ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

DEPARTMENT OF ANESTHESIA

INCIDENCE AND ASSOCIATED FACTORS OF POSTOPERATIVE DELIRIUM AMONG ELDERLY ELECTIVE ORTHOPEDIC SURGICAL PATIENTS IN SELECTED ADDIS ABABA PUBLIC HOSPITALS, ETHIOPIA, 2024, A MULTI-CENTER LONGITUDINAL STUDY.

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Full title of the research project	Incidence and associated factors of postoperative delirium among elderly elective orthopedic surgical patients in selected Addis Ababa Public hospitals
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Declaration

We the undersigned agrees to accept responsibility for the scientific, ethical, and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the research and publications office of the Addis Ababa University. The authors surely declared that there is no competing interest.

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List of Acronyms

AAU	**Addis Ababa University**
ASA	**American society of anesthesiologist**
BMI	**Body mass index**
CAM	**confusion assessment method**
CVD	**Cerebrovascular disease**
DM	**Diabetes mellitus**
POD	**postoperative delirium**
TASH	**Tikur Anbessa specialized hospital**

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Abstract

Background: Delirium is a neurocognitive disorder characterized by an acute and relatively rapid decline in cognition, disturbance of consciousness, reduced ability to focus and shift of attention. Additionally, it is well recognized that it mostly affects elderly patients, and its incidence is increased during the postoperative period. Occurring in 8% to 20% of older patients after an operation, and frequently it occurs between 24 hours and 5 days after surgery. And it can result in serious medical management problem; therefore, identification of the possible contributing factors and magnitude of the burden will help in the management of delirium in elderly patients.

Objective: To assess the incidence and associated factors of postoperative delirium among elderly elective orthopedic surgical patients in selected Addis Ababa public hospitals, Ethiopia, from February 2024 to May 2024.

Method and tools: A multi-center longitudinal study was conducted on elderly patients in four selected Addis Ababa public hospitals from February 2024 to May 2024, and a systematic sampling technique was used to select the study participants. Patients aged ≥65 years old who underwent elective orthopedic surgery were included in this study. Data was collected through chart review and interview of patients, and postoperative delirium was assessed by using confusion assessment method **(CAM)**. Both bivariable and multivariable logistic regression model were used for statistical analysis.

Results: 220 patients who underwent elective orthopedic surgery at four selected Addis Ababa public hospitals were included; most of the patients were male, 68.1% of the patients underwent lower extremity surgery, and 62.3% of the patients received spinal anesthesia. The incidence of postoperative delirium among elderly elective orthopedic surgical patients was 33.7%, and age 65-75(AOR =0.468, 95%CI (0.226-0.97),perioperative opioid usage (AOR=2.200, 95%CI (1.073-4.5313), intraoperative anticholinergic usage(AOR=2.238,95%CI(1.831-4.235),history of hospitalization(AOR=2.24,95%CI(1.202-4.206),and blood transfusion (AOR=2.83,95%CI(1.295 -6.193) were significantly associated with postoperative delirium.

Conclusion: The incidence of postoperative delirium among elderly elective orthopedic surgical patients was high in the study area (33.7%); advanced age, blood transfusion, intraoperative anticholinergic usage, pervious history of hospitalization and perioperative opioid usage were the associated factors for postoperative delirium.

Recommendation: We recommend that special attention should be paid for elderly patients with history of hospitalization, blood transfusion, who use opioid and anticholinergic medications. in addition to this, reducing opioid-based pain treatment is important. We also recommend that feature researchers to do ongoing research on long-term impact of postoperative delirium on elderly patients.

Key words: Orthopedic surgery, Postoperative delirium, Confusion assessment method.

1. Introduction

1.1 background

Delirium is the most common life-threatening neurocognitive disorder and potentially preventable clinical syndrome among persons who are 65 years of age or older.it is characterized by a disturbance in attention, level of consciousness, cognitive function (memory, orientation, speech, and thinking), change in circadian rhythm, emotional disturbance and psychomotor disturbances. In which symptoms and severity are acute in onset and may fluctuate throughout the day, it is associated with acute medical or surgical illness, and most of the time it occurs in hospitalized older peoples(1).

Post-operative delirium is a form of delirium that appears in patients who have undergone surgical procedures and received anesthesia, usually peaking between one and three days after surgery. It is different from emergence delirium, which occurs in patients after 5-15minutes of awakening from general anesthesia and resolves quickly within hours(2).

The pathophysiology of delirium still not fully understood, and the leading theories for its pathogenesis mainly focus on the disturbance of neurotransmission, specifically in the production, release, or inactivation of neurotransmitters that regulates cognitive function. Including GABA, glutamate, acetylcholine, serotonin, nor- epinephrine and dopamine. Cholinergic insufficiency and excess dopamine is the primary cause for development of postoperative delirium. Another mechanism is associated with Cytokines such as interleukin-1, interleukin-2, interleukin-6, tumor necrosis factor α (TNF-α), and interferon, also contribute to the occurrence of delirium by making the blood brain barrier more permeable and changing neurotransmission. Chronic stress due to chronic illness or trauma stimulates the sympathetic nervous system and hypothalamic pituitary adrenocortical axis, and rises cytokine levels, and causing hypercortisolism, which can damage hippocampal serotonin receptors and may cause delirium (1),(3).

Many risk factors are reported for the development of postoperative delirium. many studies found that: age, over 65 years old, male sex, preoperative cognitive impairment, electrolyte imbalance, intraoperative blood loss, intraoperative hypoxemia, use of general anesthesia, length of surgery greater than 3 hours, presence of intraoperative hypercapnia, presence of intraoperative hypotension, use of opioids, presence of postoperative sleep disorders, anemia (HCT< 30), multiple comorbidities, depression, anxiety disorders, dehydration, hyponatremia anticholinergic drugs, alcohol consumption, postoperative pain, fracture or trauma, Terminal illness, Infection with human immunodeficiency virus, Treatment with multiple psychotropic drugs, Functional dependence, immobility, Visual impairment and Hearing impairment(4).

Preventing delirium occurrence is the most effective way to reduce its occurrence and complications. since delirium has a range of causes, multicomponent approaches are the most

effective and clinically applicable methods, including; early mobilization, preventing sleep deprivation, fluid and electrolyte balance, pain control , reduction in the usage of psychoactive drugs, avoiding surgical and anesthesia related postoperative complications. In addition, all delirium patients benefit from supportive care that aims to reduce triggers for delirium as well as pharmacologic treatment with strong antipsychotic medications, Anticholinesterase and benzodiazepines have some benefit. Previously Haloperidol is most commonly used, but currently health professionals are using the newer antipsychotic medications (risperidone, olanzapine and quetiapine) (5).

The number of elderly population is increasing as healthcare quality improves, and globally, its estimated that 50% of older individuals have had at least one surgical procedure. And associated with this postoperative cognitive dysfunction is one of the most frequent complications after surgical procedure in this group of population, and is it generally misunderstood in the medical community. Elderly patients often demands a higher level of care and higher health care cost because most of the time this group of peoples have preoperative comorbidities which can be associated with a decline in cognitive and physiological functions and these factors can affect perioperative outcomes and increase the risk of postoperative delirium (6)(7)

1.2 Statement of the problem

Delirium is one of the most frequent postoperative problem in elderly patients, with incidence rate of 15% - 25% following major elective procedures and approximately 50% -60% after high-risk surgeries, including colorectal surgeries and cardiac surgeries. The incidence is reported to be higher in orthopedic surgical patients than general surgical patients (44-55% vs. 10-14%) From this, 72.4% of those died within 5 years. in hospitalized patients, the global prevalence of delirium is 17.9%, 21.8%, 29%, 28.4%, 35.9%, 51%, 12.3% in India, Ireland, Brazil, Iran, USA, Switzerland, Nigeria respectively. Sometimes delirium has brief and self-limiting nature (it recover within 4 weeks) but in up to 50% of cases, delirium can last until the moment of hospital discharge (8).

Patients who are admitted for surgical repair of hip fractures are at high risk for postoperative delirium, and the reported incidence rate of delirium in hip fracture patients ranges from 40% to 60%. most likely, this is correlated with advanced age, preoperative cognitive impairment and multiple comorbidities(9).

Postoperative delirium is associated with significant negative outcomes, such as immobility, decrease long term physiological function, pressure ulcers, urinary tract infections, respiratory problems, myocardial infarction, atrial fibrillation, longer hospital stay(an average of 5–10 extra days), and higher chance of death. Patients with delirium are more likely to die in the hospital or within 1 year after hospital discharge. In-hospital mortality rates for patients with delirium range from 22% to 76%, and this patient also have greater need for rehabilitation and home healthcare services. Therefore, it is a common condition that can have a higher burden on patients, family members, the health care system and society(3).

Patients with delirium, especially those suffering from preoperative dementia, have an increased risk of death during the perioperative period and have higher chance to discharged to nursing homes, and when they survive the hospitalization, Delirium can also accelerate the effects of Alzheimer's disease and exacerbates long-term cognitive and functional decline. Among elderly patients, even those without preoperative cognitive impairment, there is a higher risk of cognitive decline after experiencing delirium. And it is associated with a two-fold increase in the risk of post hospital discharge dementia. And The incidence of new cognitive decline after delirium is also high(7).

The economic impact of delirium is serious and expensive; the estimated additional health care cost is increased by 37%-50% in a people who are diagnosed with the condition. This cost is related to costs associated with hospital expenses for hospitalization costs, prescription drugs for management of the condition and for research allocation, as well as delirium related absenteeism of family or care giver from work and daily activity for caring delirium patient, has high economic impact. And Patients with delirium have decline in functioning, resulting in difficulty carrying out regular work and daily activities and decreased productivity, which has impact on country's economy (10).

Drug treatment for delirium is an understudied field with only a limited number of small trials to guide management; there are very few data comparing different drugs. So the choice of drug is not guided by an understanding of the pathophysiology of delirium; therefore, managing delirium with Drug therapy is reserved for patients who have severe delirium and are in danger of injuring themselves or others, but most commonly used medications for delirium do not reduce delirium and don't improve length of hospital stay. These medications have side effects including exacerbating delirium, extrapyramidal adverse effects, Neuroleptic malignant syndrome, orthostatic hypotension, epileptic seizures, weight gain, disturbed glucose metabolism, Sedation and increased risk of stroke in older patients with dementia(5).

As far as our search is concerned, no specific evidence has been reported on the incidence and associated factors of postoperative delirium among elderly orthopedic surgical patients in the study area. Hence, there is a shortage of information about it. So the inadequacy of the information may lead to under diagnosis of delirium in clinical area by health professionals, and it may complicate the health status of elderly, resulting in high impact to the hospitals and other public health sectors. Therefore, this study will fill the information gap and will provide evidence about incidence and associated factors of postoperative delirium in the study area in order to manage patients appropriately.

1.3 Justification of the study

Due to shortage of specialized geriatric units, caregivers, and providers of psychotherapy for elderly patients, screening of delirium on the postoperative hospital wards is ignored and less recognized, and poorly reported in clinical practice. Despite the elevated prevalence and burden associated with delirium, under diagnosis remains a critical concern. The occurrence of hospital mortality rate among delirious patients is high; therefore, in order to understand how to develop early prevention methods and intervention strategies it is important to identify possible risk factors of postoperative delirium.

Identifying risk factors that contribute to the development of post-operative delirium can help to focus on prevention, early detection, and better management, which can lead to improved patient care and better surgical outcome.in addition, it helps health professionals in clinical decision making, explaining risks to the patients as well as for the families and guide families to better understand the recovery process and potential outcome.

By determining the incidence of postoperative delirium and identifying its associated factors, health systems can allocate resources more efficiently, such as implementing delirium prevention protocols, providing staff education and optimizing perioperative care pathway. and this research will be helpful for the next researcher as reference.

As the number of elderly patients undergoing surgery is increasing, the prevention and treatment of postoperative delirium is significantly important public health concern. Research in this area encourages collaborations between surgeon, anesthesia professional, geriatricians, psychiatrists and other health care professionals to produce comprehensive approach to patient care.

2. Literature review

According to A Prospective Cohort Study conducted in Taiwan in 2012 with 232 participants (mean age: 74 years), shows that Overall 9.1% of the patient experienced postoperative delirium. and strong predictor of poor functional status at 6 and 12 months postoperatively was significantly associated with Delirium superimposed on cognitive impairment(11).

Retrospective cohort study done on 582 patients who underwent orthopedic surgery in 2014 which is conducted to investigate the relationship between Electrolyte disorders and aging with postoperative delirium, showed that postoperative delirium incidence in patients aged 70–79 years and in patients aged ≥80 years was higher than patients aged <70 years, In addition the incidence of postoperative delirium in the group of patients with electrolyte disorders was higher than the patients with normal electrolyte level group; therefore Aging and postoperative electrolyte disorders (hyponatremia and hypocalcaemia) are risk factors for postoperative delirium in patients undergoing orthopedic surgeries(12).

A prospective cohort study conducted in china with 572 participants in 2015 showed that 120 patients (21 %) experience POD and 452 patients (79.0%) did not experience POD. according to this study, POD is highly associated with older age, a history of stroke, lower albumin level, higher blood glucose, higher total bilirubin, higher C-reactive protein, longer surgery duration and higher volume of red blood cell transfusions (13).

A systematic review and meta-analysis study done on 1427 patients in 2015 showed that The incidence of postoperative delirium ranges from 8.2% to 54.4%, and Seven significant risk factors are identified, including old age, American Society of Anesthesiologists (ASA) classification three and greater than three, high body mass index, low serum level of albumin, intraoperative hypotension, perioperative blood transfusion and history of excessive alcohol consumption. associated with this Patients with postoperative delirium had a significantly increased duration of hospital stay and a higher mortality rate compared with those without delirium(14).

A prospective observational study done in the USA in 2015 with 594 patients conducted to show the impact of intraoperative hypotension and blood pressure variations on early postoperative delirium showed that 178 patients developed delirium on day 1 and 176 patients on day 2. Patients developing delirium were older, female, lower preoperative cognitive scores, and longer operations. Relative hypotension (decreases by 20, 30, or 40%) or absolute hypotension [mean arterial pressure MAP (<50mm Hg) and the duration of hypotension were not significantly associated with postoperative delirium. instead of this intraoperative blood pressure fluctuation is significantly associated with POD(15).

A cross sectional study conducted in turkey in 2015 on 65 orthopedic surgical patients showed that the incidence of postoperative delirium is 9(15%)and associated factors are advanced age, type of surgery(hip fracture surgery) and cognitive impairment (17).

A prospective cohort study done on 106 older Patients in 2016 at Duke University North Carolina which is conducted to show the association between obstructive Sleep Apnea and Incidence of Postoperative Delirium after Elective Knee Replacement surgery. The results showed that 15(53%) patients with obstructive sleep apnea experienced postoperative delirium and (20%) of the patients without obstructive sleep apnea develop POD. (18).

A retrospective cohort study done in Canada in 2017 on 6831 hip fracture patients shows that an increased duration of surgery is associated with higher incidence of postoperative delirium; an increase in surgical time of 30 minutes was linked to a 6% increase in risk of delirium and patients who received general anesthesia have higher risk of postoperative delirium than patients who received regional anesthesia(19).

A prospective observational study done in Boston in 2018 on 229 Patients which was conducted to investigate The Relationship between Postoperative Pain and Opioid Consumption with Postoperative Delirium shows that patients with regular preoperative opioid use have significantly greater maximal daily pain scores and requiring greater daily opioids in the first 3 days after surgery, and these patients are also more likely to develop POD (20).

Prospective cohort study conducted in japan on 6288 participants in 2018 shows that the pooled prevalence of POD was (28%). from these (23–34%) postoperative delirium was associated with an increase in perioperative mortality, and after discharge from the hospital mortality, this study also shows that approximately one-fourth of patients who undergo hip fracture surgery will develop Postoperative delirium, and delirium increased the short-term and long-term mortality in these patients (8).

A randomized, multicenter clinical trial conducted in 2018 in china with 950 elderly hip fracture patients, which was conducted to investigate effect of regional versus general Anesthesia on incidence of postoperative Delirium. The result shows that regional anesthesia without sedation did not significantly reduce the incidence and severity of postoperative delirium compared with general anesthesia(21).

In a Longitudinal study conducted in 2019 in Germany on 402 femur fracture patients, 184 (45.8%) of the participants developed POD. patients with POD are older, more frequent institutionalized, have high level of pain after surgery, and have cognitive and physical impairment. These patients have significantly more complications during the hospital stay; prolonged intensive care unit stays and high in hospital mortality and overall mortality after 12 months were significantly higher in POD patients. Twelve months after the fracture, POD was significantly associated with diminished mobility, cognitive and functional capacity, and higher risk of falls(22).

A prospective cohort study done in japan in 2019 on 106 patients who were scheduled for spine surgery From 106 patients 12 (11.3%) patients developed POD. Patients with POD are significantly older, had comorbidities , were taking a larger number of medications, high blood volume loss, had longer duration of surgery and this study shows that length of hospital stay was also significantly longer in patients with POD than without POD. Comparisons of preoperative laboratory parameters between patients with and without POD are Patients with POD had a significantly lower hemoglobin concentration, lower albumin concentration, higher BUN concentration, higher creatinine concentration, and higher CRP concentration than patients without POD(23).

A Cross sectional study done in Eritrea 2019 on 129 patients which was conducted to show the Incidence and risk factors of post-operative delirium in elderly patients who underwent surgery under spinal anesthesia shows that Postoperative delirium occurred in 14 patients (10.9%)and only age is significantly associated with postoperative delirium(6).

Prospective cohort study done in china in 2021 on 263 patients who underwent elective orthopedic surgery and was conducted to investigate the effects of preoperative anxiety on postoperative delirium shows that in patients, with preoperative anxiety have increased the occurrence of postoperative delirium, so that the presence of preoperative anxiety is significant predictor of postoperative delirium (24).

A systematic review and meta-analysis of randomized controlled trials done in china in 2021 on 2110 participants undergoing different surgeries. which was conducted to show the Effect of regional anesthesia on the postoperative delirium, showed that regional anesthesia was associated with less POD incidence compared to general anesthesia (total intravenous anesthesia (TIVA) or (inhalation anesthesia). in addition, it showed that the decrease in POD incidence was associated with a nerve block and regional-combined-general anesthesia. There is a significant correlation between regional anesthesia and the decrease in POD incidence(25).

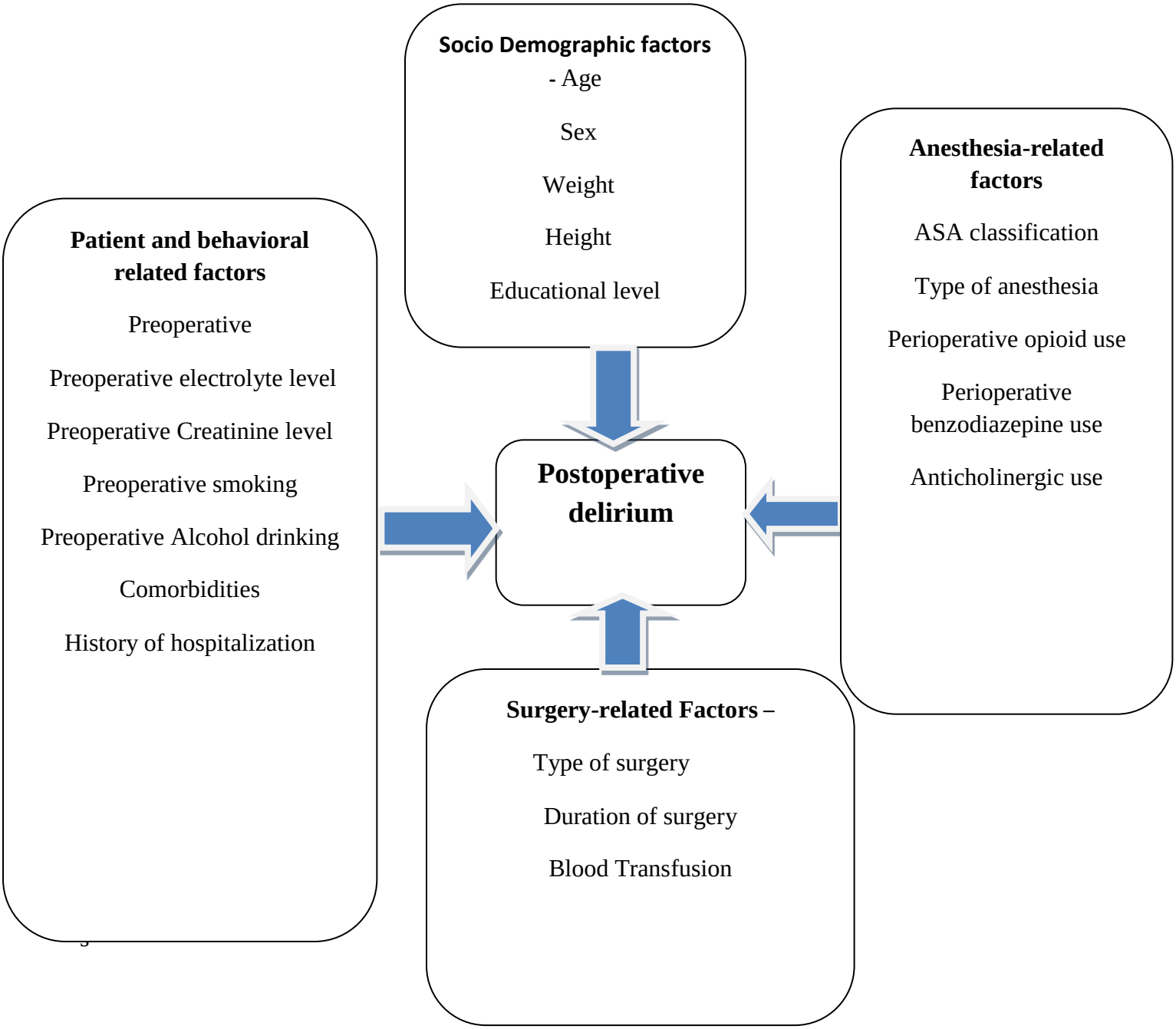


Figure 1: conceptual frame work (4, 12, 13, 17, 20, 21, 22, 23, 25)

3. Objectives

3.1 General objective

To assess the incidence and associated factors of postoperative delirium among elderly elective orthopedic surgical patients from February 2024 to May 2024 in selected Addis Ababa public hospitals.

3.2 Specific objectives

To determine the incidence of postoperative delirium among elderly elective orthopedic surgical patients from February 2024 to May 2024 in selected Addis Ababa public hospitals.

To identify associated factors for postoperative delirium among elderly elective orthopedic surgical patients from February 2024 to May 2024 in selected Addis Ababa public hospitals.

4. Material and Methods

4.1 study area

The study was conducted at selected public hospitals in Addis Ababa; the capital city of Ethiopia. There are 12 public hospitals and 46 private hospitals in Addis Ababa. Four public hospitals were selected for this study: Tikur Anbessa specialized hospital (TASH), Abet hospital, Yekatit 12 hospital and Alert hospital. Those hospitals were selected because a relatively large number of orthopedic surgeries are perfumed at them compared to other hospitals.

TASH is located in the nation's capital city Addis Ababa; it is Ethiopia's largest referral hospital. It offers diagnosis and treatment for approximately 370,000- 400,000 patients yearly, with nearly 8000 surgeries performed annually with 14 operation rooms and has four orthopedic operation tables.

Alert hospital is one of the public hospitals in Addis Ababa; it has 9 operation tables; three from those tables are for orthopedic surgeries; Yekatit 12 hospital has 6 functional operation tables and from these tables 2 are for orthopedic surgeries, Abet hospital is a trauma center and has 5 operation tables; two of these tables are for orthopedic surgeries.

4.2. Study design and study period

A multicenter longitudinal study was conducted on elderly orthopedic surgical patients from February 1st, 2024 to May 5th, 2024.

4.3 Source Population

All elderly patients aged 65 and above who underwent elective orthopedic surgery in Addis Ababa public hospitals.

4.4 Study population

All elderly patients aged 65 and above who underwent elective orthopedic surgery in selected Addis Ababa public hospitals during the study period.

4.5 Inclusion and exclusion criteria

4.5.1 Inclusion criteria

All elderly patients who underwent elective orthopedic surgeries in selected Addis Ababa public hospitals and volunteered to participate in the study and signed informed consent for the study during the study period.

4.5.2 Exclusion criteria

Patients with preoperative known cognitive impairment (dementia), patients with known psychiatric illness and long-term usage of psychotropic medications, patients who were transferred to an intensive care unit (ICU) after surgery, patients with day case surgery, ASA classification greater than three, and patients with delirium before surgery.

4.6 Sample size determination and sampling procedure

4.6.1 Sample size calculation

The sample size (n) was determined based on a single population proportion by assuming 95% confidence interval (CI) and 5% margin of error.

n= (Zα/2)2p (1-p) /d2

Where

n= is the size of the sample

Zα/2= is the standard normal value corresponding to the desired level of confidence =1.96

d=error of precision =5%

P=is the estimated proportion of an attribute =0.5(since there is no similar study done in Ethiopia as well as in Africa)

n= (1.96)2*0.5*(1-0.5)/0.052

n=384

Since the size of the population is less than 10,000 this study uses a correction formula

Corrected sample size =n*N/n+N

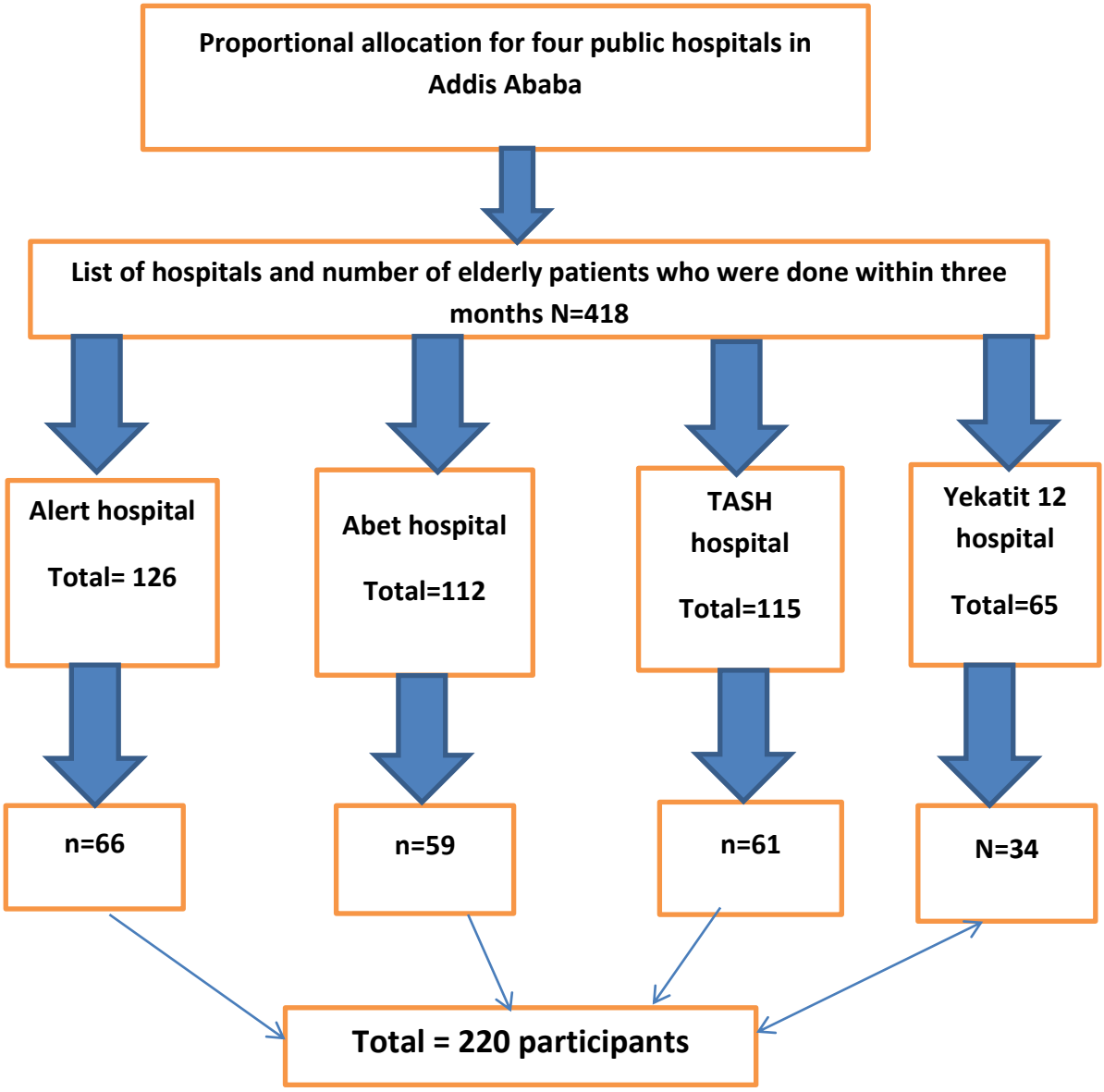
N = the total number of elderly patients undergone Orthopedic surgeries in four selected hospitals with in three months is 418

nf =418*384/418+384

nf=200

The sample size is 200 and with 10% contingency, the final sample size is equal to 220

From situational analysis the total number of elderly patients who undergo orthopedic surgery with in three month was 418. The total numbers of elderly patients who undergo orthopedic surgery in the last three month at Alert hospital, Abet hospital, TASH hospital, Yekatit 12 hospital were 126, 112, 115, and 65 respectively. The study population was taken from each hospital with a proportion allocation formula.


Proportional allocation for four public hospitals in Addis Ababa
List of hospitals and number of elderly patients who were done within three months N=418
Alert hospital
Total= 126
Abet hospital
Total=112
TASH hospital
Total=115
Yekatit 12 hospital
Total=65
n=66
n=59
n=61
N=34
Total = 220 participants

4.6.2 Sampling procedure

Systematic sampling techniques was employed on every other patient selection; this was done as k, or sample interval of 2,(k=2) was determined for each hospital as follows: k=N/n, K=126/66=2,112/159=2,115/61=2, 65/34 for Alert, Abet, TASH, and Yekatit 12 hospital, respectively; hence, with the skip interval k of 2, every other elderly patients who came for elective orthopedic surgery during the study period were our study units.

4.8. Data collection tool and procedure

A day before surgery all study participants who underwent elective orthopedic surgeries gave their informed consent for the study; Patients were assessed preoperatively for presence of delirium before surgery by using the confusion assessment method (CAM) score. Postoperatively, after surgery in the orthopedic wards, the assigned trained nurse collect data by using a structured interviewer administered questionnaire to collect the pre-operative demographic data including (age, gender, height, weight, educational level, living arrangement, lifestyle habits, alcohol drinking and tobacco smoking), past medical history, medication history, history of obstructive sleep apnea, previous history of hospitalization and data on other characteristics, including laboratory test results, diagnosis, and the type of surgery, duration of surgery, type of anesthesia, ASA classification, perioperative blood transfusion, intraoperative incidence and complications, intraoperative vital signs, intraoperative anticholinergic use, opioid use and anxiolytic use were collected from the patient chart recording and in the orthopedic wards after orthopedic surgery, using the Confusion Assessment Method (CAM), delirium was assessed by following the study participant after 24hrs of the end of surgery for 3 consecutive days by trained nurses.

4.9 Variables

4.9.1 Dependent variables

Postoperative delirium.

4.9.2 Independent variables

Socio-Demography-related factors: age, sex, weight, height, BMI, educational level.

Laboratory related factors electrolyte levels**,** Creatinine level

Anesthesia-related factors: ASA classification, type of anesthesia, perioperative opioid use perioperative benzodiazepines use and anticholinergic use.

Surgery-related factors: types of surgery, duration of surgery, blood transfusion

Patient and behavioral-related factors: preoperative smoking, alcohol drinking chronic medical comorbidity and previous hospitalization

4.10 Operational definitions

Postoperative delirium: is a form of delirium that manifests in patients who have undergone surgical procedures and received anesthesia. This complication usually occurs within 5 days after surgery, especially during the first 24–48 h postoperatively(26).

Elderly: According to world health organization definition; Elderly are individuals whose age is 65 years and above. Then old age is classified as young old (65 to 75 years) this is the time between working and retirement. And the time frame at which functional deficits starts to show up is defined as age 75-85 years old. Age 85 and above are considered as very advanced old age and a time that needs special care and support (27).

The Confusion assessment method (CAM): was derived from the Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition, which is used to asses delirium. It is composed of four key features: 1.acute change in mental status with a fluctuating course 2. inattention, 3.disorganized thinking, and 4, altered level of consciousness; the diagnosis of delirium requires the presence of both of the first two features as well as either of the last two features or all of the four features (28).

Hospitalization: care in the hospital that requires admission as an inpatient and usually requires an overnight stay.

4.11 Data quality control

To assure the quality of the data, one day training was given for data collectors about the objectives and relevance of the study, how to interview, how to fill out the questionnaires and how to use the assessment tools of delirium. During the data collection, regular data collection procedures were supervised by principal investigator. In addition to this, each questioner was revised by the investigator for being complete and appropriate. The data collectors were instructed to write card number on the questionnaire during the data collection if further cross check is needed, and a pre-test was done with 5%(11) participants at St peter's hospital.

4.12 Data processing and analysis

Data was coded and then entered into epidata version 4.6. Then the data was exported to statistical package for social science (SPSS) software version 27 for cleaning and analysis. The chi square test was done to determine the relationship between the incidence of postoperative delirium and potential associated factors. Both bivariable and multivariable logistic regression analysis was conducted to identify factors associated with postoperative delirium. In the bivariable logistic regression, variable with p-value of<0.2 were taken in to multivariable analysis. In the final model an adjusted odds ratio with 95% confidence interval was used to state the strength of the association. The p value of <0.05 was taken as a cutoff to declare statistical significance. And patient's data were presented using frequencies, percentages, figures and tables.

4.13 Ethical consideration.

Before data collection to conduct this study, Ethical clearance was obtained from Addis Ababa University College of Health Science for TASH and from Addis Ababa Public Health and Emergency Management Directorate for alert hospital, abet hospital and yekatit12 hospital. The aim of the study was clearly explained to the study participants and their right to refuse was maintained. Information was collected after obtaining informed consent from each participant. The personal information of study participants was kept entirely confidential. The name and address of the participant were omitted from the questioner. The data was used only for the intended purpose of the study.

4.14 Dissemination and utilization of the study

The result of the study will be submitted to the collage of health science of Addis Ababa University, Anesthesia department, Addis Ababa city health bureau, ministry of health, Ethiopian Anaesthetist Association, and other responsible bodies. Moreover, efforts will be done to publish the findings of the study and disseminated through different journals and scientific publications.

5. Result

5.1 Socio-demographic factors and behavioral characteristics of the study participants

In this study, a total of 220 elective orthopedic elderly patients who met the inclusion criteria were included, with response rate of 100%. From this. the majority were male 113(51.4%).pertaining their age most of them were between 65 and 75 years old 93(42.3%), and more than half of the study participants 129(58.3%) were illiterates, while only 62(28.6%) can only read and write without formal education. The vast majority of the study participants were non-smokers 213(96.8%).see table 1

Table 1: Socio-demographic and behavioral characteristics of the study participants at selected Addis Ababa public hospitals, Ethiopia, 2024 (n=220)

Variables	Frequency(n)	Percentage (%)
Gender		
male	113	51.4
Female	107	48.6
Age		
65-75	93	42.3
75-85	59	26.8
>85	68	30.9
BMI		
underweight	32	15.4
Normal weight	130	59.1
Overweight	45	20.5
Obese	11	5
Educational status		
uneducated	129	58.6
Can read and write	62	28.2
Elementary school	20	9.1
Secondary school	7	3.2
Collage and above	2	0.9
Cigarette smoking		
yes	7	3.2
No	213	96.8
Alcohol drinking		
yes	32	14.5
No	188	85.5

5.2 Surgery and anesthesia related factors associated with the study participants

From 220 participants, 193 (87.7) were ASAII and 27(12.3) were ASAIII. Regarding comorbidity disease, 92(41.1%) of the patients have comorbidity disease. Diabetes accounts for 35(38%), 20(21.7 %) were hypertensive, 16(17.4%) have respiratory disease, 6(6.5%) have cardiovascular disease, 5(5.4 %) have cerebrovascular disease and 10(10.9%) participants have other comorbidities from these 5(2.3%) patients have chronic kidney disease(CKD),2 (0.9%)patients have chronic liver disease (CLD),7(3.2%)patients have RVI.And 86(39.1%)patients have a history of previous hospitalization. Regarding the type of surgery and anesthesia, 70(31.8) patients underwent upper extremity surgery, 150(68.11%) underwent lower extremity surgery, 137(62.3%) patients received spinal anesthesia, 14(6.4%)received GA with facemask, 27(13.3%)of patients underwent surgery by peripheral nerve/plexus block and 42(19.1%) received GA with ET. From these 14(25%) of the patients were induced by ketamine, 26(46.4%) patients were induced by propofol, 15(26.8%) induced with ketofol and only one(1.8%)patient was induced with thiopental

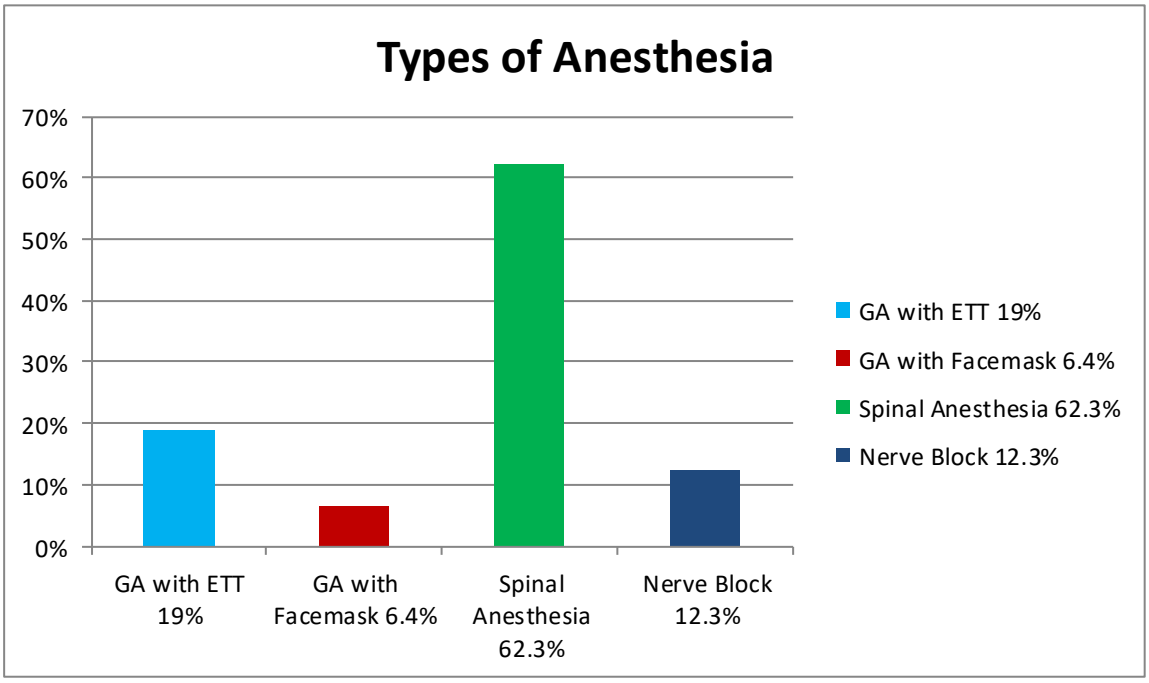


Figure 2: types of anesthesia the study participants received at selected Addis Ababa public hospitals, Ethiopia 2024(n=220)s

Table 2: surgery and anesthesia risk factors associated with the study participants at selected Addis Ababa public hospitals, Ethiopia, 2024 (n=220)

Variables	Frequency(n)	Percentage (%)
ASA physical status		
ASAII	193	87.7
ASAIII	27	12.3
Perioperative opioid use		
Yes	150	68.2
No	70	31.8
Anticholinergic use		
Yes	74	33.6
No	146	66.4
Duration of surgery		
<3hours	92	41.8
>3hours	128	58.2
Blood transfusion		
Yes	39	17.7
No	181	82.3
history of hospitalization		
Yes	86	39.9
No	134	60.1
Creatinine level		
Low	23	10.5
Normal	141	64.1
High	56	25.5
Sodium level		
low	75	34.1
normal	91	41.4
high	54	24.5
Potassium level		
low	30	13.6
normal	172	78.2
high	18	18.2
blood transfusion		
yes	39	17.7
no	181	82.3

5.3 Incidence of postoperative delirium in elective orthopedic surgical patient

From the total participants, 73 (33.7%) develop post-operative delirium, and 147 (66.3%) didn't develop postoperative delirium.

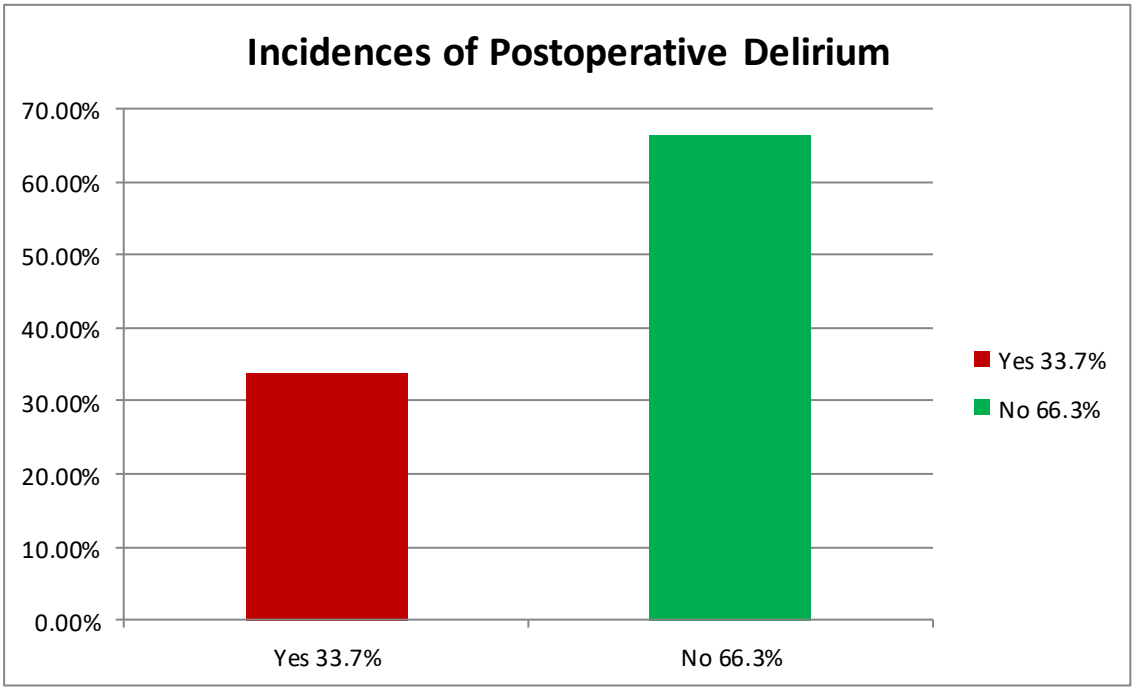


Figure 3: incidence of postoperative delirium in elderly orthopedic surgical patients at selected Addis Ababa public hospitals, Ethiopia 2024(n=220).

From the participants who developed POD, 38(52.1%) were female, 35(47.9%) were male, and 31(42.5%) had chronic comorbidity disease, Regarding opioid usage, 58(79.55%) of participants who use opioid perioperatively develops POD. and 36(49.3%) patents who used intraoperative anticholinergic had POD, 20(27.4%) patients with lower level of sodium developed POD, and (27.4%) of the patients with high level of sodium developed POD. And regarding creatinine level, 20(27.4%) developed POD with higher level of creatinin, and 10 (13.7%) patients develop POD with low level of creatinine.

Table 3A: incidence of postoperative delirium in elderly orthopedic surgical patients at selected Addis Ababa public hospitals, Ethiopia 2024(n=220)

Variables	Postoperative delirium	
	Yes	No
ASA physical status		
ASAII	63 (86.4%)	130(88.4%)
ASAII	10(13.7%)	17(11.6%)
Alcohol drinking		
Yes	13 (17.8%)	19 (12.9%)
No	60 (82.2%)	128 (87.1%)
Cigarette smoking		
Yes	4(5.5%)	3 (2%)
No	69 (94.5%)	144(98%)
Comorbidity disease		
Yes	31 (42.5%)	61 (41.5%)
No	42 (57.5)	86 (58.5%)
Age		
65-75	25 (34.2%)	68(48.6%)
75-85	16(21.9)	43(29.3%)
>85	32(43.8%)	36(24.5%)
Gender		
Male	35(47.9%)	78(53.1%)
Female	38(52.1%)	69(46.9%)
Opioid use		
Yes	58(79.55%)	92 (62.6%)
No	15 (20.5%)	55 (37.4%)
Benzodiazepine use		
Yes	18 (24.7%)	24 (16.3%)
No	55 (75.5%)	123 (83.75%)
Anticholinergic use		
Yes	36 (49.3%)	38 (25.9%)
No	37 (50.7%)	109 (74.1%)
BMI		
Underweight	12(16.7%)	21 (14.3%)
Normal weight	44 (61.1%)	86 (58.5%)
Overweight	15 (20.8%)	30 (20.4%)
Obesity	1(1.4 %)	10 (6.85%)

Table 3B: incidence of postoperative delirium in elderly orthopaedic surgical patients at selected Addis Ababa public hospitals, Ethiopia, 2024(n=220)

Variables	Postoperative delirium	
	Yes	No
Duration of surgery		
<3 hours	24 (32.9%)	68 (46.3%)
>3 hours	49 (67.1%)	79 (53.7%)
Type of anesthesia		
GA with ETT	12 (16.5%)	30(20.4%)
GA with Facemask	1(1.45%)	13 (8.8%)
Spinal anesthesia	49 (67.14%)	88 (59.9%)
Nerve block	11 (15.1%)	16 (10.9%)
Induction agent		
Ketamine	1 (7.7%)	13 (30.3%)
Propofol	6 (46.25%)	20 (46.55%)
Ketofol	6 (46.25%)	9(2.3%)
Thiopental	0 (0.0 %)	1 (2.3)
Maintenance agent		
TIVA	1(7.7%)	13 (30.2%)
Isoflurane	8 (61.5%)	23 (53.5%)
Halothane	4(30.8%)	7 (16.35%)
Blood transfusion		
Yes	23(31.5%)	16 (10.9%)
No	50 (68.5%)	131 (89.1%)
Hospitalization		
Yes	38 (52.1%)	48 (32.7%)
No	35 (47.9%)	99 (67.3%)
Potassium level		
Low	12 (16.4 %)	18(12.2%)
Normal	53 (72.6%)	119 (81%)
High	8 (11%)	10 (6.8%)
Sodium level		
Low	20 (27.4%)	55 (37.4%)
Normal	33 (45.2 %)	58 (39.5%)
High	20(27.4%)	34 (23.1%)

5.4 Associated factors of Post-operative delirium in elderly patients who underwent elective orthopedic surgery

In bivariable logistic regression age, perioperative blood transfusion, hospitalization history, cigarette smoking, preoperative sodium level, perioperative opioid use, perioperative benzodiazepine use, duration of surgery and intraoperative anticholinergic use were associated with postoperative delirium with the p value of <0.2; hence these variables were exported to multivariable analysis to determine independent associated factors for postoperative delirium and in the multivariable logistic regression analysis age, perioperative blood transfusion, previous history of hospitalization, intraoperative anticholinergic use, perioperative opioid use are strong predictors for the development of postoperative delirium: the odds ratio of developing postoperative delirium($p<0.05$); in elderly patients who had previous history of hospitalization has about 2.248 times higher odds of developing postoperative delirium than those who had no previous hospitalization history {AOR:2.248;95%CI(1.202-4.206},p=0.011)). The patients who were on opioid treatment perioperatively has about 2.2times higher odds of developing postoperative delirium than their counterparts {AOR:2.200,95%CI(1.073-4.513),p=0.031)) and regarding about anticholinergic use patients who used anticholinergic intraoperatively has 2.24 times higher odds of developing postoperative delirium than the patients who didn't use anticholinergic (AOR 2.238,95%CI(1.183-4.235), P value=0.013), patients who transfused blood has 2.83 times higher risk for developing POD than the patients who were not transfused (AOR 2.83,95CI% (1.295-6.193) and regarding patents age; patients whose age is 65-75 has 0.468 times less odds of developing postoperative delirium than patients whose age is greater than 85 years old (AOR 0.468 95%CI(0.225-0.97)p value=0.041

Table 4: list of associated factors of postoperative delirium in elderly orthopedic surgical at selected Addis Ababa public hospitals, Ethiopia 2024(n=220)

Variables	POD		COR (CI95%)	AOR (CI95%)	P value
	Yes	no			
hospitalization					
no	35(47.9%)	99(67.3%)	1	1	
yes	38(52.1%)	48(32.7%)	2.239 (1.261 -3.976)	2.248(1.202-4.206)	0.011
anticholinergic use					
no	37(50.7%)	109(74.1%)	1	1	
yes	36(49.3%)	38(25.9%)	2.791(1.549-5.029)	2.238(1.183-4.235)	0.013
opioid use					
no	15(20%)	55(37.4%)	1	1	
yes	58(79.5%)	92(62.6%)	2.312(1.196-4.467	2.2(1.073-4.513)	0.031
Age					
>85	32(43.8%)	36(24.5%)		1	

75-85	16(21.9%)	43(29.3%)	0.988 (0.414-2.06)	0.943(0.428-2.076)	
65-75	25(34.2%)	68(46.3%)	0.414(0.214-0.801)	0.468(0.226-0.97)	0.041
Blood transfusion					
No	50(68.5%)	131 (89.1%)		1	
yes	23(31.5%)	16(10.9%)	3.766(1.84-7.71)	2.83(1.295-6.193)	0.009

6. Discussion

In this study, the overall incidence of postoperative delirium among elderly orthopedic surgical patients was 33.7%, and the associated factors were increasing age, perioperative blood transfusion, history of pervious hospitalization, perioperative opioid usage, and intraoperative anticholinergic use.

The incidence of delirium in this study was comparable with a study conducted in japan, incidence of postoperative delirium was 28%(8), and similarly a study done in USA showed that the incidence of POD was (27.7%).

On the other hand, the result of this study on incidence of POD is higher than other studies; a study done in Taiwan found that the overall incidence of POD was 9.1%(11), similarly the incidence of POD was 15%(17),7.5%.(11), and 22.7%(30) in turkey, Italy, and Canada respectively

the result of this study on the incidence of delirium was lower than that of study carried out in Germany, which was (45.8%)(22).

The reason for this variation may be related to clinical setup, sample size, type of surgery, study design difference, population difference. The other reason may be due to variability of delirium assessment methods; currently there are many different diagnostic methods for delirium; the confusion assessment method (CAM),CAM for the ICU and the diagnostic and statistical manual of mental disorder are the most often used diagnostic methods in addition to this variability in the individual who asses delirium: psychiatrist, nurse, students, medical doctors, other health professionals could lead to variation in the incidence of postoperative delirium.

Many risk factors are reported for the development of postoperative delirium. Many studies found that age, depressive disorders, cognitive impairment, male sex, general anesthesia electrolyte imbalance, opioid use, benzodiazepine use, anticholinergic use blood transfusion, comorbidity disease and hospitalization are risk factors for the development of postoperative delirium.

the result of this study found that postoperative delirium incidence in patients aged greater than 85 is higher than that of 65-75 years old. This finding is in line with study done in china and German (26) 24): advanced age is strong risk factor for the incidence of postoperative deliruim.

The result of this study found that intraoperative anticholinergic usage is significant risk factor for POD. This is similar to a study done in USA (31)but a research conducted in Netherlands found that there was no association between incidence of postoperative delirium and anticholinergic usage (32)

The reason for this is associated with the type and does of anticholinergic medications, health condition of the study participants, and drug interaction

In this study, perioperative opioid usage is significantly associated with the incidence of POD. This finding is similar to study done in Boston (36),but another study conducted in Netherlands found that there was no significant association between opioid use and incidence of postoperative delirium(32).

The reason for these variations may be due the difference of sample size, study population, living condition of the study participant due to does and type of opioid, liver and renal problems and drug interactions, and medical condition of the patients.

The result of this study found that perioperative blood transfusion is significant risk factor for the development of postoperative delirium in elderly patients who underwent orthopedic surgeries. This finding is similar with study done at university of Maryland in Baltimore.(33) and other two research conducted in china found similar result (14)(34) but a study conducted in Korea found that there is no association between blood transfusion and POD (35)

The reason for this may be due to the difference in number of units transfused and the different blood components transfused.

The result of this study showed that hospitalization is significantly associated with postoperative delirium this finding is in line with a study done in Germany (24) and anather study conducted in tianjine university china (37).

7. Strength and limitation of the study

Strength: multicenter study in elderly elective orthopedic surgical patient.

Limitations: The limitation of this study was we didn't examine other associated factors that have reported in previous studies because they are not routinely done. this factors are albumin level, C- reactive protein, and total bilirubin.

8. Conclusion

The incidence of postoperative delirium among elderly elective orthopedic surgical patients was high in the study area(33.7%). Advanced age, blood transfusion, intraoperative anticholinergic usage, pervious history of hospitalization, perioperative opioid usage were the associated factors for postoperative delirium.

9. Recommendation

We recommend that special attention should be paid for elderly patients with history of hospitalization, perioperative blood transfusion advanced age, patients who use opioid and anticholinergic medications in addition to this reducing anticholinergic medication and opioid based pain treatment is important.

We also recommend the feature researchers com to do ongoing research on long term impact of postoperative delirium on elderly patients.

References

1. Maeker E, Maeker-Poquet B. Delirium in the elderly. NPG Neurol - Psychiatr - Geriatr. 2021;21(122):68–94.

2. Sun J, Zhang Q, Lin B, He M, Pang Y, Liang Q, et al. Association Between Postoperative Long-Term Heart Rate Variability and Postoperative Delirium in Elderly Patients Undergoing Orthopedic Surgery : A Prospective Cohort Study. 2021;13(May):1–10.

3. Wan M, Chase JM. RE: Delirium in older adults. B C Med J. 2017;59(6):296.

4. &NA; Delirium in Older Persons. Surv Anesthesiol. 2006;50(6):290–1.

5. Caplan G. Managing delirium in older patients. Aust Prescr. 2011;34(1):16–8.

6. Mengistu MB, Andemeske YM, Emhatsion A, Wrieta H, Gebreyesus N. Incidence and Risk Factors of Post-Operative Delirium in Elderly Patients Who Underwent Spinal Anesthesia in Orotta, Halibet and Sembel Hospitals: A Cross Sectional Study in Eritrea. J Surg Anesth Res. 2021;2021(2):1–8.

7. Farhan AB, Rehatta NM, Setiawati Y, Pudjirahardjo WJ. Risk Factor Analysis of Post-Operating Cognitive Dysfunction in Elderly Patients. Int J Innov Sci Res Technol. 2021;6(8):679–84.

8. Bai J, Liang Y, Zhang P, Liang X, He J, Wang J, et al. Association between postoperative delirium and mortality in elderly patients undergoing hip fractures surgery : a meta-analysis. 2020;317–26.

9. Koskderelioglu A, Onder O, Gucuyener M, Altay T, Kayali C. Screening for postoperative delirium in patients with acute hip fracture : Assessment of predictive factors. 2017;919–24.

10. Kinchin I, Mitchell E, Agar M, Trépel D. The economic cost of delirium : A systematic review and quality assessment. 2021;(November 2020):1026–41.

11. Liang C kuang, Chu C liang, Chou M yueh, Lin Y te, Lu T, Hsu C jen, et al. Interrelationship of Postoperative Delirium and Cognitive Impairment and Their Impact on the Functional Status in Older Patients Undergoing Orthopaedic Surgery : A Prospective Cohort Study. 2014;9(11):5–12.

12. Wang LH, Xu DJ, Wei XJ, Chang HT, Xu GH. Electrolyte disorders and aging: Risk factors for delirium in patients undergoing orthopedic surgeries. BMC Psychiatry. 2016;16(1):1–7.

13. Guo Y, Jia P, Zhang J, Wang X, Jiang H, Jiang W. Prevalence and risk factors of postoperative delirium in elderly hip fracture patients. J Int Med Res. 2016;44(2):317–27.

14. Scholz AFM, Oldroyd C, Mccarthy K, Quinn T, Hewitt J. Systematic review and meta-analysis of risk factors for postoperative delirium among older patients undergoing.

15. Hirsch J, DePalma G, Tsai TT, Sands LP, Leung JM. Impact of intraoperative hypotension and blood pressure fluctuations on early postoperative delirium after non-cardiac surgery. Br J Anaesth. 2015;115(3):418–26.

16. Elsamadicy AA, Adogwa O, Lydon E, Sergesketter A, Kaakati R, Mehta AI, et al. spine surgery. 2017;27(August):209–14.

17. Ozbas A, Ak ES, Cavdar I, Findik UY, Kutlu FY, Akyuz N. Determining the incidence of postoperative delirium in elderly patients who undergo orthopaedic surgical interventions in Turkey. J Pak Med Assoc. 2018;68(6):867–71.

18. Flink BJ, Rivelli SK, Cox EA, White WD, Falcone G, Vail TP, et al. Obstructive sleep apnea and incidence of postoperative delirium after elective knee replacement in the nondemented elderly. Anesthesiology. 2012;116(4):788–96.

19. Ravi B, Pincus D, Choi S, Jenkinson R, Wasserstein DN, Redelmeier DA. Association of Duration of Surgery With Postoperative Delirium Among Patients Receiving Hip Fracture Repair. JAMA Netw open. 2019;2(2):e190111.

20. Sica R, Wilson JM, Kim EJ, Culley DJ, Meints SM, Schreiber KL, et al. The Relationship of Postoperative Pain and Opioid Consumption to Postoperative Delirium After Spine Surgery The Relationship of Postoperative Pain and Opioid Consumption to Postoperative Delirium After Spine Surgery. 2023;

21. Li T, Li J, Yuan L, Wu J, Jiang C, Daniels J, et al. Effect of Regional vs General Anesthesia on Incidence of Postoperative Delirium in Older Patients Undergoing Hip Fracture Surgery: The RAGA Randomized Trial. Jama. 2022;327(1):50–8.

22. Balzer-geldsetzer M, Buecking B, Ruchholtz S, Kis B, Dodel R. Longitudinal Study on Functional and Cognitive Outcomes in Patients with Postoperative Delirium after Femoral Fracture. 2019;

23. Kimura A, Shiraishi Y, Sawamura H, Sugawara R, Inoue H, Takeshita K. Predictors of Postoperative Delirium in Older Patients Undergoing Elective Spine Surgery. Spine Surg Relat Res. 2023;7(1):13–8.

24. Ren A, Zhang N, Zhu H, Zhou K, Cao Y, Liu J. Clinical Interventions in Aging Effects of Preoperative Anxiety on Postoperative Delirium in Elderly Patients Undergoing Elective Orthopedic Surgery : A Prospective Observational Effects of Preoperative Anxiety on Postoperative Delirium in Elderly Patient. 2022;

25. Li T, Dong T, Cui Y, Meng X, Dai Z. Effect of regional anesthesia on the postoperative delirium: A systematic review and meta-analysis of randomized controlled trials. Front Surg. 2022;9(July):1–14.

26. Guo Y, Jia P, Zhang J, Wang X, Jiang H, Jiang W. Prevalence and risk factors of postoperative delirium in elderly hip fracture patients. 2016;

27. Boozer AL. Old age and aging. Encycl Anc Hist. 2019;(October):1–2.

28. Curtis R, Dyck V, Capezuti E, Fulmer TT. The Confusion Assessment Method (CAM) The Confusion Assessment Method Instrument : 2012;59(13).

29. Tariq A, Carmen M, Laura EQ, Thuan SP, Safdar VL. Incidence , risk factors and clinical impact of postoperative delirium following open reduction and internal fixation (ORIF) for hip fractures : an analysis of 7859 patients from the ACS - NSQIP hip fracture procedure targeted database. Eur J Orthop Surg Traumatol. 2019;29(2):435–46.

30. Saravana-Bawan B, Warkentin LM, Rucker D, Carr F, Churchill TA, Khadaroo RG. Incidence and predictors of postoperative delirium in the older acute care surgery population: A prospective study. Can J Surg. 2019;62(1):33–8.

31. Fox C, Smith T, Maidment I, Chan WY, Bua N, Myint PK, et al. Effect of medications with anti-cholinergic properties on cognitive function, delirium, physical function and mortality: A systematic review. Age Ageing. 2014;43(5):604–15.

32. Slor CJ, Jonghe ÃJFM De, Vreeswijk ÃR, Groot E, Ploeg TVD, Gool WA Van, et al. Undergoing Hip Surgery. 2011;1313–9.

33. Raphael J, Hensley NB, Chow J, Parr KG, Mcneil JS, Porter SB, et al. Red Blood Cell Transfusion and Postoperative Delirium in Hip Fracture Surgery Patients : A Retrospective Observational Cohort Study. 2021;2021.

34. Liu Y mei, Huang H, Gao J, Zhou J, Chu H chen. Hemoglobin Concentration and Post-Operative Delirium in Elderly Patients Undergoing Femoral Neck Fracture Surgery. 2022;8(January):1–8.

35. Kwon Y suk, Kim J ho, Lee J jun, Seo E min. The Relationship between Perioperative Blood Transfusion and Postoperative Delirium in Patients Undergoing Spinal Fusion Surgery : Clinical Data Warehouse Analysis. 2022;1–15.

36. Sica R, Wilson JM, Kim EJ, Culley DJ, Meints SM, Schreiber KL. The Relationship of Postoperative Pain and Opioid Consumption to Postoperative Delirium After Spine Surgery. J Pain Res. 2023;16:287–94.

37. Wang C guang, Qin Y fei, Wan X, Song L cheng, Li Z jun, Li H. Incidence and risk factors of postoperative delirium in the elderly patients with hip fracture. 2018;1–7.

10. ANNEXE

10.1 Annex 1: INFORMATION SHEET.

Name of Principal Investigators: Yegle Asrat

Name of the Organization: Addis Ababa University, College of Medicine and health science. Department of Anesthesia.

Greetings Hello, my name is Yegle Asrat is a final year post graduate anesthesia student from Addis Ababa University. I am currently conducting a study on incidence and associated factors of Postoperative delirium among elderly Patients who are undergoing orthopedic surgery and who are selected for surgery in Abet hospital, Tikur Anbesa specialized hospital yekatit 12 hospital, and Alert hospital Addis Ababa Ethiopia.

Benefit of the Research Project: It mainly used to facilitate optimization for other patients and you may not benefit directly from this study. But it is important to study this first scientific research in our hospitals and in our country Because I strongly believe that the results of the study can be used as an input to reduce incidence of postoperative delirium by identifying the underlying problems and identifying the determinant factors.

Protecting participant's confidentiality: During data collection the patients name will not be taken, instead they will be identified by their card number or by code in the chart. All questionaries' collected will be kept confidential the information collected will be used only for research purpose.

Right not to participate in the study: If you do not want to participate in this research study or you do not feel comfortable, you can stop at any time and in any situation or answer some questions. I want to assure you that your refusal to participate will not affect your medical care or your health.

Person to contact: If you have any further questions or would like to receive further information about the project, please contact:

1.Yegle Asrat (Principal investigator):+251-963925715

2. Mr Silesh Abiy (B.Sc. M.Sc.) (Advisor)
3. Mr Ashenafi Seifu (B.Sc. M.Sc.) (Advisor)

10.2 Annex II. Informed consent

Data collector will read this paragraph to the selected participant I have been informed briefly and, I understand well about the objective of the study. Since it has no any impact in my stay and even I understand that I am free to withdraw at any time. So, I here to approve my informed consent with my signature to take part in the study_____

Signature of participant _____ Date _____

Name of data collector _____date _____

10.3 Annex III. English version Research questionnaires **Part 1 socio-demographic characteristics of the participant**

S NO	Questions	Response	Code
1	Age in year	_____	
2	Gender	1. Male 2. Female	
3	Weight in kg	_____	
4	Height	_____	
5	BMI in kg/m2	_____	
6	Marital status	1.Single 2.maried 3.divorced	
7	Educational level	1, Uneducated 2.Can write and read 3.Elementary school 4.Secondary school 5.Collage and above	

Part 2. Behavioral characteristics of the participants

SNO	Question	Response	Code
8	Do you smoke cigarette	1. Yes 2. No	
10	Do you drink alcohol	1. Yes 2. No	
11	Do you have comorbidity disease	1.yes 2.no	

Part 3. Questions related to surgery and anesthesia

SNO	Questions	Response	Code
14	ASA Physical status	1,II 2.III	
15	Which comorbidity disease do you	1.Diabeties	

	have	2.Hypertension 3.Respiratory disease 4.Cardiovascular disease 5.Muscoloskeletal disease 6.Cerebrovascular disease 7,Autoimmue disease 8.others specify	
20	Preoperative creatinine level	_____	
21	Preoperative potassium level	_____	
22	Preoperative sodium level	_____	
23	Preoperative chloride level	_____	
25	Does the patient use benzodiazepine perioperatively	1. Yes 2. No	
27	Does the patient use opioids Perioperatively	1. Yes 2.No	
28	Type of surgery performed	1, upper extremity 2, lower extremity	
30	Does the patient has Pervious Hospitalization	1.Yes 2.No	
33	Type of anaesthesia	1.GA/ETT 2.GA/LMA 3.GA with facemask 4.SA 5.Peripheral Nerve block 6,other	
34	Induction agent	1.Ketamine 2.Propofol 3.Ketofol 4.Thiopental 5.Others	
35	Maintenance agent	1.Halothane 5.others 2.Isoflurane 3.TIVA	

		4.sevofluran	
36	Intraoperative anticholinergic use	1. Yes 2.No	
38	Duration of surgery	1.< 3hours 2.>3 hours	
40	Blood transfusion	1. Yes 2.No	

Part 4. Postoperative delirium assessment by CAM (confusion assessment method)

S.N	Questions	Responses						
		Day1		Day2		Day3		
		Yes	No	Yes	No	YeS	No	
1	**Feature 1: Acute onset and fluctuating course** Is there any acute mental change from the patient's baseline?							
2	**Feature 2: Inattention** Did the patient have difficulty focusing attention, keeping track of what was being said?							
3	**Feature 3: Disorganized thinking** Was the patients thinking disorganized or Incoherent (rambling conversation, unclear or illogical flow of ideas)?							
4	**Feature 4: Altered level of consciousness** Would you rate this patient's level of consciousness as alert(normal), vigilant(hyper alert),lethargy(drowsy, Easily aroused), stupor (difficulty to arouse), orcoma (unarousable)?							
	Presences of delirium(positive diagnosis)	**1, Yes** **2, No**						