0.7-2.7)	0.35
Yes	1	
Medical intervention		
No	1	
Yes	0.4 (0.2-0.8)	0.02
Age Categories (years)		
<55	1	
≥55	2.4 (1.2-4.8)	0.01
Gender		
Male	1	
Female	0.4 (0.2-1.0)	0.03

4.5 The relationship between ICH score and 30 day outcomes of patients with ICH on CT at MOI and MNH-Mloganzila from September 2023 to March 2024.

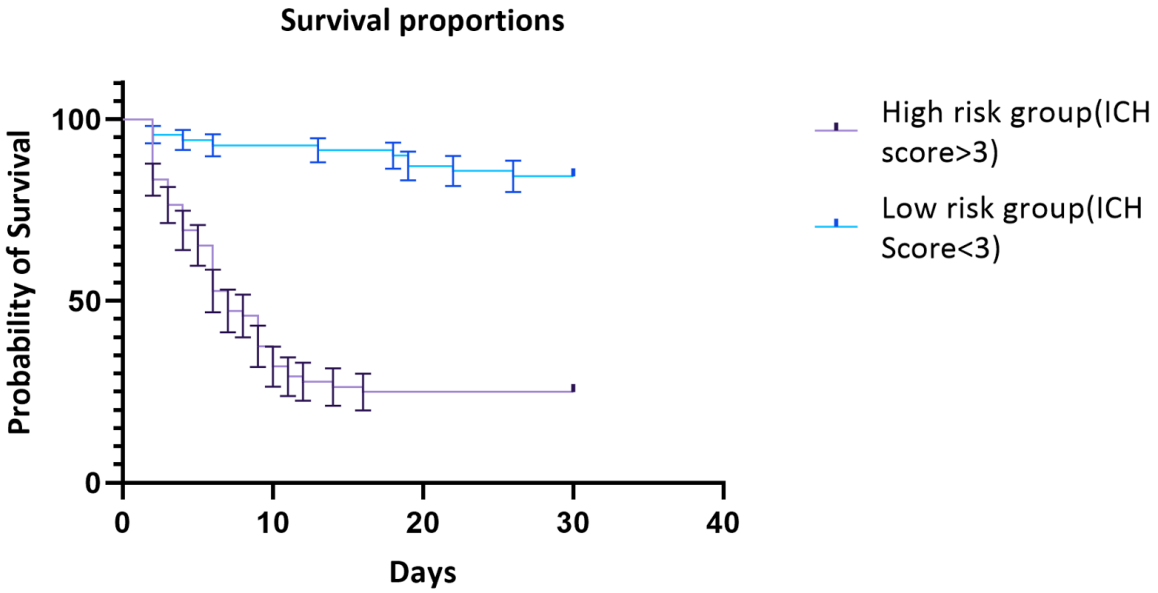


Figure 6: Kaplan Meier survival probability curve showing of high risk and low risk ICH score categories.

There was a significant difference in survival times between the low risk group (ICH <3) and high risk group groups (ICH>3). (Log rank test P<0.0001). The Kaplan-Meier survival probability estimates at 30days about 0.90 for the low risk and 0.25 for the high risk group.

Mortality rate post EVD

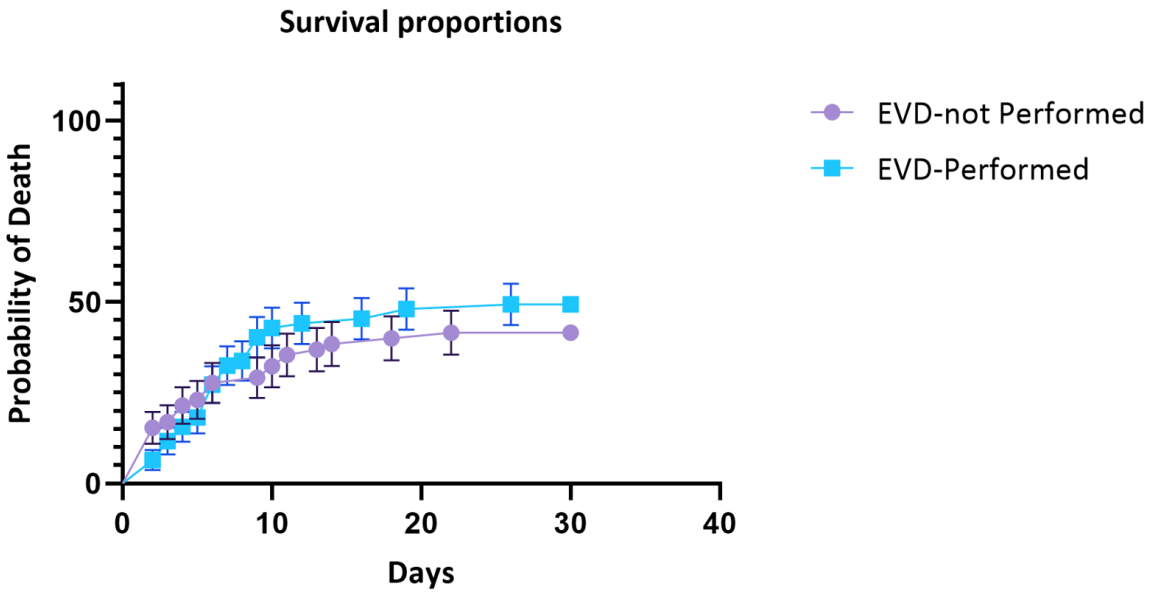


Figure 7: Kaplan Meier survival curve shows death probability of the patient following EVD placement.

There was a significant difference in death times between the patient with EVD placement and those with no EVD placement. (Log rank test P<0.0001). The Kaplan-Meier survival probability estimates at 30days about 0.49 for the patient underwent EVD and 0.41 for those whom EVD was not performed.

CHAPTER FIVE

5.0 DISCUSSION

5.1 Discussion

Intracerebral hemorrhage remains an important and one of the frequent medical emergencies with devastating outcomes for the patients. Standard management plan is still under discussion and is also a subject of many studies in medicine on difference treatment options. This study investigated the CT-Scan patterns, scores, and outcomes of intracerebral hemorrhage among patients attending MNH and Mloganzila Hospital. In the course of investigating the demographic characteristics associated with patients presenting with ICH, we found that the mean age was 55 years, with ICH being more common in males compared to female participants. This observation concedes with a previous study done by An SJ, Kim TJ et al(13, 17) which indicated a higher incidence in the age group of 55 to 74 years and a lower incidence in people aged between 35 to 54 years. The observed similarity could be attributed to the increased risk of ICH with age and accompanying factors such as Diabetes Mellitus and hypertension, which are more common in people of advanced age. Regarding the sex of the participants, our results are quite similar to previous studies done by Giroud M et alin France (17, 18, 19), which highlighted male gender as a non-modifiable risk factor for ICH. Reasons contributing to these incidence rates in men could include involvement in risky behaviors like alcohol consumption, cigarette smoking, and less engagement with healthcare services compared to females. As highlighted in previous studies (13), male patients may be less attentive to health concerns and more engaged in non-health behaviors that increase their risk of ICH.

We also found that hypertension was the most common risk factor (96.5%). Our findings are in line with previous studies which indicated hypertension as one of the most common risk factors, with a 3.5 times increase in the risk of ICH occurrence (17, 20). Hypertension can cause increased vascular damage and microaneurysms, both of which can put additional stress on blood vessels leading to rupture.

In our study 30-day mortality rate was found to be 46% at MOI and MNH-Mloganzila, highlighting significantly higher mortality rates among patients with specific conditions such as larger hematoma volumes (>30cm³), midline shift, hydrocephalus, underlying aneurysms, and higher ICH scores (≥3). Interestingly, mortality rates were also elevated in cases of intracerebral bleeds affecting the pons and basal ganglia, while lower mortality was associated with thalamic hematomas. Surgical intervention for hematoma evacuation showed a significantly higher mortality rate compared to non-surgical management, with no statistical difference observed for patients with or without an external ventricular drain (EVD). Furthermore, patients aged 55 years and above had a higher mortality rate compared to younger patients (58% versus 36%). These findings are consistent with previous studies (27, 28), which also reported higher mortality rates associated with similar clinical factors. Alignment in methodologies and potential similarities in patient demographics and racial backgrounds may contribute to these consistent observations.

Regarding the CT-Scan patterns, we found that the majority of the bleedings were supratentorial, accounting for 93% (133/142) of the study population. They were primarily located in the basal ganglia in 52% (74/142), followed by lobar areas (temporal, parietal, occipital, and frontal) in 25% (35/142) and the thalamus in 22% (31/142). Eleven percent (15/142) of bleeds were located infratentorial, primarily at the pons in 5% (7/142) and the cerebellum in 5% (7/142). These findings are quite similar to previous studies (11, 24). Both current and previous studies used the same research setting and were conducted in hospital-based populations, which could explain the observed similarity. However, a study by Ya-Yen Lee indicated somewhat different results, with ICH location in the basal ganglia slightly higher by 18% compared to our findings, and supratentorial location lower by 27% compared to our findings. This study included a much larger sample size and was conducted over an extended period which might account for the observed differences. Regarding bleeding volume, most of our patients had a bleeding volume of more than 30 cm³, which is in line with a previous study (25). We also found that ICH scores of 2 and 3 were the most common in the study population. ICH score has been linked with increased mortality in a

previous study (15). This finding highlights the possibility of ICH progression leading to increased mortality rates as highlighted in the previous study (18).

Our study found a significant difference in survival times between patients classified into low-risk (ICH <3) and high-risk (ICH >3) groups, Kaplan-Meier survival probability estimates at 30 days were approximately 90% survival probability for the low-risk group and 25% for the high-risk group, highlighting substantial differences in outcomes based on initial ICH risk stratification. Additionally, the mortality rate following external ventricular drain (EVD) placement showed a notable distinction in death times between patients who underwent EVD placement and those who did not, with a significant (49% death rate in patient who underwent EVD placement and 41% death probability to the patient without EVD placement. This observation is quite different from previous studies (28, 30), which highlights the importance of EVD placement and how it has reduced mortality rates by more than 28%. Our study, therefore, implicates that there is a need for searching on other probable cause of death in patient with EVD placement in order to give proper management and reduce mortality for patients presenting with ICH.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Majority (96%) of patients with spontaneous ICH are hypertensive and male are more affected as compared to female. Most of ICH are supratentorial in location. ICH is associated with high 30-days mortality (46%), it is almost 100% in patients with ICH score of 4**.** ICH score at admission, larger hematoma volumes, midline shift hydrocephalus, older age, male gender and the presence aneurysms are strong predictors of 30‑ day mortality in patients with spontaneous ICH.

The mortality rate in this study was 46%. mean age for patients with ICH was 55 years, with males comprising 60% of the participants. Majority of patients with CH in this study had hypertension. CT scan analysis revealed that 93% of hemorrhages were supratentorial, primarily located in the basal ganglia (52%) and lobar areas (25%). Higher ICH scores (≥3) were significantly associated with increased mortality rates. The ICH score at admission, along with the initial volume and location of the hemorrhage, are strong indicators of 30-day mortality in patients with non-traumatic intracerebral hemorrhage. Therefore, using CT patterns and the ICH score allows for risk stratification of patients, helping to identify those at high risk for poor short-term outcomes and enabling appropriate categorization and management

6.2 Recommendations:

1. Adapt the ICH score for better risk stratification to improve management of ICH patients.

2. Conduct more studies with larger sample sizes to investigate the reasons behind the 100% mortality rate in patients with an ICH score of 4.

3. Examine additional factors contributing to deaths related to external ventricular drains (EVD).

6.3 Study limitation

Some patients were lost to follow-up after discharge, and for others, surgery was performed before ICH grading could be done, so postoperative ICH assessments were utilized instead.

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APPENDIXES

Appendix I. Consent Form (English Version)

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

DIRECTORATE OF RESEARCH AND PUBLICATIONS,

MUHAS

ID-NO…….

Consent to Participate in a Study

My name is Dr. Isangya Lameck, I am conducting a study on computed tomography patterns, score and outcome of intracerebral haemorrhage among patients attending Muhimbili orthopedic institute and Muhimbili national hospital

Study Purpose

The study is conducted as a partial fulfilment of the requirements for the degree of Master of Medicine in Radiology at MUHAS. This study aims to evaluate the computed tomography patterns, score and outcome of intracerebral haemorrhage among patients attending Muhimbili orthopedic institute and Muhimbili national hospital. This is of paramount importance as it will help to enlighten the role of CT scan to predict the 30 days' mortality outcome and hence modification of management protocols of patients with intracerebral hemorrhage. We kindly ask you to participate in this study because your information on the symptoms and findings will help to establish the CT patterns of intracerebral haemorrhage, ICH score and predict the 30 days' mortality outcome. Kindly be honest and true for accuracy of the results that could lead to better intervention and recommendations in the future.

How to be involved

The Patients who agree to participate in this study will be required to sign the consent form,then interviewed after that.

Confidentiality

The information obtained from you will be confidential. No name will appear on any documentof this study instead Identification numbers will be used.

Participation and Right to Withdraw

Involvement in this study is voluntary. You can participate or refuse to participate from this study. Refusal to participate from this study will not interfere with your management.

Benefits

Collectively, the findings of this study will provide a statistical evidence based suggestions and recommendations on importance of CT scan in predicting the 30days mortality outcome amongpatient with intracerebral haemorrhage. Furthermore, thus the study results will help to improvepatients' management thus improve quality of life.

Contact Personally

If you ever have questions about this study, you should contact the Principal Investigator, Dr. Isangya Lameck Muhimbili University of Health and Allied Sciences, P. O. Box 65001(email:angelaisangya988@gmail.com).

In case you have questions about your rights of participation in this study, you may contact Dr. Jacob Mboka, who is the supervisor of this study (email mbokajacob@gmail.com)

Participant agrees.

I .....have read the contents in this form. My questions have

been answered. I am willing to participate in this study.

Signature of participant ……Date…….……

Signature of Researcher ……..Date…….

Appendix II: Consent Form (Swahili Version)

CHUO KIKUU CHA AFYA NA SAYANSI SHIRIKISHI MUHIMBILI

KURUGENZI YA TAFITI NA UCHAPISHAJI

FOMU YA RIDHAA

Namba ya utambulisho……...

Ridhaa ya kushiriki kwenye utafiti

Habari! Jina langu ni Dr.Isangya Lameck.Ninafanya utafiti kutathmini Matokeo ya wagonjwa walopatata changamoto ya ugonjwa wa damu kuvilia katika ubongo kwa ktumia kipimo cha Ct scan miongoni mwa wagonjwa watakaohudhuria katika hospitali ya taifa Muhimbili na Moi.

Madhumuni ya Utafiti

Utafiti huu unafanywa kama utimilifu wa sehemu ya mahitaji ya Shahada ya Uzamili ya Tiba katika Radiolojia katika chuo cha MUHAS. Utafiti huu unalenga kutathmini jukumu la CT scan katika kutathmini ugonjwa wa damu kuvilia katika ubongo. Hili ni la umuhimu mkubwa kwani litasaidia kuangazia jukumu la uchunguzi wa uchunguzi wa CT scan na uwezo wa kuto tathmini ya matokeo ya ugonjwa wa damu kuvilia kwenye ubongo na hivyo kurekebisha itifaki za matibabu kwa w wagonjwa wenye tatizo hili. Unaombwa kushiriki katika utafiti huu kwa sababu maelezo yako kuhusu dalili na matokeo yatasaidia kubaini matokeo ya CT scan ya kichwa kwawagonjwa wenye tatizo la damu kuvilia kichwani.Tafadhali kuwa mkweli na mwaminifu kwani usahihi wa matokeo yatasaidia uingiliaji kati bora na mapendekezo katika siku zijazo.

Jinsi ya kushiriki

Ukikubali kushiriki katika utafiti huu, utasailiwa alafu utatakiwa kujibu maswali kutokakwenye dodoso lililoandaliwa alafu utaendelea na kipimo kama kawaida.

Usiri

Taarifa zote zitakazokusanywa kupitia dodoso hili zitakuwa ni siri. Jina lako halitatumikabadala yake tutatumia namba ya utambulisho.

Uhuru wa kushiriki na haki ya kujitoa

Kushiriki kwenye utafiti huu ni hiari. Unaweza kushiriki au kukataa kushiriki na hiihaitakuondolea haki ya kupata matibabu yako.

Nani wa kuwasiliana naye

Kama una maswali kuhusiana na utafiti huu, wasiliana na mtafiti mkuu Dkt. Isangya Lameck Chuo Kikuu cha Afya na Sayansi ya Tiba Muhimbili, S. L. P. 65001, Dar es Salaam, Simu 0757583290, au msimamizi wa utafiti huu Dr. Mboka Jacob (baruapepe mbokajacob@gmail.com**)**

Kama umekubali kushiriki weka sahihiMshiriki amekubali

Mimi..... nimesoma maelezo ya fomu hii nimeyaelewa na

nimekubali kushiriki katika utafiti huu.

Sahihi ya mshiriki…… Tarehe ya kutia sahihi…….....

Sahihi ya mtafiti…… Tarehe ya kutia sahihi……

Appendix III: Analysis of variables

Objective	**Variable to be assessed**	**Method of analysis**
To determine the socio-demographic characteristics of patients	Age, Sex, residential information, education level, occupation.	Continuous data: Means and standard deviations Categorical data: Frequency distribution and percentage
To determine factors associated with ICH among patients with intracranial haemorrhage on CT attending MOI and MNH-Mloganzila from September 2023 to March 2024.	Factors such as Hypertension, anticoagulant usage and smoking will be analysed	Frequency distribution and percentage
To determine the CT patterns of the patients with ICH at MNH and MOI	Brain Pattern including location, haematoma volume, intraventricular extension, midline shift, presence of Hydrocephalus, intraventricular haemorrhage, Infratentorial origin of ICH	Frequency distribution and percentage
To determine the ICH score	GCS score, ICH volume, IVH, Infratentorial origin of ICH, age	Frequency distribution and percentage

To determine the 30-day mortality outcomes of patients presenting with ICH	Recovered Died	Frequency distribution and percentage
To determine the relationship between ICH score and 30-day mortality patient outcomes of patients with ICH at MOI and MNH	ICH score and 30-day mortality outcome.	Chi square test

Appendix IV: Data collection Form

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

RADIOLOGY DEPARTMENT

DATA COLLECTION FORM

A. DEMOGRAPHIC AND CLINICAL CHARACTERISTICS OF THE RESPONDENT

DOB	
Age	□ 30 to 40years □ 50 to 60years □70 to 80 years □ 40 to 50years □ 60 to 70years □ Above 80 years
Sex	□Female □ Male
Hypertension	1.Yes 0.No
Anticoagulant usage	1.Yes 0.No
Smoking	1.Yes 0.No
Surgical evacuation of hematoma	1.Yes 0.No
EVD placement	1.Yes 0.No

B. CT PATTERNS OF THE PATIENTS WITH ICH AT MNH AND MOI

ICH present	1.Yes 0.No
LOCATION 1	1.Basal ganglia 2. Lobar (frontal, parietal, temporal, occipital) 3.Thalamus 4. Cerebellum 5. Pons 6. Other (specify)
Infra/supratentorial ICH Location	1.Supratentorial 2.Infratentorial
HEMATOMA VOLUME (Actual volume in cc)	(e.g 15cc)
HEMATOMA VOLUME category	1.<30cc 2.>30cc
INTRAVENTICULAR EXTENSION	1.Yes 0.No
MIDLINE SHIFT	1.Yes 0.No
PRESENCE OF hydrocephalus	1.Yes 0.No
Other types of Intracranial haemorrhage	0.No 1.Epidural 2.Subdural

	3.SAH
Underlying lesion	1.Yes 2.No

E. ICH SCORE

Component	**ICH Score point (The first numbers are codes)**
GCS score (actual score)	
GCS category	
3 - 4	1.2
5 - 12	2.1
13- 15	3.0
ICH volume (cm^3) actual	
ICH volume (cm^3) category	
≥30	1.1
<30	2.0
Intraventicular extension	
Yes	1.1
No	2.0
Infratentorial origin of ICH	
Yes	1.1
No	2.0
Age	
≥80	1.1

<80	2.0
Total ICH score	**0.0** **1.1** **2.2** **3.3** **4.4** **5.5** **6.6**
ICH score category	**1.Less than 3** **2. Greater or equal to 3**
GCS score indicates GCS score on initial presentation (or after resuscitation); ICH volume, volume on initial CT calculated using ABC/2 method; and IVH, presence of any IVH on initial CT.	

F. 30 DAYS MORTALITY OUTCOME OF THE PATIENT WITH ICH

(Please tick where appropriate)

30 DAYS MORTALITY	**1.Not died** **2.Died**

Appendix V: 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

Ref. No.DA.282/298/01.C/1759 Date: 28/06/2023

MUHAS-REC-06-2023-1759
ISANGYA LAMECK
SCHOOL OF MEDICINE
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: COMPUTED TOMOGRAPHY PATTERNS, SCORE AND OUTCOME OF INTRACEREBRAL HEMORRHAGE AMONG PATIENTS ATTENDING MUHIMBILI ORTHOPEDIC INSTITUTE AND MUHIMBILI NATIONAL HOSPITAL.

Reference is made to the above heading,

I am pleased to inform you that the Chairperson 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: 28/06/2023
EXPIRATION DATE OF APPROVAL: 28/06/2024

STUDY DESCRIPTION:
Purpose:
The main purpose of this prospective analytical study is to investigate the computed tomography patterns, score and outcome of intracerebral hemorrhage among patients attending Muhimbili orthopedic institute and Muhimbili national hospital-Mloganzila.

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-%2014672.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,

Chairperson, MUHAS Research and Ethics Committee

Appendix VI: 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

In reply quote;
Ref. No. HD/MUH/T.248/2021 10th July, 2023

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

Re: INTRODUCTION LETTER

The bearer of this letter is Isangya Lameck (HD/MUH/T.248/2021), a student at Muhimbili University of Health and Allied Sciences (MUHAS) " pursuing MMed. Radiology.

As part of her studies, she will be doing an elective research titled: "**Computed Tomography Patterns, Score and Outcome of Intracerebral Hemorrhage Among Patients Attending Muhimbili Orthopedic Institute and Muhimbili National Hospital.**" she is being supervised by Dr. Mboka Jacob from MUHAS and Dr. Joel Bwemelo from MOI.

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

Kindly provide her the necessary assistance to facilitate the conduct of her research.

We thank you for your cooperation.

Ms. Victoria Mwanilwa
For: DIRECTOR, POSTGRADUATE STUDIES

c.c Isangya Lameck

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1015; Direct Line:+255-22-2151378;Telefax:+255-22-2150465;E-mail:dpgs@muhas.ac.tz;Web:https://www.muhas.ac.tz

Appendix VII: Permission letter



THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH

MUHIMBILI NATIONAL HOSPITAL
MLOGANZILA

In reply please quote
Ref. No.: JA.294/428/01B/128 16/01/2024

Ag. Head of Department
Internal Medicine and Surgery
Muhimbili National Hospital-Mloganzila

RE: PERMISSION TO COLLECT DATA AT MNH - MLOGANZILA

Name of Principal Investigator	Isangya Lameck
Title	"Computed tomography patterns, Scores and outcome of Intracerebral Hemorrhage among patients attending Muhimbili Orthopedic Institute and Muhimbili National Hospital"
Institution	Muhimbili University of Health and Allied Sciences
Supervisors	Dr. Mbeka Jacob Dr. Lulu Sakala-Mloganzila
Period	15th January 2024-28th June 2024

Approval has been granted to the above principal investigator to collect data at MNH-Mloganzila. Kindly ensure the named principal investigator abide to the ethical principles and other conditions of the research approval.

Ng'amilo Mbwilila
For: Executive Director
Muhimbili National Hospital-Mloganzila

Muhimbili Human Resource Management and Administration
Muhimbili National Hospital
For Director
P.O. Box 65000
Dar-es-Salaam

c.c. DMS
cc. DSS
cc. Isangya Lameck

Mloganzila, Kibamba – Ubungo, P.O. BOX 65000, Dar es Salaam, Tanzania.
Telephone: +255-22-2225715, Telephone: +255-22-2215701.
Email: [illegible] Website: [illegible]