POSTOPERATIVE DELIRIUM AMONG ELDERLY PATIENTS UNDERGOING ELECTIVE SURGERY AT MUHIMBILI ORTHOPAEDIC INSTITUTE

Nsia Richard Mushi, MD

Mmed (Anesthesiology) Dissertation

Muhimbili University of Health and Allied Sciences

October, 2019

Muhimbili University of Health and Allied Sciences

Department of Anesthesiology

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By

Nsia Richard Mushi, MD

Dissertation submitted in (partial) fulfilment of the Requirement for the Degree of Master of Medicine (Anaesthesiology) of

Muhimbili University of Health and Allied Sciences

October, 2019

CERTIFICATION

The undersigned certify that she has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled: ***"Postoperative delirium among elderly patients undergoing elective surgery at Muhimbili orthopaedic institute*** "in (Partial) fulfillment of the requirement for the degree of Master of Medicine in Anesthesiology of Muhimbili University of Health and Allied Sciences.

_____

Dr. Karima Khalid
Supervisor

_____

Date

DECLARATION AND COPYRIGHT

I**, Nsia Richard Mushi**, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature: _____Date: _____

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ACKNOWLEDGEMENT

First and foremost i would like to thank GOD, for the courage, strength and guidance in pursuing this degree and making this research a possible one.

Secondly, to my supervisor Dr Karima Khalid, for her inputs and guidance, as well as the Head of Department of Anaesthesiology, Muhimbili University of Health and Allied Sciences (MUHAS), Dr. Edwin Lugazia, for his continuous support and being readily available for consultation whenever needed.

I would like to express my special thanks of gratitude to Dr.Respicious Boniface and Dr Bronwyn Rae for their kindness, patience and simply sharing their knowledge and experience in reviewing this dissertation.

The entire academic staff and members of the anaesthesia departments of MUHAS as well as Muhimbili Orthopaedic Institute (MOI) for their endless support and understanding. To the other healthcare providers at MOI thank you very much for your cooperation during this research.

Last but not least, my family. My dad, Dr Richard Mushi and my mom, Janeth Mushi. Their motivation and cheerleading skills are not of this world. My sisters, Doreen and Rebecca, without forgetting my nieces, Janeth Natujwa and Navoneiwa Doreen, who possess the superpower of turning any bad day into a good one.

The journey and experience gained has been surreal.

DEDICATIONS

This work is dedicated to my parents, Richard and Janeth. I owe you absolutely everything. I would also like to dedicate this work to my charming elderly patients. They are the real champions!

ABSTRACT

Introduction

Postoperative delirium is identified as one of the commonest complications in the elderly who have undergone surgery. Associated risk factors have been found to be advanced age, smoking, alcohol consumption and trauma-related injuries.

Broad Objective

The aim of the study was to ascertain the incidence of postoperative delirium among elderly patients undergoing elective surgery at Muhimbili Orthopaedic Institute and determine the associated risk factors for development of postoperative delirium

Methodology

This was a prospective cohort study that enrolled elderly patients (≥ 60years) who were admitted and underwent elective orthopaedic surgery at Muhimbili Orthopaedic Institute from October 2018 to February 2019. Preoperative assessment was done and detailed medical history recorded. Delirium was assessed in the study subjects daily in the postoperative period using the Confusion Assessment Method.

Results

A total of 132 patients were included in the study. Of these 18 (13.6%) were diagnosed with postoperative delirium. Age, sex, smoking, alcohol consumption and intraoperative blood transfusion were found to have an association with development of postoperative delirium. Multivariate analysis of the above variables confirmed that advanced age (AOR: 7.4 [CI 0.93-59.57] p=0.05), smoking (AOR: 10.57 [CI 2.14-52.19] p=0.004), alcohol consumption (AOR: 3.9 [CI 1.25-12.12] p=0.019) and trauma-related injuries (AOR: 3.9 [CI1.21-12.53] p=0.023) were independently associated with postoperative delirium.

Conclusion

Postoperative delirium was identified as a common complication after surgery in elderly patients. Risk factors in this study were advanced age, history of smoking, alcohol consumption and sustained injuries from trauma

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LIST OF ABBREVIATION

ASA	-	American Society of Anaesthesiologist
BMI	-	Body Mass Index
CAM	-	Confusion Assessment Method
COPD	-	Chronic Obstructive Pulmonary Disease
CRP	-	C-Reactive Protein
DSM	-	Diagnostic and Statistical Manual
GA	-	General Anaesthesia
ICD	-	International Classification of Diseases
IRB	-	Institutional Review Board
MMED	-	Master's of Medicine
MMSE	-	Mini-Mental Status Examination
MOI	-	Muhimbili Orthopaedic Institute
MOI	-	Muhimbili Orthopaedic Institute
ORIF	-	Open Reduction and Internal Fixation
PACU	-	Post Anaesthesia Care Unit
POCD	-	Postoperative Cognitive Dysfunction
POD	-	Postoperative Delirium
RA	-	Regional Anaesthesia
SPSS	-	Statistical Package for Social Scientists

DEFINITION OF TERMS

Elderly- refers to ages nearing or surpassing the life expectancy of human beings. The United Nations cut off age is 60+ years to refer to the older or elderly persons.

Delirium- Acute confusional state characterized by attention deficit, disorganized behaviour and altered sleep-awake cycle. In this study, delirium was assessed by the Confusion Assessment Method.

Postoperative period – entailed the recovery period in the hospital stay, beginning immediately after the surgical procedure to the time of discharge from the hospital/full recovery.

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND

Delirium is a common complication in the postoperative period, which often goes undiagnosed and poses a challenge to physicians involved in the perioperative management of surgical patients.

There are several medical definitions of delirium outlined in the literature, but from the ICD -10 Delirium is defined as an etiologically nonspecific organic cerebral syndrome characterized by concurrent disturbances of consciousness, attention, perception, thinking, memory, psychomotor behaviour, emotion, and the sleep-wake schedule, with variability in duration and presentation ranges from mild to severe(1).

Post-operative delirium is a kind of delirium that presents in patients that have undergone surgery and anaesthesia, and commonly presents within 1-4 days postoperatively. It should be differentiated from emergence delirium which manifests during or immediately after emergence from general anaesthesia(2).

Postoperative Delirium is seen in patients who have undergone major surgery, (both cardiac and non-cardiac) with a higher incidence in non-cardiac surgeries and in particular orthopaedic surgeries(3). Amongst the age group of patients presenting with post-operative delirium, the incidence is found to be higher in the elderly patients.

Post-operative delirium as a common complication in the elderly has been associated with adverse outcomes which affect both the patients and family as well as the institution. Apart from being an uncomfortable experience for the patient, other adverse outcomes include increased length of hospital stay, increased medical adverse events, decreased functional outcome at 3months and increased 6 months mortality (4-7).

It is important for the clinician to attempt to identify whether delirium is secondary to a medical condition or the result of a medication side effect, substance intoxication, substance withdrawal, or multiple medical and toxic insults

Several risk factors have been found to contribute to the development of post-operative delirium in elderly patients. Advanced age, polypharmacy, malnutrition, presence of comorbidities significantly predisposes the elderly to develop post-operative delirium.

The etiology of postoperative delirium is not fully understood and is thought to be multifactorial. There is insufficient data explaining pathophysiology of post-operative delirium however there are postulated theories.

One theory linked to development of postoperative delirium is cerebral hypoperfusion (ischaemic brain injury) resulting from possible cerebral microemboli particularly in orthopaedic surgery. There is no specific focus/target in the brain that is associated with delirium, however, the pilot study by Janz et al concluded after conducting brain autopsy on ICU patients who developed delirium, hippocampal lesions represented the most common neuropathologic site of injury, present in 5 (71%) of 7 patients in the study(8).

Another theory is inflammatory pathways, involving pro-inflammatory cytokines, including interleukin-1b (IL-1b), tumour necrosis factor-a (TNF-a) and interleukin-6. There has been a correlation between preoperative CRP levels and development of post-operative delirium(9).

Postoperative delirium is a clinical diagnosis that is to be made by assessment of patients by care providers. Any change in behaviour such as inattention, disorganized thinking, or changes in physical activity such as lethargy, agitation, observed in a patient may be an indicator of postoperative delirium.

As postoperative delirium has been seen to be associated with long term complications, daily routine assessment of patients who have been identified to be at risk of developing postoperative delirium is warranted. Clinical presentation of postoperative delirium has been classified as 3 different types based on motor activity observed in the patient. There is hypoactive, hyperactive and mixed types. The hyperactive variant presents as restlessness, agitation, hallucinations and delusions, making this variant quick to be recognized. The hypoactive variant is characterised by lethargy, inability to talk and commonly missed or misdiagnosed as depression.

As there is no definitive laboratory test or imaging that can confirm delirium, hence we use clinical assessment to make the diagnosis. Several assessment scales have been employed in the diagnosis of delirium including mini mental status examination, confusion assessment method(10),the Neelon and Champagne (NEECHAM) Confusion Scale(11)and the Diagnostic and Statistical Manual (DSM) of mental disorders.

Confusion Assessment Method (CAM) is an algorithm that is based on the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IIIR criteria. It is a validated tool that has been proved to be reliable, specific and sensitive for diagnosing delirium (10).

It has four diagnostic features: Feature 1- Acute onset and fluctuating course, Feature 2- Inattention, Feature 3- Disorganized thinking and Feature 4 - Altered level of consciousness. Diagnosis of delirium requires presence of features 1 and 2 and either of feature 3 and/or feature 4.

Table 1. CAM SCORE(10)

Confusion Assessment Method (CAM) Diagnostic Algorithm	**Date of assessment**	
	Time of assessment	
		Yes or No
1. Acute onset and fluctuating course? (Acute change in mental status from baseline, fluctuating behaviour through the day)		
2. Inattention? (Difficulty focusing attention, easily distracted, difficulty keeping track of what is being said)		
3. Disorganised thinking? (disorganized or incoherent thinking, rambling or irrelevant conversation, unclear or illogical flow of ideas)		
4. Altered level of consciousness? (This feature is shown by any answer other than “alert”, including: hyper-alert, lethargic, stupor, or coma)		

1.2 LITERATURE REVIEW

Overview

Postoperative Delirium (POD) - has been found to affect elderly patients more than any other age group(12) with even higher incidences in patients presenting with hip fractures (7). Even with the high rate of surgical interventions in the elderly for a variety of reasons, little is known of the pathophysiology of delirium(13).

Although the aetiological factors have not been fully explained, there are several risk factors that contribute to the development of postoperative delirium as will be discussed in later sections.

Epidemiology

Postoperative delirium is identified as the most common complication following surgery in elderly patients. The reported incidence of POD varies widely.

In a systematic review by Dasgupta and Dumbrell, it was found that the incidence of postoperative delirium across studies ranged from 5.1% - 52.2% with higher incidences in patients following hip fracture (range 16%-43.9%) and aortic surgeries (range 46%-52.2%) (3).

In another systematic review meta-analysis conducted by Bruce et al, in 2007, it was found that the incidence ranged from 4-53%, which is not very different from the results given by Dasgupta et al. The variations, in this review by Bruce et al were thought to be due to the tools/methodology of screening delirium, timing of patients screening etc used in the different studies reviewed(14).

In one prospective cohort study done by O'Regan in 2010,fromIreland, thatincluded 50 patients aged 65 years going for hip fracture surgery and over, found an incidence of 50%(15).

In another prospective observational study conducted by Raats et al, from March 2013 to November 2014, that included 232 elderly patients undergoing elective surgery, the incidence of postoperative delirium was found to be 15%(4).

Risk Factors

The associated factors that contribute to development of postoperative delirium have been described in the context of the perioperative period.

Preoperative risk factors

Age

Age has been identified as one of the significant predictors for developing postoperative delirium with the incidence of delirium increasing with age.

In one systematic review and meta-analysis by Smith et al, that reviewed 32 studies looking at factors predicting incidence of postoperative delirium following hip fracture surgery, suggested that there is a nearly two-times greater probability of post-operative delirium with those aged 80years or over(16).

Comorbidities

One prospective cohort study done by Lee et al, looked at predisposing factors for postoperative delirium after hip fracture repair by examining four hundred and twenty five elderly patients with a mean age of 80 presenting with acute hip fracture. Patients both with dementia and without dementia were involved in the study and it was found that in the group without dementia a greater number of co-morbidities was a significant risk factor for incident delirium(17).

In the meta-analysis by Smith et al, there was quality evidence that pre-existing conditions such as stroke, depression, heart failure, visual loss and dementia (again no need to put capitals) predicted the development of postoperative delirium, while low significant probability seen with diabetes mellitus, hypertension, COPD, cancer and hearing impairment(16).

Esther et al, in their recent systematic review reported that congestive heart failure and hypertension were significantly associated with postoperative delirium(18).

Current Medications

The meta-analysis by Smith et al, concluded that there was a low quality evidence that a greater number of prescribed medications was a risk factor for the development of postoperative delirium(16).

However, in a recent systematic review by Esther et al, published in 2014, it was found that the use of more than 3 medications predisposes the patients to postoperative delirium(18).

In another recent prospective cohort design study by Kim et al, and published in 2017, revealed that polymedication (medications >5) is a significant risk factor for developing delirium(19).

Pro-inflammatory markers

Presence of infection has been linked to have an association with development of postoperative delirium as seen in the most recent prospective cohort study done by Vasunilashorn et al that examined an association between inflammatory marker (CRP) measured preoperatively and on postoperative day 2 (POD2) and delirium incidence, duration, and feature severity. The study involved adults aged 70 years and older undergoing non-cardiac surgery. It was found that not only is there an independent association between preoperative high CRP levels and development of postoperative delirium, but specifically there is 1.5 greater risk of the elderly developing postoperative delirium with CRP levels of more than 3mg/L, 0.4 more delirium days and a more severe delirium presentation(9).

In another prospective study by Guo et al, conducted to determine the incidence don't confuse incidence and prevalence - and associated risk factors by enrolling 572 elderly patients aged 65years and older who underwent THA for hip fracture, found that higher CRP levels were a significant independent risk factor for postoperative delirium(20).

These recent studies support the findings in earlier studies conducted to examine the association between CRP and development of delirium. One such study was by Macdonald et al, which concluded that CRP levels predict the incidence of postoperative delirium and recovery from it(21).

Intra-operative Factors

Intraoperative blood transfusion

An earlier study conducted by Marcantonio et al, to examine the association of intraoperative factors anaesthesia route, blood loss and hemodynamic complications such as intraoperative hypotension, revealed that delirium was associated with greater blood loss and intraoperative blood transfusion(22).

One study done by Behrends et al, that involved 472 older adults going in for non-cardiac surgery, to determine the association between intraoperative blood transfusion and early postoperative delirium in older patients, found that intraoperative blood transfusion of more than 1,000 mL of RBCs increases the risk of delirium on the first postoperative day in older adults undergoing noncardiac surgery(23).

In more recent prospective study conducted by Guo et al, it was found that greater volumes of red cell transfusion during surgery are independently associated with postoperative delirium(20).

Duration of anaesthesia

In the prospective study done by Lee et al, it was concluded that duration of anaesthesia, regardless of the type of anaesthesia and that prolonged exposure to anaesthesia may predispose a patient without dementia to develop postoperative delirium(17).

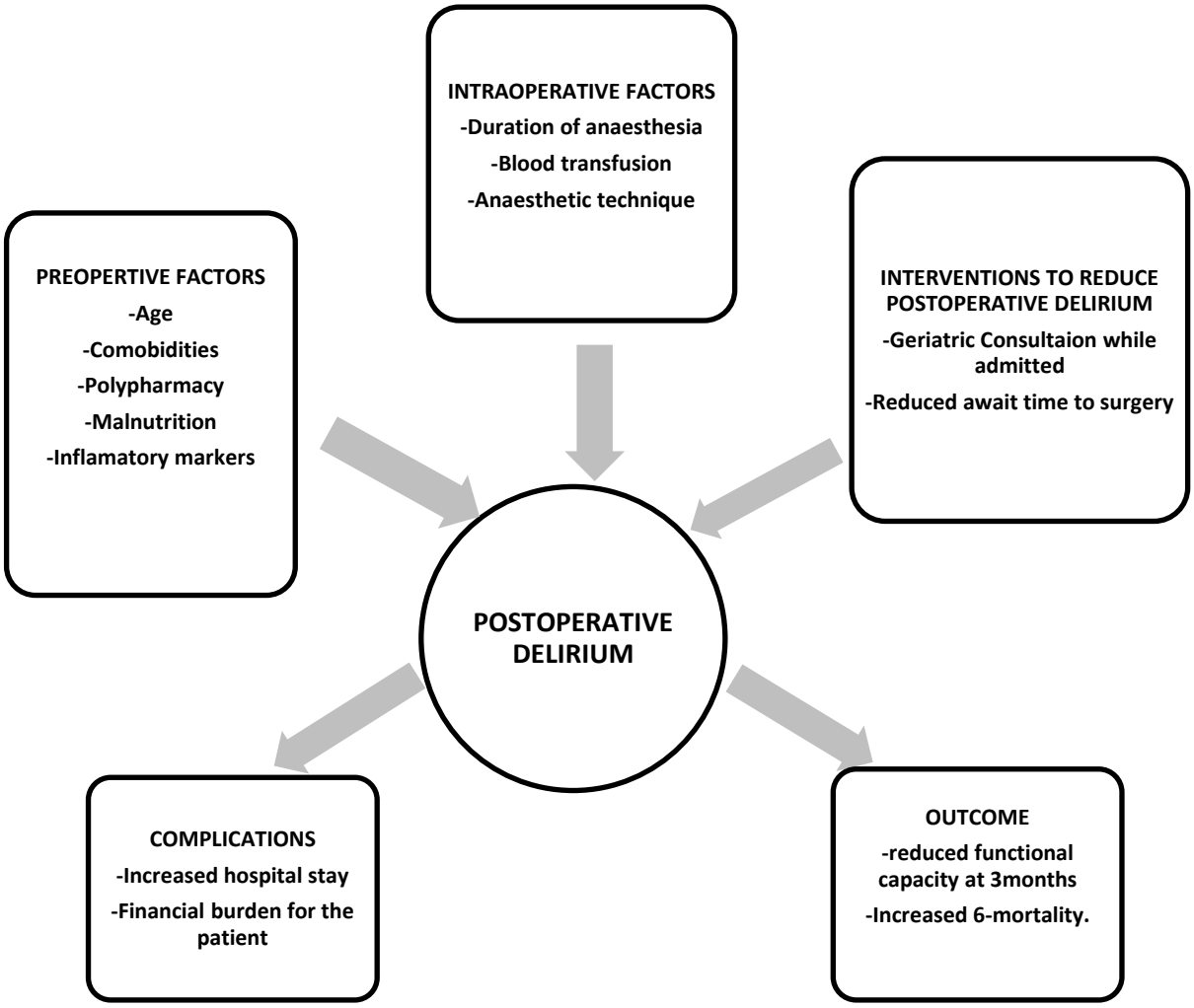
In another prospective study in China, conducted in elderly patients undergoing THA for hip fracture, Guo et al concluded that longer duration of surgery is an independent risk factor for occurrence of postoperative delirium(20).

However in the systematic review by Smith et al, no significant association was found between intra-operative variables reviewed (i.e type of anaesthesia given to the patient, mean duration of procedure, requirement for blood transfusion, and intra-operative blood loss) and development of postoperative delirium(17).

Postoperative factors

However in a meta-analysis by Smith et al, there is a low quality evidence suggesting the association of postoperative use of morphine and development of postoperative delirium and a moderate quality of evidence suggestive that the presence of postoperative urinary tract infection and postoperative pneumonia increased the chances of developing postoperative delirium by four fold and three fold respectively(16).

1.3 CONCEPTUAL FRAME WORK



Description of the Conceptual Framework.

The aim of the study is to determine the incidence of postoperative delirium in the elderly undergoing orthopaedic surgery at Muhimbili Orthopaedic Institute, as well as identify the predisposing factors that contribute to the development of postoperative delirium.

Hence, the predisposing factors that will be closely looked at has been divided according to the timing in the perioperative management of these patients, thus;

1. Preoperative Factors
2. Intraoperative Factors

Therefore, the primary outcome is diagnosis of postoperative delirium as assessed by presence of feature 1 and 2 and any of feature 3 or feature 4 in the CAM Scoring system.

1.4 STATEMENT OF THE PROBLEM

There is a rapidly advancing medical technology that has made it possible for the elderly to safely undergo surgery. The elderly, who present with a wide range of co-morbidities, are at a higher risk of a number of complications in the perioperative period. Delirium is a common complication experienced in the elderly in the postoperative period but often goes undiagnosed.

As POD is associated with increased duration of hospital stay, long term cognitive impairment, and increased mortality within 6 months of development, it is imperative that the recognition of such a complication is made promptly and interventions are employed to treat it early or better yet, prevent it before it occurs.

In our setting, postoperative delirium is not a well-established entity and health care providers and staff are not made aware hence there could be delayed diagnosis or worse, misdiagnosis that results in compromising patients care particularly in this particular age group.

Hence, this study intended to outline the magnitude of the problem and identify particular risk factors that predispose our elderly patients to develop postoperative delirium.

1.5 STUDY RATIONALE

This study aimed at determining the incidence of postoperative delirium and identify its predisposing factors, in the elderly undergoing orthopedic surgery at Muhimbili Orthopaedic Institute since there is paucity of data in the area showing the extent of the problem.

Knowing the magnitude of the problem in our setting will suggest ways to improve the perioperative care of the elderly population going for surgery.

Last but not least, this study was conducted as partial fulfillment for an award of MMED Anaesthesiology.

1.6 RESEARCH QUESTIONS

1. What is the incidence of postoperative delirium among the elderly aged 60 years and older undergoing orthopedic surgery at MOI?
2. What are the associated risk factors for post operative delirium among elderly patients undergoing elective orthopedic surgery at MOI?

1.7 OBJECTIVES

1.7.1 Broad Objective

To determine the incidence and the associated risk factors for postoperative delirium among elderly patients undergoing elective orthopedic surgery at Muhimbili Orthopaedic Institute.

1.7.2Specific Objectives

1. To determine the incidence of postoperative delirium among elderly patients undergoing orthopaedic surgery at Muhumbili Orthopaedic Institute from October 2018 to February 2019.
2. To identify the risk factors associated with development of postoperative delirium among elderly patients undergoing orthopedic surgery at Muhimbili Orthopaedic Institute.

CHAPTER TWO

2.0 METHODOLOGY

2.1 Study Design

A prospective observational cohort study.

2.2 Study Area

The study was conducted at Muhimbili Orthopaedic Institute, (MOI) which is located within Muhimbili National Hospital compound in west Upanga area, Ilala District in Dar-es-salaam. The Institute operates as a super speciality facility with abed capacity of more than 380. It serves as a referral hospital providing tertiary care to patients from within and outside the region of Dar-es-salaam.

MOI is renowned as a centre of excellence exclusively providing primary, secondary and tertiary care of preventive and curative health services in the field of Orthopaedics, Traumatology and Neurosurgery. Currently it has 6 operating theatres that operate daily with 25-30 patients.

All the patients admitted and are due for elective surgery are typically seen by the anaesthesia team for preoperative evaluation12-24hrs prior to the day of surgery. However, those that present for same day surgery are also seen prior in the anaesthesia clinic that is conducted on an outpatient basis daily.

During the pre-anaesthetic visit, there is history taking by the registrar anaesthetist, thorough clinical examination and thereafter perioperative management of the patient is formulated based on the physical status and the surgery to be done. Subjects for this study were recruited from this pre-anaesthetic evaluation prior to surgery and followed after the surgery.

2.3 Study Population

The study population enrolled elderly patients aged 60 years and older who were admitted and scheduled to undergo elective surgery at Muhimbili Orthopaedic Institute during the study period.

2.4 Study Subjects Eligibility

Inclusion Criteria

Elderly patients of 60years and older scheduled to undergo elective orthopaedic surgery.

ASA physical status I and II

Exclusion Criteria

Patients with pre-existing delirium as based on the CAM Score.

Those expected to be discharged within 2 days after surgery

Patients going for non-elective surgery (emergency surgery)

Patients who cannot give informed consent

Patients who will require being admitted in ICU and remain intubated postoperatively.

2.5 Sample Size

Sample size was calculated using assumptions for a prospective cohort study design. Advancing age has been used to calculate the sample size as it is one of the major risk factors for development of postoperative delirium in the previous studies(16)(24).

The percent of Unexposed with outcome (postoperative delirium) is assumed to be 20.5% from previous study (25) and percent of Exposed with outcome to be 40.9%

The sample size was calculated from OpenEpi, version3, using formula for the method described in Kelsey et. Al(26); where

$N_1 = \frac{(Z1-\alpha+Z1-\beta)^2 2 \times \overline{pq}\,(r+1)}{r(P1-P2)^2}$ and $N_2 = rN_1$

Two-sided significance level($\mathbf{Z_{1-\alpha}}$): 95 (1.96)

Power($\mathbf{Z_{1-\beta}}$, % chance of detecting): 80 (0.84)

Ratio of sample size, Unexposed/Exposed (**r**) :1

Percent of Unexposed with Outcome**(P2)**: 20.5%

Percent of Exposed with Outcome (**P1**) :40.9%

Therefore;

$N_1 = \frac{(1.96+0.84)^2 \text{ X } 0.6975 \text{x} 0.3025(1+1)}{1(0.409-0.205)^2}$

$N_1 = 80$, $N_2 = 80$

A minimum sample size of 160 study subjects was therefore included in this study.

2.6 Sampling technique and Recruitment

In this study non-probability sampling technique was applied to obtain the respondents. The operating list was obtained a day before and patients were selected based on the knowledge and judgement of the principal researcher.

Patients in the study group were recruited by the principal researcher.

2.7 Data Collection

Patients aged 60 years and older scheduled for elective surgery were assessed for eligibility to be included in the study. If they were eligible they were asked to give consent to participate in the study and have their data collected.

The Principal researcher and two research assistants were involved in data collection during the study period. In order to eliminate bias, the principal researcher was responsible for both preoperative assessments of the study subjects to screen for eligibility for the study and to conduct postoperative assessment to screen for delirium.

Preoperative assessments of the study subjects were done within 12 to 24 hours before surgery where the principal researcher used the data collection tool (See Appendix) to obtain the necessary information such as demographic data, detailed history and review laboratory investigations, assign ASA status.

The two research assistants were Medical Officers (Registrars) who have been working in Anaesthesia Department and were trained both theoretically and practically on how to collect data during the study period. The assistants role was to collect data during the intraoperative period and inform the principal researcher.

Postoperative assessment was conducted. Screening for delirium using CAM score was done by interviewing the study subjects, the results then recorded, and review of the anaesthetic charts done.

Diagnostic criteria described for Delirium by CAM contains four features (1) Acute change or fluctuating course of mental status; (2) Inattention; (3) Altered level of consciousness; (4) Disorganized thinking. A positive diagnosis of delirium requires the presence of items (1) and (2), and either (3 or (4). (Refer to table 1)

2.8 Data Analysis

Statistical analysis was done using Statistical Package for Social Scientists (SPSS) for windows version 23. Frequency distribution tables were used to describe categorical variables, and means and standard deviation for continuous variables.

Bivariate analysis was done using Chi-square test for categorical variables and Student t-test for continuous variables, using p-value of ≤ 0.05 for statistical significance. However for those categorical variables whose values in the cells of contingency table were <5, Fisher's exact test was used.

Variables with significant bivariate association with postoperative delirium were entered into a multivariate logistic regression model to assess independent effects.
Parameter of measurement to assess association used is Odds Ratio

2.9 Study Variables

Dependent Variable

The dependent variable in this particular study is presence of postoperative delirium as diagnosed using the CAM Score Criteria.

Independent Variables

The independent variables in this study are

Age

Sex

ASA Status

Inflamatory marker- CRP

Hemoglobin Level

Smoking

Alcohol use

Lag time from admission to surgery

Type of Surgery

Type of anaesthesia

Anaesthesia time

Intraoperative blood transfusion

2.10 Ethical Clearance and Consideration

Official ethical clearance was obtained from the MUHAS ethical research committee, and the permission to conduct the study at Muhimbili Orthopaedic Institute from the Chief Executive Director of MOI.

The principal researcher approached the eligible patients, and after explaining the aim of the study, obtained an informed written consent before enrolling them in the study.

Strict patient confidentiality was observed at all times during the study period, no information will be disclosed to any unauthorized personnel.

Study subjects were free to refuse to participate/withdraw from the study at any time. Patients care will not be at jeopardy by not participating.

2.11 Study Limitation and Mitigation

The anticipated limitations of this study included incomplete anaesthetic chart filling of intraoperative events by the attending nurse anaesthetists, and this was mitigated by training them on how to properly fill the charts.

CHAPTER THREE

3.0 RESULTS

Table 2. Demographic and medical characteristics of the study population (n = 132)

Variable	Patients		Mean ±SD
	N	%	
Age			
60-70	76	57.6	
71-80	52	39.4	
81-100	4	3	
Sex			
Male	60	45.5	
Female	72	54.5	
ASA			
I	56	42.4	
II	76	57.6	
Injury			
Trauma	68	51.5	
Non-Trauma	64	48.5	

A total of 132 patients were recruited between October 2018 and February 2019 for this study. Out of the 132 patients, 60 were males (45.5%) and 72 (54.5%) were females. As for the age groups, a large proportion of patients were aged 60 to 79 years old, and the remaining belonged to the range 80 to 100 years.

The initial presenting complaint and the reason for admission was injuries sustained secondary to trauma in 51.5% of cases and 48.5% due to injuries sustained due to causes other than trauma.

After the pre-anaesthetic evaluation, patients who were assigned ASA class I(those with no co morbidities) were only 56 (42.4%) and while those with co morbidities given ASA class II accounted for majority of cases (76 (57.6%)

Incidence of Delirium among elderly postoperative patients

Out of 132 patients included in the study, 18 patients presented with delirium postoperatively, while 114 had no delirium. The incidence of delirium was 18 (13.6%), comprising of 12 males and 6females.

Table 3. Bivariate analysis for factors associated with postoperative delirium

Variable		Patients with Delirium	Patients with No delirium	Significance	
				X^2	p-value
		N(%)	N(%)		
Baseline Variables					
Age	60-70	9 (11.8)	67 (88.2)		
	71-80	7(13.5)	45(86.5)		0.1+
	81-100	2(50)	2 (50)		
Sex	Male	12 (20)	48 (80)		
	Female	6 (8.3)	66 (91.7)	3.78	0.05+
ASA Status	I	6 (10.7)	50 (89.3)		
				0.28	0.4+
	II	12 (15.8)	64 (84.2)		
Smoking	Smokers	4 (57.1)	3 (42.9)		
	Non-Smokers	14 (11.2)	111 (88.8)		0.007*
Alcohol	Alcohol use	6 (31.6)	13 (68.4)		
	Non Alcohol Use	12 (10.6)	101 (89.4)	6.067	0.01+
C-RP	Normal	15 (13.3)	98 (86.7)		
	High	3 (15.8)	16 (84.2)		0.73*
Pre-op Hemoglobin Level	<10g/dl	4 (23.5)	13 (76.5)		
	≥10g/dl	14 (13)	100 (87)		0.27*
Injury Type	Trauma	14 (20.6)	54 (79.4)		
	Non Trauma	4 (6.3)	60 (93.8)		
					0.02*
Lag time from admission to surgery	Admission to 7 days	13 (13)	87 (87)		
	8-14 days	3 (13.6)	19 (86.4)	0.8+	
	>14 days	2 (20)	8 (80)		
Intraoperative Variables					
Choice of anaesthesia	GA	9 (15.5)	49 (84.5)		
	L-RA	9 (12.2)	65(87.8)	0.5+	
Blood Transfusion	Yes	13 (17.8)	5 (8.5)		
	No	60 (82.2)	54 (91.5)	0.106	0.12+
Type of Surgery	ORIF	11 (20.4)	43 (79.6)		
	Arthroplasty	8 (13.3)	52 (86.7)		0.4+
	Other	0	18 (100)		

*Fisher's Exact Test, +Pearson

All preoperative and intraoperative categorical variables were analysed using Chi-square X^2 test using p value ≤ 0.05 for statistical significance. However, a known risk factors like age whose *p* value was 0.1 (i.e >0.05) was still included in multivariate logistic regression. For those variables with expected values of <5 in any of the cells of contingency table, Fisher's exact test was used.

In the bivariate analysis (refer to table 3 above), age (p = 0.1), sex (p=0.05), Smoking p=0.007), alcohol intake (p= 0.01), injury type (p=0.02) and blood transfusion intraoperatively were found to have an association with developing POD.

Age wise, patients were categorised on 10 years increments from 60 years up to 100 years. Those aged 60 to 70 years constituted >50% of total patients, closely followed (39%) by those aged 71-80 years old. Even though those who are aged 81 years to 100 years were the fewest (only 4) in the whole group, half of them developed POD.

Table 4. Multivariate Logistic Regression for factors associated with Postoperative Delirium

Variable	AOR	95% Confidence Interval	*P*-value
Age			
60-70	1		
71-80	1.15	0.40-3.33	0.78
81-100	7.44	0.93-59.57	0.05
Sex			
Female	1		
Male	2.75	0.96-7.84	0.059
Type of Injury			
Non-Trauma	1		
Trauma	3.9	1.21-12.53	0.023
Smoking			
Non-Smokers	1		
Smokers	10.57	2.14-52.19	0.004
Alcohol consumption			
No	1		
Yes	3.9	1.25-12.12	0.019

Variables found to have an association in the bivariate analysis were entered into multivariate logistic regression. Smoking and alcohol consumption (p= 0.004, p=0.019 respectively) as well as advanced age (p=0.05) and injuries sustained from trauma (p=0.02) were statistically significant risk factors for development of postoperative delirium.

CHAPTER FOUR

4.0 DISCUSSION

4.1Incidence of post-operative delirium.

Post-operative delirium is increasingly becoming a problem particularly in elderly patients, with adverse outcomes such as delayed recovery, prolonged hospitalization and decreased functional outcome(27)(28).In this study, the incidence of postoperative delirium in elderly patients undergoing elective orthopaedic surgery was found to be 13.6%, compared to other similar studies that showed incidence of 5-48% (29)(30).

In a meta-analytic review conducted by Bruce et al, the incidence was found to be 3.6-28.3% in cases of elective surgery.(14) The differences in the incident rates were attributable to factors such as, but not limited to, different screening tools used to diagnose delirium, timing in interviewing the patient postoperatively. In this study , the diagnostic tool used was CAM, which has been validated as a reliable and safe tool to use in diagnosis of delirium (10)(31). However other tools for screening delirium found in literature include NEECHAM, DSM-IV, MMSE etc(11).

With postoperative delirium, the symptoms, as observed in the elderly, wax and wane, hence the low incidence of delirium found in this study could be due to regression of symptoms by the time of their assessment, as well as a small sample size and variations in inclusion and exclusion criteria – as in this case the principal researcher selected only those cases undergoing elective surgery and not emergency procedures. Other patients with dementia, mental illness were also not included.

4.2 Associated risk factors for Postoperative Delirium.

Postoperative delirium remains poorly understood in its pathophysiology and modalities of treatment(7)(32). For that matter, prevention is now more advocated, that is by early identification and correction of the known risk factors that play a role in its development.

In this study we investigated the association between postoperative delirium and independent variables. On multivariate analysis, age, smoking, trauma, and alcohol intake were found statistically significant risk factors. As outlined before, some of the known risk factors for postoperative delirium such as vision and hearing loss, and chronic cognitive impairment (dementia) were not included in this study.

The ages of our patients in this study ranged from 60-100 years. Our results identified advanced age of 75 years and above as a risk factor of developing delirium in the postoperative period. This finding tallies with previous reports such as that done by Wang et al, (29) that showed an increase in the odds of developing POD in those patients aged 70 years and above compared to those aged less than 70 years. Findings in this study are concurrent with a study conducted by Ansaloni et al(33)that identified age to be an independent risk factor for POD. Similar findings were also reported in a systematic review done by Dasgupta and Dumbrell(3) that showed there is an association between advanced age and POD.

Elderly patients admitted for elective procedures included those who suffered injury secondary to trauma and those who didn't have prior history of trauma. Incidence of delirium was found to be higher in those patients who had trauma-based injury, and there was found a significant association between injury type (Trauma) and development of delirium.

Consistent with findings from other studies, alcohol consumption was found to be an independent risk factor for delirium. Long term effects of alcohol abuse in the brain include those in frontal lobes leading to impairment of executive function as well as memory impairment(34). In this study, history of alcohol intake was determined preoperatively in the structured questionnaire that was used as a tool for data collection, however a shortcoming was it didn't quantify the amount and years of alcohol use.
This is similar to a study by Sousa G et al(35), that evaluated the relationship between alcohol abuse and postoperative delirium. They utilized the CAGE tool to determine alcohol abuse which was found to be an independent predictor for POD. Comparable findings were also found in a literature review by Noimark(36).

Although the incidence of delirium amongst non-smokers was higher compared to smokers in this study, smoking was found to be statistically significant for POD. Several studies have defended the link between smoking and delirium.

One pathophysiological hypotheses on the development of delirium is the deficiency of acetycholine(37), which is important for cortical arousal, attention, learning, and memories(38). In smokers, one of the possible causes of delirium is nicotine abstinence linked to acetycholine deficiency, which results from up regulation and desensitization of nicotinic acetycholine receptors(39).

This contrasts with the majority of similar studies that looked at the relationship between cigarette smoking and delirium. A meta-analysis by Hsieh et al, that reviewed 14 cohort studies in surgical and ICU patients, reported there was no sufficient data to link cigarette smoking and delirium(40). The reason for disparity could be due to a very small number of smokers in the sample size despite the inclusion of both current smokers as well as those with years of abstinence.

In this study, the ASA classification of the patient was not found to be statistically significant, even though more than half of those patients that developed POD had ASA class 2. There are mixed reviews regarding the ASA classification and development of delirium. In a study by Wang et al, it was reported that ASA classification (>2 level) was strongly associated with development of POD, while a report by Brouquet et al(41), stated elderly patients with ASA class 3-4 were susceptible to POD. Similar findings of Brouquet regarding ASA class 3-4 was found by Raats et al(42).

This present study concurs with a study by Ansaloni et al(33) that didn't not find ASA to be a risk factor for POD. In all the above mentioned studies, the inclusion criteria for age had a higher cut off point (i.e 75years, 65 years respectively) compared to this study that included elderly from the age of 60yrs, and additionally, the studies had included elderly patients with ASA classification of >3 for which in our study such patients were excluded.

Although sex was significant in the bivariable analysis, it didn't come out as a significant risk factor for POD on multivariate analysis. This is consistent with similar studies such as that done by Dai et al (43), a prospective cohort study done to determine risk factors for POD in Chinese elderly patients, and sex was not found to be significantly associated with development of POD. Regarding sex difference again, a meta-analysis by Yang et al (44) reported that there was no significant sex difference between those that developed delirium postoperatively and those that did not. However, in contrast to above findings, male sex

was found to be at higher risk of developing POD and have more postsurgical complications in a prospective cohort study conducted by Esther O and colleagues(45).

Lag time to surgery was another factor assessed for an association with postoperative delirium. In this study, the median length of stay in the ward before going for surgery was 10days. Majority of patients that developed delirium had stayed from admission up to 7 days in the ward before going for their surgeries. Lag time to surgery was not statistically significant as a risk factor for development of delirium in the postoperative period. Compared to other studies in the literature, one study by Lee et al,(17) found that lag time from the emergency room to the operating room was a significant predisposing factor for developing delirium particularly in patients who had dementia in the preoperative period. This however was not the case for those without dementia.

Type of anaesthesia administered during surgery was also one of the independent variable analysed. The elderly patients in this study were operated either under GA or RA (that is either spinal anaesthesia, local infiltration etc) and neither type of anaesthesia was found to be an independent risk factor for development of delirium. This concurs with a similar study by Slor et al(46) that specifically looked into the effects of GA on the risk of incident delirium. The recent detailed systematic review report by Patel V and colleagues (47)on the impact of the anaesthetic technique (regional versus general anaesthesia) on postoperative delirium in elderly patients, concluded that no anaesthesia type influences development of delirium.

On multivariate analysis, both blood transfusion and intraoperative events such as hypotension and desaturation were not found statistically significant in the development of postoperative delirium.

4.2 LIMITATIONS

As for the data collection, the elderly patients were taken from the PACU to general wards after completion of surgery, hence there was no continuous 1:1 24 hourly nurse monitoring of these patients in the postoperative period, therefore some manifestations of delirium may have gone missed.

The study group comprised of elderly patients who have undergone elective surgery hence the results cannot be generalized for emergency surgeries as well.

Patients with dementia and mental illness were excluded in this study, therefore the incidence of POD in this study may have been underestimated.

Timing of assessment of the patients was early evening, and this may have missed cases that presented at other times of the day.

Loss of follow-up on laboratory investigations results

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

The incidence of postoperative delirium in the elderly patients undergoing elective orthopaedic surgery remains low in our setting. Advanced age, trauma-related injuries, smoking and alcohol consumption were found to be statistically significant independent risk factors for developing postoperative delirium in the elderly.

5.2 RECOMMENDATIONS

This study was based on elderly patients undergoing elective orthopaedic surgery at MOI, so i recommend another study to be done about elderly who are undergoing surgery in different surgical specialities and incident rates compared.

A follow up study of the elderly patients who develop POD to determine the outcome.

Early prediction of those elderly patients who are at inherent risk of developing delirium postoperatively, by ensuring staff education on recognition and documentation of symptoms of delirium especially the hypoactive type.

Early consultation to the physician and intervention with anti-psychotics to reduce the duration and severity of delirium.

Minimisation of environmental manipulation of the elderly (limited/avoid use of physical restraints)

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APPENDICES

APPENDICE 1.RESEARCH QUESTIONARE (English Version)
PART ONE:

PREOPERATIVE EVALUATION

Social Demographic Data

Serial NO; _____
Age: ____
Sex: Male☐ Female ☐

Date of admission:_____

Duration of stay in the ward: _____

Type of Injury: _____

Surgery planned: _____

Co morbidity:

□ DM □ HTN □OTHERS _____

Current Medications (Long-term and in the ward):☐ES ☐ NO (If YES, mention below)

_____
_____

Smoking history YES □ NO□
Alcohol Use YES□ NO□

ASA Status: ____

Laboratory values

TEST	VALUE
C-reactive protein	
Hb (g/dl)	

CAM EVALUATION

Confusion Assessment Method (CAM) Diagnostic Algorithm	**Date of assessment**	
	Time of assessment	
		Yes or No
1. Acute onset and fluctuating course? (Acute change in mental status from baseline, fluctuating behaviour through the day)		
2. Inattention? (Difficulty focusing attention, easily distracted, difficulty keeping track of what is being said)		
3. Disorganised thinking? (disorganized or incoherent thinking, rambling or irrelevant conversation, unclear or illogical flow of ideas)		
4. Altered level of consciousness? (This feature is shown by any answer other than "alert", including: hyper-alert, lethargic, stupor, or coma)		

PART TWO:

2. INTRAOPERATIVE EVALUATION

2.1 Type of anaesthesia given

GA□ SAB□

2.2 Induction Time : _____

2.2.1 Medications given

2.2.2 Premedication _____

2.2.3 Induction _____

2.2.4 Maintanance _____

2.2.5 Emergence _____

2.3 Type of Surgery (Tick Appropiate Box and Specify)

2.3.1 Humerus ☐ _____

2.3.2 Radius/Ulnar ☐ _____

2.3.3 Femur ☐ _____

2.3.4 Tibia/Fibula ☐ _____

2.3.5 Total Hip Replacement ☐ _____

2.3.6 Total Knee Replacement ☐ _____

2.4 End of Anaesthesia time : _____

2.5 Blood loss Estimation _____

2.6 Blood transfusion : YES ☐ NO ☐

2.7 Duration of Surgery: _____

PART THREE

POSTOPRATIVE EVALUATION

CAM EVALUATION

Confusion Assessment Method (CAM) Diagnostic Algorithm	**Date of assessment**	
	Time of assessment	
		Yes or No
1. Acute onset and fluctuating course? (Acute change in mental status from baseline, fluctuating behaviour through the day)		
2. Inattention? (Difficulty focusing attention, easily distracted, difficulty keeping track of what is being said)		
3. Disorganised thinking? (disorganized or incoherent thinking, rambling or irrelevant conversation, unclear or illogical flow of ideas)		
4. Altered level of consciousness? (This feature is shown by any answer other than "alert", including: hyper-alert, lethargic, stupor, or coma)		

APPENDICE 2. RESEARCH QUESTIONAIRE (Swahili version)
DODOSO LA TAFITI

SEHEMU YA KWANZA: (KABLA YA KUINGIA KWENYE UPASUAJI)

Namba: _____

Umri: ___

Jinsia: UME ☐ KE: ☐

Tarehe ya kulazwa: _____

Muda aliokaa wodini:_____

Jeraha/mvunjiko alilopata:_____

Aina ya upasuaji uliopangwa_____

Mangonjwa ya awali (Mbali ya jeraha) :

Kisukari ☐shinikizo la damu ☐Mengineyo ☐

Dawa anazotumia (Dawa za muda mrefu pamoja na hapo wodini):Zipo Hamna ☐ (Kama ☐ zipo, orodhesha hapa chini)

_____

_____

UvutajiSigara : Ndiyo ☐ Hapana ☐

Unywajipombe :Ndiyo ☐ Hapana ☐

ASA Status:

Matokeo Ya Vipimo:

KIPIMO	JIBU
C-reactive protein	
Hb (g/dl)	

CAM

Confusion Assessment Method (CAM) Diagnostic Algorithm	**Date of assessment**	
	Time of assessment	
		Yes or No
1. Acute onset and fluctuating course? (Acute change in mental status from baseline, fluctuating behaviour through the day)		
2. Inattention? (Difficulty focusing attention, easily distracted, difficulty keeping track of what is being said)		
3. Disorganised thinking? (disorganized or incoherent thinking, rambling or irrelevant conversation, unclear or illogical flow of ideas)		
4. Altered level of consciousness? (This feature is shown by any answer other than "alert", including: hyper-alert, lethargic, stupor, or coma)		

SEHEMU YA PILI

UPASUAJI NA USINGIZI

Aina ya usingizi aliyopewa

Kaputi □ Nusu kaputi□

2.8 Muda wa kuanza dawa za usingizi : _____

2.8.1 Dawaalizopatiwa

2.8.2 Awali _____

2.8.3 Kianzio _____

2.8.4 Uendelezo _____

2.8.5 Mwisho/Kuamka _____

2.9 Aina ya Upasuaji (weka alama ya V kwenye kisanduku husika, natoa maelezo zaidi)

2.9.1 Mfupa wa bega- Humerus ☐ _____

2.9.2 Mifupa ya Mkono ☐ _____

2.9.3 MfupawaPaja ☐ _____

2.9.4 Mfupa wa Mguu (Chini ya Goti, Kabla ya Kisigino) ☐ _____

2.9.5 Kubadilisha Nyonga ☐ _____

2.9.6 Kubadilisha Goti ☐ _____

2.10 Muda wa usingizi kuisha : _____

2.11 Wingiwa Damu aliopoteza _____

2.12 Aliongezewa Damu? : NDIYO ☐ HAPANA ☐

SEHUMU YA TATU

BAADA YA UPASUAJI

CAM EVALUATION

Confusion Assessment Method (CAM) Diagnostic Algorithm	**Date of assessment**	
	Time of assessment	
		Yes or No
1. Acute onset and fluctuating course? (Acute change in mental status from baseline, fluctuating behaviour through the day)		
2. Inattention? (Difficulty focusing attention, easily distracted, difficulty keeping track of what is being said)		
3. Disorganised thinking? (disorganized or incoherent thinking, rambling or irrelevant conversation, unclear or illogical flow of ideas)		
4. Altered level of consciousness? (This feature is shown by any answer other than "alert", including: hyper-alert, lethargic, stupor, or coma)		

APPENDICE 3.CONFUSION ASSESSMENT METHOD (CAM) SCALE (ENGLISH VERSION)

Note: The diagnosis of delirium requires a present or abnormal rating for criteria 1, 2, and 3 or 4.

FEATURE 1: **Acute onset and fluctuating Course PRESENT ABSEN** ☐ ☐

Indicated by positive responses to the following questions:

 Is there evidence of an acute change in mental status from the patient's baseline?

And

 Did this behavior fluctuate during the past day-that is tend to come and go or increase and decease in severity?

FEATURE 2: Inattention **PRESENT** ☐ **ABSENT** ☐

Indicated by a positive response to the following question:

 Does the patient have difficulty focusing attention –for example, being easily distractible or having difficulty keeping track of what is being said?

FEATURE 3: Disorganized thinking **PRESENT** ☐ **ABSENT** ☐

Indicated by a positive response to the following question:

 Is the patient's speech disorganized or incoherent, with rambling or irrelevant conversation, unclear or illogical flow of ideas, or unpredictable switching from subject to subject?

FEATURE 4; Altered level of consciousness **PRESENT** ☐ **ABSENT** ☐

Indicated by any response other than alert (normal) to the following question:

 Overall, how would you rate this patient's level of consciousness?

Alert (normal) Vigilant (hyperalert) Lethargic (drowsy, easily aroused) Stupor (difficult to arouse)

APPENDICE 4 : CONFUSION ASSESSMENT METHOD (CAM) SCALE (SWAHILIVERSION)

Angalizo: Utambuzi wa kuweweseka unahitaji vipengele 1 na 2, na moja kati ya kipengele 3 au 4.

KIPENGELE 1: **Mabadiliko ya kuanza ghafla na hali ikienda ikibadilika NDY ☐ HPN ☐**

Ulizakama:

- Kuna mabadiliko ya ghafla ya hali ya akili, tofauti na ilivyokuwa mwanzo?
- Je, Hali hii imeenda ikibadilika-badilika? Ikipungua ama kuongezeka?

KIPENGELE 2: Kutokuwa hakika NDY ☐ HPN ☐

Mpe mgonjwa zoezi dogo kama:

- Ataje herufi zote za jina lake, halafu azirudie kuanzia herufi ya mwisho. Mfano H-A-L-I-M-A/ A-M-I-L-A-H

  AU
- Taja siku za juma, halafu mwambie mgonjwa azirudie kuanzia jumapili kurudi nyuma. Mfano: jumapili-Jumamosi-ijumaa-Alhamisi,Jumatano,Jumanne,Jumatatu.

KIPENGELE 3: Kufikiri kusipopangiliwa NDY ☐ HPN ☐

Uliza/Angalia kama:

- Mgonjwa ana matamko yasiyoeleweka yasiyo na mpangilio, maongezi yasiyo na mfuatano/mshahabiano

KIPENGELE 4: Kiwango cha Ufahamu kushuka NDY☐ HPN ☐

Angalia kama mgonjwa ana ufahamu kamili? Kama Ndiyo, basi kiwango cha fahamu kiko sawa.

Kama mgonjwa ana dalili zifuatazo hajitambui, anaweweseka, anasinzia, ana fujo kupita kiasi, basi kiwango cha fahamu kimeshuka.

APPENDICE 5. CONSENT FORM (ENGLISH VERSION)

Introduction

I, Dr.Nsia Richard Mushi, is researcher from Muhimbili University of Health and Allied Sciences (MUHAS) , and i am planning to conduct a study tittled 'Post-Operative Delirium in elderly patients aged 60 years and older undergoing elective orthopaedic surgery at Muhimbili Orthopaedic Institute', with not only an aim of finding number of patients who develop Delirium post surgery, but also knowing what predisposes a patient to develop it.

Patient Confidentiality and Protection

I would like to request your permission to be involved in the research as a participant. The records of this study will be kept strictly confidential, and will be kept with me. I will not include any information in any report we may publish that would make it possible to identify you.

Voluntary participation

Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study.

Risks and discomforts

There are no anticipated risks associated with this research.

Potential Benefits

The results from the current research will help us understand the magnitude of the problem being studied and hence help us improve on the future care and management of elderly patients going for surgery at our facility.

Contact Person

If you have any questions or concerns about this study or if any problems arise, please contact **the principal researcher, Dr Nsia Richard Mushi at MUHAS at +255-713-268390**. You may also wish to contact **the Director of Research and Publications – MUHAS, Dr Bruno Sunguya,** MUHAS P.O.BOX 65001, Dar es Salaam. Telephone; 022-2150302-6

Consent

I..... Have read and understood the contents of this form and i have been given enough information about the aim of the research and I, therefore, consent without any reinforcement to participate in this study

Signature of Participant_____

Signature of Researcher_____Date: _____

APPENDICE 6.FOMU YA KURIDHIA KUSHIRIKI KATIKA TAFITI.

Utangulizi

Mimi, Dr Nsia Richard Mushi, ni mitafiti kutoka Chuo cha Sayansi ya Tiba (MUHAS), ni na mpango wa kufanya Utafiti kujua ni wagonjwa wangapi wenye umri wa miaka sitini na kuendelea wanaofanyiwa upasuaji wa mifupa, hupata kuweweseka baada ya kufanyiwa upasuaji huo, na pia kujua vitu vichangiavyo kupata kuweweseka huko.

Usiri na ulinzi kwa mshikiri

Ninaomba utayari na ruhusa yako kushiriki katika tafiti hii.Kumbukumbu za tafiti hii zitawekwa kwa usiri na zitakuwa na uangalizi kutoka kwa mtafiti mkuu. Sitahusisha taarifa/maelezo yoyote yatakayo pelekea mtu kukujua.

UshirikiwaHiari

Ushiriki wako katika tafitihiiniwahiari. Una uhuru wa kutokushiriki na pia una ouhuru wa kujitoa katika tafiti muda wowote upendao bila kuwa na faini/malipo/kukosa tiba.

Athariza kushiriki

Hakuna madhara yoyote yanayotarajiwa kwa kushiriki tafiti hii.

Faidaza kushiriki

Matokeo ya tafiti hii ya tatuwezesha kujua ukubwa wa tatizo hili la kuweweseka pamoja na kujua vitu vichangiavyo kutokea kwa tatizo hili, hivyo basi itatusaidia kuboresha huduma na afya za wagonjwa wetu.

Mawasiliano

Mtafiti Mkuu, Dr.Nsia Richard Mushi, simu Namba: +255-713-268390, Mkurugenzi wa Utafiti na Uchapichaji, MUHAS, Dr. Bruno Sunguya, MUHAS P.O.BOX 65001, Dar es Salaam. Telephone; 022-2150302-6

Ridhaa ya kushiriki

Mimi _____ nimesoma na kuelewa mambo yaliyoandikwa katika fomu hii ya ushiriki na pia nimepewa taarifa zote muhimu pamoja na malengo ya tafiti hii na ninatoa ridhaa yangu pasipo kulazimishwa, kushiriki katika tafiti hii.

Sahihi ya Mshiriki_____

Sahihi ya Mtafiti _____

Tarehe: _____

APPENDICE 7. Ethical clearance

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

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

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

Ref. No. DA.287/298/01A/ 17th August, 2018

Dr. Nsia R. Mushi
MMed. Anaesthesiology
MUHAS

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED: "POSTOPERATIVE DELIRIUM AMONG ELDERLY PATIENTS UNDERGOING ELECTIVE SURGERY AT MUHIMBILI ORTHOPAEDIC INSTITUTE

Reference is made to the above heading.

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

The ethical clearance is valid for one year only, from 7th August, 2018 to 6th August, 2019. In case you do not complete data analysis and dissertation report writing by 6th August, 2019, you will have to apply for renewal of ethical clearance prior to the expiry date.

Dr. Emmanuel Balandya
ACTING: DIRECTOR OF POSTGRADUATE STUDIES

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