



ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCE
DEPARTMENT OF ANESTHESIA

Prevalence of preoperative anemia and associated factors among major elective orthopedics surgery at selected governmental hospitals, Addis Ababa, Ethiopia, from February 1 to April 30, 2021

Investigator: Dawud Ahmed (BSC, MSC student in anesthesia)

Advisor 1. Leulayehu Akalu (assistance professor in anesthesia)

2. Meron Abrar (BSC, MSC in anesthesia)

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Name of investigator	Dawud Ahmed Tareke
The full title of the research project	Prevalence of preoperative anemia and associated factors among major elective orthopedics surgery at selected governmental hospitals, Addis Ababa, Ethiopia, from February 1 to April 30, 2021
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Study period	From February 1 to April 30, 2021
Address of investigator	Cell phone: +251922901239
	Email: Dawudahmed5274@gmail.com
Name of Advisor(s)	<ol style="list-style-type: none"> 1. Leulayehu Akalu (assistance professor in anesthesia) 2. Meron Abrar (BSC, MSC in anesthesia)
Source(s) of Funding	Addis Ababa University

Declaration

I, the undersigned, declare that this thesis is my original paper in partial fulfillment of the requirements for the Master in Anesthesia. I understand that plagiarism will not be accepted and all directly quoted material has been appropriately referenced

Name: Dawud Ahmed_____

Signature; _____

Submitted to; Department of Anesthesia, Addis Ababa University.

Date of Submission: _____

This thesis result has been submitted for examination with my/our approval as Advisors and on the Master Science in Anesthesia

Name Signature

Advisor

1. _____

2. _____

Examiner

1. _____

2. _____

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Abstract

Background: Preoperative anemia is a common hematologic problem in major orthopedic surgery. More than one-third of orthopedics patients were anemic preoperatively. Preoperative investigation and treatment of anemia are recommended before orthopedic surgery. Pre-operative anemia alone is an independent risk factor for perioperative complications, prolonged hospital stays, infection and increased mortality rate.

Objective: To assess the Prevalence of preoperative anemia and determine associated factors among adult major elective orthopedics patients at selected governmental hospitals, Addis Ababa, Ethiopia. From February 1, to April 30, 2021

Method A cross-sectional survey was conducted in selected governmental hospitals, Addis Ababa, Ethiopia from February 1, to April 30, 2021. A total sample of 242 patients scheduled for major elective orthopedics was included in the data collection. A systematic random sampling technique was used. Bi-variable and multivariable logistic analyses were done to determine whether each of the independent factors is associated or not with the outcome variables. Only variable with a p-value < 0.2 during the bi-variable analysis were entered into the multivariable analysis. The strength of the association was present by the odds ratio and 95% Confidence interval.

Result: Preoperative anemia was found in 37.6% of the patients. ASA Class 2 were [AOR: 2.5, 95 % CI: (1.28, 4.89)], malignancy [AOR: 4.37, 95% CI: (1.58,12.1)], history of trauma [AOR: 3.54, 95 % CI: (1.69, 9.7)], and history of previous surgery [AOR: 4.37, 95% (CI: 1.58,12.1)] were significantly associated with preoperative anemia major elective orthopedics surgery.

Conclusion and recommendation: More than one-third of elective orthopedics patients were anemic before surgery. ASA class, malignancy, trauma, and surgical history were significantly associated with preoperative anemia. So, we recommend for major elective orthopedic surgery patients, early diagnosis and treatment of preoperative anemia were indicated.

Keywords: Elective, preoperative anemia,

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Acronyms and abbreviations

ART.....	Antiretroviral therapy
ASA	American society of anesthesiologist
BMI	Body mass index
HAART	Highly Active Anti-retroviral therapy
Hb.....	Hemoglobin
HIV.....	Human immunodeficiency virus
NSAID	Non-steroidal anti-inflammatory drugs
OR.....	Odds ratio
UK.....	United Kingdom
USA.....	United States of America
WBC.....	White blood cell
WHO.....	World health organization
VTE.....	venous thromboembolism
RBC.....	Red blood cells
AAU.....	Addis Ababa University
TASH.....	Tikur Anbessa specialized hospital

1. INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Anemia is a condition that occurs when the number of red blood cells(RBC) is not sufficient to meet the body's physiologic needs (1). Definition World Health Organization (WHO) of Anemia is reduction of a hemoglobin (Hb) level below 12 g/dL (hematocrit <36%) for non-pregnant women and 13.0 g/dL (hematocrit <39%) for men. WHO also classifies anemia based on the severity of mild, moderate, and severe. Hb level less than 8g/dl is severe anemia, Hb level between 8–10.9 g/dL are moderate anemia for both male and female, and Hb between 11–11.9 g/dL mild anemia in women, and Hb between 11–12.9 g/dL mild anemia in men in the age of 15 years and above(1).

Anemia is a reduction in the red blood cells and could be classified based on the decrease production, destruction, or loss of RBC mass, and also Based on RBC morphology, anemia can be classified as microcytic (mean corpuscular volume, MCV <80 fL), macrocytic (MCV >100 fL), and normocytic anemia (MCV 80-100 fL)(1–3). Hemoglobin is important to carry oxygen and if they have very low or abnormal RBC, or decrease hemoglobin concentration, there will be a reduced capacity of the blood to carry oxygen to the body's tissue (1).

Anemia is a major global public health problem, affecting about one-third of the general population around the world(3,4). WHO data shows that the estimation of prevalence anemia is 43% population in developing, and 29% in developed countries(5). The national prevalence of anemia in the 2016 Ethiopia Demographic and Health Survey (DHS) study shows that 23% and 18% in adult male and female respectively that is higher in a rural area(6).

Iron deficiency is the most common cause of anemia worldwide, but other nutritional deficiencies (including folate, vitamin B12, and vitamin A), acute and chronic inflammation, parasitic infections, and inherited or acquired disorders that affect hemoglobin synthesis, red blood cell production, or red blood cell survival, can cause anemia(1,3).

Anemia is the most common preoperative hematologic diagnosis, and the reduced oxygen-carrying capacity of the blood plays a critical role in causing perioperative morbidity and mortality

Preoperative anemia is common among non-cardiac surgical patients, including orthopedic surgery. It is independently and strongly linked to an extended stay in the hospital, resulting in the utilization of more healthcare resources. It is also the most important predictor of allogeneic blood transfusions during surgery(7).

Pre-operative anemia increases the risk for postoperative complications such as myocardial infarction, ischemic stroke, acute kidney injury, or even death (8,9). Anemia is associated with increased mortality, increase venous thromboembolism(VTE) risk, and higher re-admission rate, in patients with hip fracture(10).

1.2 Statement of the problem

Prevalence of preoperative anemia orthopedics surgery range from 7 to 35%(11). The prevalence of anemia among people in developing countries is high because of low socioeconomic status and poor health facilities(5). Pre-operative anemia prevalence varies by age, gender, comorbidities, surgical indication, lifestyle, and socioeconomic level, as well as the criteria used to define anemia(12,13). Anemia was found in just around only 12% of elective patients who were treated preoperatively(12).

In orthopedics surgery, preoperative anemia is a common hematologic condition and an independent risk factor for perioperative morbidity and mortality. When compared to patients who are not anemic, anemia increases the chance of death from respiratory (respiratory failure and hypoxia), cardiac (myocardial infarction, congestive heart failure, and cardiac arrest), septic, multi-organ failure and hemorrhagic(14).

Different research was looked into the impact of preoperative anemia on perioperative morbidity and mortality. There is an association between preoperative anemia and negative outcomes in elective surgical patients, including an increased risk of oxygen depletion (lower blood oxygen-carrying capacity), allogeneic blood transfusion, length of hospital stay, intensive care admissions, surgical site infections, readmission to hospital, use of healthcare resource, and more complicated surgery course of hospital treatment (15–21).

Pre-operative anemia is a common illness that is sometimes dismissed as nothing more than a surrogate measure of the severity of the pathology requiring surgical intervention; many clinicians do not believe it increases patient risk, and it is not always effectively treated before surgery(18). Preoperative anemia is related to a higher risk of morbidity and mortality in surgical patients, hence it should be explored, diagnosed, and treated before undergoing elective surgery(12). Preoperatively treating patients with iron reserves is likely to reduce the number of anemia cases and blood transfusion complications(20,22).

The treatment of preoperative anemia in orthopedic patients is not a top priority for most surgeons(23). Anemia is a treatable and preventable disorder that may often be treated without the use of blood transfusions and with fewer side effects. Preoperative anemia therapy is an excellent technique for lowering the overall cost of treatment for surgical patients, in addition to ensuring optimal outcomes for orthopedic patients(24).

The major goal of early detection is to give time for preoperative measures to increase hemoglobin concentration and improve patient health conditions to avoid hazards. These studies are not studied out in Ethiopia.

The goal of our study was to determine the prevalence of preoperative anemia and its associated factors in major elective orthopedic patients. It may be beneficial for physicians and anesthetists to demonstrate different causes and comorbidity associated with anemia to reduce transfusion risk, get further knowledge or optimize clinical management, and improve anesthesia and surgery quality. It's also crucial for researchers to establish a framework for future research.

1.3 Significance of Study

In patients undergoing elective surgery, such as orthopedics surgery, anemia is a common hematologic issue (15,18). In Ethiopia, various studies on anemia have been conducted, but not has been done to determine the prevalence and associated factors that affect preoperative anemia.

Preoperative anemia is one of the risk factor for increased perioperative morbidity and mortality in major elective orthopedic surgery patients. Allogenic blood transfusions, length of hospital stay, surgical site infections, greater healthcare resource utilization, and a more complicated hospital treatment course are all factors to consider. If the patient is not properly examined and optimized before surgery, pre-operative anemia results in a shortage of human resources and financial waste(11,16).

A first step towards effectively implementing a pre-operative anemia management protocol is knowledge of the prevalence and related factors anemia, which this study aimed to address. The findings of the study, in general, may aid our practice in a variety of ways, including optimizing anemia and related factors, avoiding surgery cancellation on the day of surgery, determining whether a patient requires a constellation for further investigation, adjusting or modifying intraoperative anesthesia, and surgical management, and requiring patients to be closely monitored postoperatively.

Knowing which patients are at a higher risk of postoperative problems due to anemia is beneficial because physician and anesthetist may focus their efforts more effectively on these individuals. Also, hopefully, this research will serve as a beginning point for future research as well as a baseline for future studies on similar issues and in adjacent fields.

LITERATURE REVIEW

2.1. Prevalence of preoperative Anemia

An observational multicenter study was done Between November 2010 and March 2011, on One thousand five hundred and thirty-four patients undergoing major elective orthopedics surgery at 17 institutions in six European countries. Anemia was found in 14.1% of patients before surgery. There was no preoperative Hemoglobin level less than 8 g/dl, or no severe anemia in any of the patients(11).

All major elective orthopedics surgery performed between 2016 and 2018 were included in the Sweden retrospective observational Study on Clinical and Budget Impact of Treating Preoperative Anemia. which comprised a total of 881 procedures. Preoperative anemia was found to be prevalent in 21.5 percent of patients (25).

Between January 2000 and June 2013, comprehensive case-control research in a single institution in the United States examined the connection between preoperative anemia and adverse outcomes following total joint arthroplasty (TJA). It found preoperative anemia in 19% of the patients(26).

A retrospective analysis of consecutive individuals from a long-term follow-up study of 3,050 participants who had hip, knee, or spine surgery between November 1, 2008, and December 31, 2009. Anemia was found in 17.6% of the patients before surgery(27).

An analysis of 330 orthopedic surgeons in the United States and over 9000 patients undergoing elective orthopedics surgery showed that up to 35% of these patients were anemic before surgery(24).

2.2 Factors associated

2.2.1. Socio-demographic factors

According to certain research, sex is strongly linked to preoperative anemia in elective surgery patients. In Ghana(7), China(28), and The United States(29) female patients had a higher chance of being anemic than male. In other studies, conducted in Australia (8,30)and the Harare region

(31), male patients were considerably more likely to be anemic than females. Gender did not differ in orthopedics anemia in a Swedish study (32). A comparative cross-sectional study was done using secondary data of Gilgel Gibe Field Research Center, Anemia was higher in rural residents 46.6% than urban residents 20.1%(33).

Biological, environmental and social factors like age, urban/rural, educational status, occupation, body mass index(BMI), marital status, and income associated with anemia as studies show in Switzerland(34), India (35), Ghana (7), Malawi (36), Debretabor (37). Preoperative anemia prevalence increase as the age increases according to the study in the USA (38), Spain(39), and China (28). Primary education, more likely to develop anemia than those who had secondary and above the educational level in Gonder (40) at the national Ethiopia level (33).

One research done at the University of Gondar Hospital among HIV/AIDS patients taking ART shows that anemia is less common in married and single groups than divorced and widowed groups (40).

2.2.2 Clinical characteristics and Comorbidities

According to a study conducted in India, anemia affects 40–64 percent of cancer patients (41). Anemia is found in 23 percent of newly diagnosed cancer patients at Black Lion Hospital(32). Study in Australia and USA study shows that malignancy is highly related to anemia(3,42).

Patients with a history of hypertension, renal failure, smoking, or HIV were shown to have a higher risk of preoperative anemia in a South African study of non-cardiac surgical patients(4). A study conducted at a University of Gondar Hospital among HIV/AIDS patients taking ART shows that anemia is more common in divorced and widowed groups than married and single groups (40).

Peptic ulcer disease was significantly associated with anemia, according to a cross-sectional study conducted in Butajira Hospital (43) Research conducted in Dessie referral hospital indicated that the prevalence of anemia among diabetic patients was 26.7%(36), and in the Harare, region revealed that the prevalence of anemia in diabetic patients was 34.8%(31). Renal disease was also highly related to preoperative anemia in South Africa study(44).

Two studies conducted in Ghana (7) and Debre tabor hospital(37) show that patients who have a malaria history highly related to Anemia. A study was carried in Korea indicated that patients with a history of asthma were positively associated with anemia(45). The research was conducted in Singapore(46) and South Africa (4,44)shows ASA status is highly associated with preoperative anemia.

2.2.3 Medication-related factors

Certain classes of drugs have been related to the prevalence of anemia and these include glucocorticoids and non-steroidal anti-inflammatory drugs (NSAD)(47). Another study in South Africa shows 7.2% of patients develop anemia in non-steroidal anti-inflammatory (NSAD) drug users (4).

A cross-sectional study was done in Debre tabor hospital HIV (retroviral) positive patients shows anemia is more prevalent in anti-retroviral treatment regimen users(37). A Los Angeles study shows that the Incidence of anemia in patients diagnosed with solid tumors receiving chemotherapy is 89.5% (48).

2.2.4. Previous history of trauma and surgery

A study conducted in Spain indicated that trauma patients receiving fracture repair surgery had a higher prevalence of preoperative anemia (15). As indicated in Switzerland (11) and Singapore (46), anemia is strongly linked to patients who have had previous surgery.

2.3. Conceptual framework

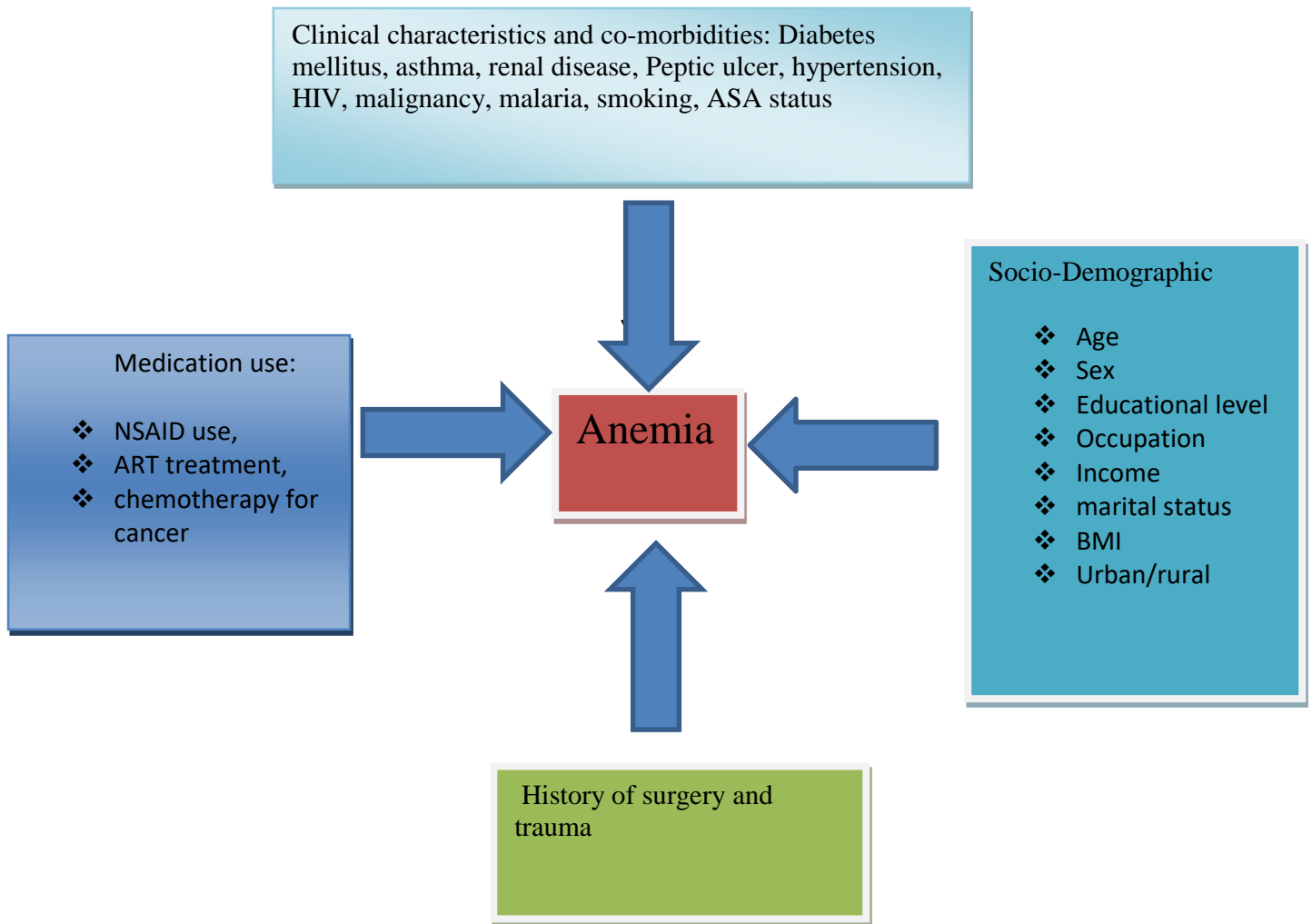


Figure 1: Conceptual framework of factors associated with preoperative anemia for patients who schedule for major elective orthopedic surgery at selected governmental hospitals from February 1 to April 30, 2021.

3. Objective

3.1 General Objective

To assess the Prevalence of preoperative anemia and determine associated factors among major elective orthopedics patients at selected governmental hospital Addis Ababa, Ethiopia. From February 1 to April 30, 2021

3.2 Specific Objectives

1. To assess the prevalence of preoperative anemia in major elective orthopedics patients
2. To determine associated factors of preoperative anemia in major elective orthopedics patients

4. METHOD AND MATERIALS

4.1. Study Area

The research was carried out at selected government hospitals in Ethiopia's capital city, Addis Ababa (TASH, Alert hospital, Abet hospital, and Minillik II hospital). Addis Ababa, Ethiopia's capital city, has long been referred to as the "capital of Africa" because it is also the seat of the African Union. It is situated at an elevation of 7,726 feet (2,355 meters) above sea level. It is the world's third-largest capital city. There are 12 government hospitals in the city. The study was conducted from February 1 to April 30, 2021, in these four hospitals.

4.2. Study design and period

The Multicenter, cross-sectional study design was used.

4.3. Population

4.3.1. Source population

All adult major elective orthopedics surgical patients at Addis Ababa governmental hospital.

4.3.2. Study population

All adult patients were scheduled for major elective orthopedic surgery at the selected governmental hospitals (TASH, Alert Referral hospital, Abet Referral hospital, and Minillik II Referral hospital) during the study period.

4.4. Inclusion and Exclusion criteria

4.4.1 Inclusion

All patients 15 years and above who undergo major orthopedics surgery were included.

4.4.2 Exclusion criteria

No hemoglobin results, Patient refusal, Psychiatric patients, and Patient on treatments of anemia was excluded from the study.

4.5. Study variables

4.5.1. Dependent variable

Preoperative anemia of major elective orthopedic surgery

4.5.2. Independent variables

Socio-demographic variables: age, sex, weight, height, educational status, occupation, marital status, residence (rural or urban).

Clinical characteristics and comorbidities: Peptic ulcer, hypertension, HIV, malaria, diabetes mellitus, malignancy, asthma, renal failure, ASA status.

Medications used: NSAID use, ART regimen, chemotherapy drugs...

Previous history surgery.

Trauma/injury

4.6 Sample size determination

In the study area or at the national level, there is no documented information on the prevalence of preoperative anemia in orthopedics surgery and its associated factors. Using the finite population correction formula, the sample size was estimated by assuming a 0.5 prevalence of preoperative anemia in major orthopedics surgery and a 5% margin of error at a 95% confidence interval using the following calculations

$$n = \frac{z_{\alpha/2}^2 p(1-p)}{w^2}$$

Where; n = sample size, z= 1.96, p= 0.5, CI= 95% & α = 5%

w= margin of error =0.05

$n = (1.96)^2 \times 0.5 (1- 0.5) / (0.05)^2 = 384$

$nf = n / (1+n/N)$, N =514.... correction formula for population less than 10,000.

So, $nf = 384 / (1+384/516) = 220$

We added 10% of nf for the non-response rate; (i.e., $220+22=242$); As a result, a total of 242 adult major elective orthopedic surgery patients were included in this research.

4.7 Sampling techniques

The study areas were selected from all governmental city hospitals purposely. We had chosen the first four hospitals to depend on large number of major orthopedic surgery flow. After the situational analysis was done for the last three months each hospital, elective orthopedic surgeries are done in Tikur Anbessa specialized hospital, 159 cases in Abte hospital, 196 cases, in Minillik hospital, 69 cases, and in Alert Hospital, 91 cases per three months were undergone elective surgery on average.

Finally, proportional sample size was assigned to each hospital based on their average three-month report. During the study period, a systematic sampling technique was used to obtain the required sample size. The second case was chosen by lottery, and every k^{th} patient was chosen for the study period.

$$k = N/n, \text{ where } n = \text{total sample size} = 514$$

$N =$ population the last three months 242, sample interval $= 514/242 = 2$

The second study participant was selected using the lottery method from the major elective orthopedics scheduled.

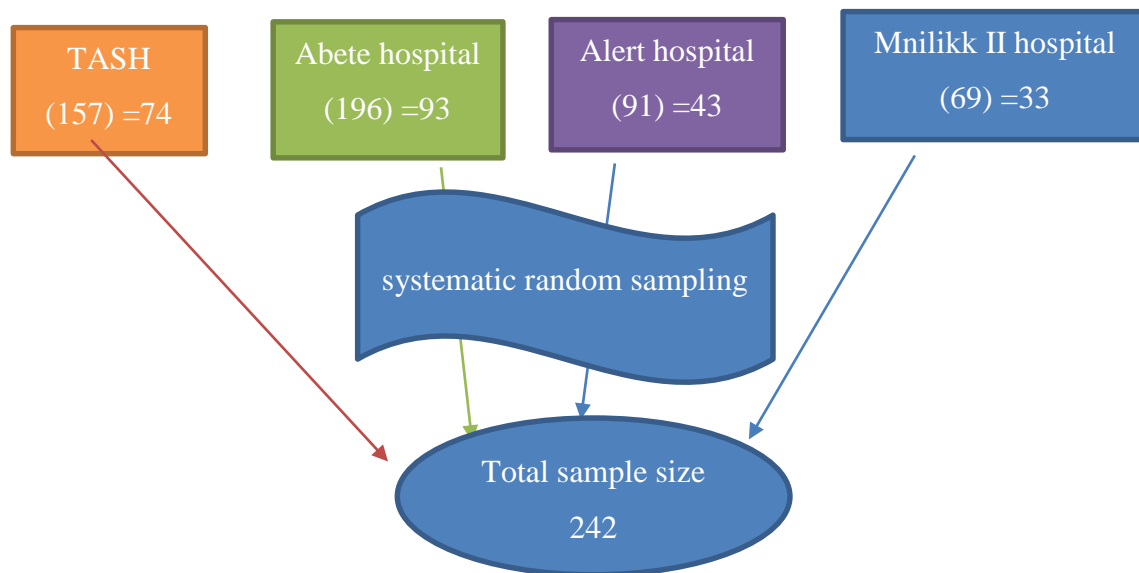


Figure 2. Total and sample population distribution in four hospitals

4.8. Data collection tools and procedure

Data were collected from patients him/her/self or caregivers by using a structured checklist and English language from February 1 to April 30, 2021. Hemoglobin measurements were obtained from the patient's medical records by reviewing charts. Four anesthetists were involved as data collectors after took training on how to collect records and fill on the format prepared.

The questionnaire was designed to obtain available information on socio-demographic characteristics (age, sex, marital status, employment, educational status, etc.), Clinical co-morbidities (hypertension, diabetic Mellitus, heart failure, etc.), medication-related factors, hematologic measurements, and previous surgery.

4.9. Data Quality assurance

To assess whether the checklist items are easily understood by the data collector, the checklist was pre-tested by a random selection of 5% of the charts of elective adult major elective orthopedic surgery patients. The Pretest was conducted in Yekatit Hospital. Before the main study, the checklist was extensively modified and updated.

Data collectors were trained on each of the items included in the study tool, the purpose of the study, the objective, the confidentiality of the information obtained, and inclusion and exclusion criteria. Throughout the survey, the principal investigator was closely monitored on the data collectors. The collected data were checked for completeness, accuracy, and clarity.

4.10. Data Processing and Analysis

First, the data were checked and entered into SPSS version 26. Descriptive statistics were done using statistical measurements. The findings were reported using frequency, percentages, averages, standard deviations, ultimately tables and graphs. The Hosmer-Lemeshow goodness of test for the model was checked. A bi-variable analysis was used to check which variables were associated with anemia.

Any variables that were significant at $P < 0.2$ in the bi-variable analysis were candidates for inclusion in the multivariable analysis to control for potential confounder effects. Finally, the variables that had a significant association with the outcome variable were identified using OR, 95 percent CI, p-values less than 0.05.

4.11. Operational definitions

Anemia is reduction of a hemoglobin (Hb) level below 12 g/dL (hematocrit $< 36\%$) for non-pregnant women and 13.0 g/dL (hematocrit $< 39\%$) for men(1).

Mild anemia is Hb between 11–11.9 g/dL in females and Hb between 11–12.9 g/dL(1).

Moderate and severe anemia Hb levels less than 8g/dl is severe anemia and Hb level between 8–10.9 g/dL is moderate anemia for both males and females(1).

Adult patient: - age of patient 15 years and above years for both genders(7).

Elective surgery: - is surgery that is scheduled in advance because it does not involve a medical emergency

Orthopedics surgery: - is a type of surgery in which a medical professional, such as an orthopedist or orthopedic surgeon, performs surgery on the bones, joints, and ligaments of the human body to correct disorders.

Preoperative Hb The most recent Hb assessed within 28 days before surgery was considered(26).

4.13. Ethical consideration

Ethical clearance was obtained from Addis Ababa University (AAU) of the ethical Review Board. The department of anesthesia was provided approval and a letter of collaboration for the Tikur Anbessa Specialized Hospital, Alert, Abet, and Minillik Referral hospital. After complete explanations of the study's goals and methods, all selected patients gave verbal informed consent. The study team classified and created participant records; as a result, participant records and the privacy of the health facility were kept private.

4.14. Dissemination and Utilization of the results

The findings/results of the study will be submitted as a thesis to the AAU College of Health Sciences' Department of Anesthesia as part of a Master's Degree requirement in Advanced Clinical Anesthesia. Following submission, the outcome will be publicly defended. Copies of the report will distribute to appropriate departments and stakeholders. Efforts were made to present the findings at scientific conferences, and they will be submitted for publication in journals.

5. Result

5.1 Socio-demographic characteristics

A total of 242 elective major orthopedic patients were included in the study with a 100% response rate. From these 160 (66.9%) of them being male. The mean age of the patients was 38.7 years, with a standard deviation of ± 16.2 . More than two-thirds of the participants 176(76%) were between the ages of 15 and 49. The majority of the individuals 201(83.1%) had a normal weight or a BMI of 18.5 to 24.9 kg/m². More than half of the participants were married 129 (53.3%) and lived in the urban 136 (52.6%). Moreover, 21% of the respondents were business owners, whereas 57% of the participants were low-income.

Table 1: Table 1 Socio-Demographic Characteristics of study participants among major elective orthopedics surgery at the selected governmental hospital, Addis Ababa, Ethiopia from February 1 to April 30, 2021

Variables	Categories	Frequency (n)	Percent(%)
Sex	Male	160	66.1%
	Female	82	33.9%
Age in year	15-49	184	76.3%
	50-65	39	16.1%
	Above 65	19	7.9%
BMI	<18.5	17	7.0%
	18.5-24.9	201	83.1%
	25-29.9	22	9.1%
	>30	2	0.8%
Marital status	Single	63	26.0%
	Married	136	56.2%
	Divorced	28	11.6%
	Widowed	15	6.2%
Residence	Urban	129	53.3%
	Rural	113	46.7%
Educational level	No formal schooling	24	9.9%
	From grade 1-8 grade	49	20.2%
	From grade 9-12 grade	108	44.6%

	College and university	61	25.5%
Religion	Orthodox	121	50.0
	Muslim	55	22.7
	Protestants	43	17.8
	Catholics	21	8.7
	Other	2	0.8
Occupation	Civil servant	43	17.8%
	Daily laborer	40	16.5%
	Merchant	52	21.5%
	Housewife	21	8.7%)
	Farmer	31	12.8%
	Student	39	16.1%
	Not employed	16	6.6%
Monthly income	High (>10,900)	29	12.0%
	Medium (3201–10,900)	76	31.4%
	Low(0–3200)	137	56.6%

5.2. Clinical Characteristics of Study Participants

Almost More than half of the participants were 140(57.9%)ASA 1. From all,18 (7.43 percent) and 26 (10.7 percent), had a history of hypertension and cancer respectively. More than half of the participants, 143 (59.1%), had experienced trauma within the previous history.

Table 2: A cross-tabulation of preoperative clinical characteristics of the patient and their association with preoperative anemia among elective major orthopedics patients at the selected governmental hospitals, Addis Ababa, Ethiopia, from February Ito April 30, 202, (n=242)

Variables	Categories	Total (n)	Anemia	
			Yes (n=96)	No (n=146)
Hypertension	Yes	18(7.43%)	8(44.44%)	10(56.66%)
	No	224(92.56)	83(37.1%)	141(62.9)
DM	Yes	15(6.2%)	8(53.3%)	7(46.7%)
	No	227(93.8)	83(36.6%)	144(63.4%)

Peptic ulcer	Yes	12(5%)	4(33.3%)	8(66.7%)
	No	230(95%)	87(37.8%)	143(62.2%)
Asthma	Yes	5(2.1%)	1(20%)	4(80%)
	No	237(97.9%)	90(38%)	147(62%)
Renal disease	Yes	5(2.1%)	3(60%)	2(40%)
	No	237(97.9%)	88(31.1%)	149(62.9%)
Malignancy	Yes	26(10.7%)	16(59.3%)	11(40.7%)
	No	216(89.7%)	75(34.9%)	140(65.1%)
Malaria	Yes	8(3.3%)	2(25%)	6(75%)
	No	234(96.7%)	89(38%)	145(62%)
Smoking	Yes.	6(2.5%)	1(16.7%)	5(83.3%)
	No	236(97.5)	90(38.1%)	146(61.9%)
HIV status	Positive	11(4.5%)	7(63.6%)	4(36.4%)
	Negative	233(94.5%)	84(36.4%)	147(63.6%)
Chemotherapy	Yes	4(1.7%)	2(50%)	2(50%)
	No	238(98.3%)	89(37.4%)	149(62.6%)
NSAD	Yes	10(4.1%)	4(40%)	6(60%)
	No	232(95.9%)	87(37.5%)	147(62.5%)
ART medication	Yes	9(3.7%)	6(66.7%)	3(33.3%)
	No	233(96.3%)	85(36.5%)	148(63.5%)
History of trauma	Yes	143(59.1)	67(53.1%)	76(46.9%)
	No	99(40.9)	24(24.2%)	75(75.8%)
History of surgery	Yes	30(12.4%)	20(66.7%)	10(33.3%)
	No	212(87.6%)	71(33.5%)	141(67.5%)
ASA Status	ASA I	140(57.9%)	36(25.7%)	104(74.5%)
	ASA II	102(42.15%)	55(53.3%)	47(46.7%)

5.3. Prevalence of Preoperative Anemia

The prevalence of anemia among elective major orthopedics patients was 37.6% (95% CI: 31.8–43.4%) Regarding the severity of anemia, 47 (51.6) of the major elective orthopedic patients for anemia were moderate anemia, 40(44%) were mild anemia and 4 (4.4%) were severe anemia.

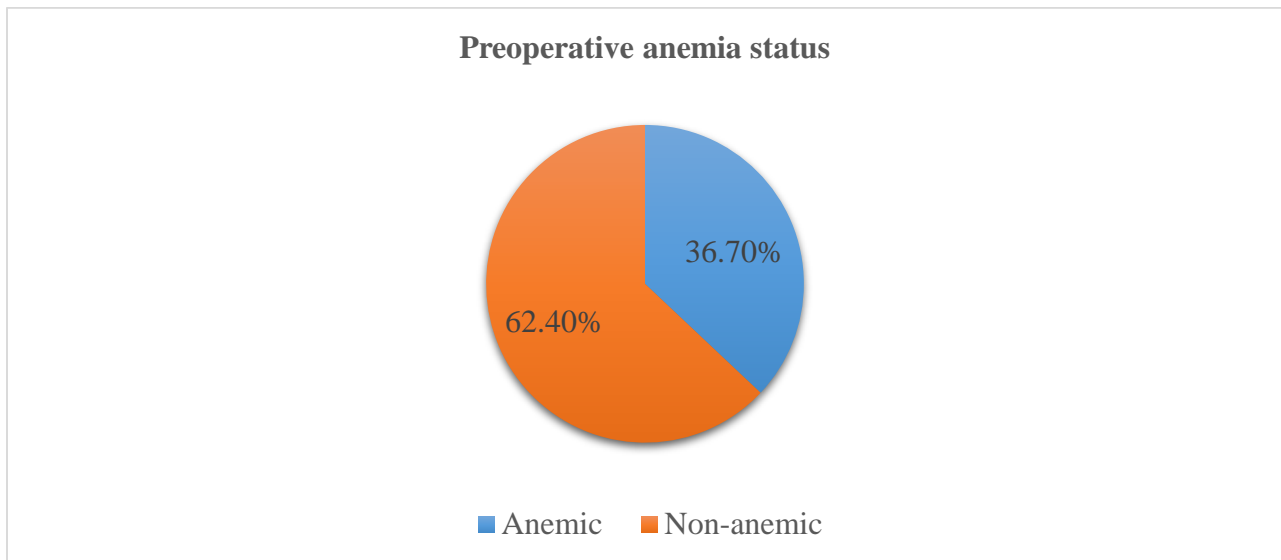


Figure 3: Prevalence of preoperative anemia among adult elective major orthopedics surgical patients in selected governmental hospital, Addis Ababa, Ethiopia, 2021.

5.4. Factors associated with Preoperative Anemia

To test the relationship between anemia and the independent variables, bi-variable and multivariable logistic regression models were used. In a bi-variable study sex, ASA class, residence, education level, income, occupation, malignancy, HIV, ART, trauma, and previous surgery were all found to be positively associated with anemia with a p-value of less than 0.2 and were candidates for multivariable logistic regression.

Anemia was significantly associated with ASA2 class, malignancy, history of trauma, and previous surgery in multivariate logistic regression. Patients with ASA status 2 were odd ratio of 2.5 times (AOR: 2.5, 95 % CI: 1.28, 4.89) More likely to develop preoperative anemia than those with ASA level 1. The odds of having preoperative anemia were 4.37 times (AOR: 4.37, 95% CI: 1.58,12.1) greater among patients with malignancy than among those without a history of malignancy, according to this study.

Preoperative anemia was more common in patients with trauma orthopedic patients 3.5 times (AOR: 3.54, 95 percent CI: 1.69, 9.7) than in patients with non-traumatic patients. Patients who had previously undergone surgery were 3.5 times (AOR: 3.5, 95 percent CI: 1.27, 10.30) more likely to have preoperative anemia than those who had not previously undergone surgery

Table 3: Bi-variable and multivariable binary logistic regression-showing factors associated with preoperative anemia among major elective orthopedics surgical patients in selected governmental hospital, Addis Ababa, Ethiopia, 2021, (n=242).

Variables	Categories	Anemia		COR(95% CI)	AOR(95% CI)
		Yes (n=98)	No (n=227)		
Sex	Female	26(31.7)	56(68.3)	I	I
	Male	65(40.6)	95(59.4)	1.74(0.84-2.58)	1.24(0.58-2.78)
ASA Status	ASA I	36(25.7)	104(74.3)	I	I
	ASA II	55(53.9)	47(46.1)	3.38(1.96-5.8)	2.5(1.28-4.89)**
Residence	Urban	33(25.6)	96(74.4)	I	I
	Rural	55(51.3)	55(48.7)	3.07(1.78-5.27)	1.57(0.74-3.3)
Educational level	No formal schooling	14(58.3)	10(41.7)	7.14(2.48-20.55)	2.87(0.7-11.89)
	From grade 1-8 grade	27(55.1)	22(44.9)	6.26(2.6-15.12)	1.8(0.5-6.5)
	From grade 9-12	40(37)	68(63)	3(1.37-6.56)	1.28(0.43-3.8)
	College and university	10(16.4)	51(83.6)	I	I
Occupation	Civil servant	6(14)	37(86)	I	I
	Daily laborer	16(40)	24(60)	4.11(1.4-11.98)	1.05(0.2-5.5)
	Merchant	20(38.5)	32(61.5)	3.85(1.38-10.8)	2.0(0.5-8.0)
	Housewife	9(42.9)	12(57.1)	4.63(1.36-15.7)	1.34(0.22-8.1)
	Farmer	19(61.3)	12(38.7)	9.76(3.2-30.2)	2.62(0.44-15.6)
	Student	13(33.3)	26(66.7)	3.1(1-9.2)	1.85(0.35-9.7)
	Not employed	8(50)	8(50)	6.2(1.7-22.75)	1.06(0.16-7.01)
Monthly income	High (>10,900)	4(13.8)	25(86.2)	I	I
	Medium (3201-10,900)	21(27.6)	55(72.4)	2.39(0.74-7.68)	2.6(0.68-10.1)
	Low(0–3200)	66(48.2)	71(51.8)	5.8(1.9-17.58)	2.97(0.74-11.95)

Malignancy	Yes	16(59.3)	11(40.7)	2.72(1.2-6.15)	4.37(1.58-12.10) **
	No	75(34.9)	140(65.1)	I	I
HIV status	Positive	7(63.6)	4(136.4)	3.1(0.87-10.77)	1.17(0.06-23.05)
	Negative	84(36.4)	147(63.6)	I	I
ART medication	Yes	6(66.7%)	3(33.3%)	3.48(0.85-14.2)	2.12(0.07-61.51)
	No	85(36.5%)	148(63.5%)	I	I
History of Trauma	Yes	67(46.9)	76(53.1)	2.76(1.57-4.85)	3.54(1.69-9.7) **
	No	24(24.2)	75(75.8)	I	I
History of surgery	Yes	20(66.7)	10(33.3)	3.97(1.77-8.94)	3.5(1.27-10.30) **
	No	71(33.5)	141(66.5)	I	I

** : significant in the Multi –variable binary logistic regression (p-value < 0.05)

AOR adjusted odds ratio, COR crude odds ratio, CI confidence interval.

I: Reference,

Hosmer and lemeshow test

CI: confidence interval

6. Discussion

In our study, Patients who had elective major orthopedic surgery have a higher risk of preoperative anemia. ASA status, malignancy, trauma, and previous surgery were all significantly associated with preoperative anemia. Preoperative anemia was detected in 37.6% of the participants. Our Study almost similar to those study in the United States patients undergoing elective hips or knee arthroplasties showed that up to 35% of these patients were anemic before surgery(24).

Our study was almost 2.5 times higher than previous research in hospital-based observation study of elective orthopedics procedures conducted in Seventeen centers in six European countries (14.1%), This was an observational study assessing the prevalence of anemia before and after surgery, in patients undergoing elective orthopedic surgery in Europe(11).

Possible cause these variations between our results to those of older studies, our study was excluded patients on anemia treatment but not in the previous study and a history of major surgical intervention within 4 weeks prior to the elective procedure was not part of the previous study but a history of surgery was significantly associated with anemia in our finding(11). Our sample size was smaller than in other studies, which could indicate a high prevalence in ours.

The prevalence of anemia in our finding higher than Another retrospective study was conducted in Australia,(49), and in Sweden(25). Another single-institution retrospective study in the United States (26,27) and Singapore (8), were lower results than ours. These Variations of the prevalence of preoperative anemia among elective orthopedics patients may be due to differences in the cutoff value used to measure (criteria used to define anemia) it, a sample size, multicenter study (more than 4 study area), date of hemoglobin, differences in the overall characteristics of the study area that could be related to the prevalence of anemia among surgical patients.

The Prevalence of preoperative anemia people in developing countries is high because of low socioeconomic status and poor health facilities(5,6). Almost all of the previous studies were conducted in developed countries, in developing country the trauma management of first-aid unlikely the same.

Patients on ASA 2 were 2.5 times more likely than those on ASA 1 to have preoperative anemia, according to the findings of this study. Other investigations confirmed this conclusion in comorbidities and, as a result, a poor health status(4).

From our studies, patients with a history of malignancy had odd ratio of 4.37 times higher chances of developing preoperative anemia than those without a history of malignancy. This conclusion was supported by other investigations, including elective major surgery in Melbourne, Australia(3), A Case Study Involving Signet Ring Cell Metastatic Breast Cancer with Severe Microangiopathic Hemolytic Anemia in USA(42), and Indian(30).

There have been a few mechanisms suggested. First, metastatic cancer with bone involvement may cause secondary myelofibrosis, which causes a direct release of prothrombotic extremely large von Willebrand factor multimers, which enhance coagulation and platelet aggregation by binding to glycoprotein 1b-IX complex. Red cell fragmentation due to direct contact with tumor emboli within blood vessels or intraluminal fibrin thrombi has been suggested as a second possible mechanism (32,42).

Patients undergoing surgery for trauma were odd ratio of 3.54 times more likely to have preoperative major elective orthopedics anemia than those non-traumatic. The study conducted in Spain indicated that trauma patients receiving fracture repair surgery had a higher prevalence of preoperative anemia(15). This finding could be the result of blood loss (50).

Our finding indicated that, patients who had previously undergone surgery had odd ratio a 3.7 times higher risk of preoperative anemia than those who had never undergone surgery. According to researches, prior surgical history had a significant impact on preoperative anemia Switzerland(11) and Singapore(46). This could be attributed to operational blood loss, decreased post-operative erythropoiesis, or poor bone marrow function(15). Other possible cause may be pre-existing anemia before the surgery.

7. Strength and limitation of the study

7.1 Strength

The first of its kind in Ethiopia, the study will serve as a baseline for future research across the country.

7.2. Limitations

A potential weakness of the study, the selection of hospitals was based purposely, this may not representative of all hospitals.

It was difficult to generalize

No study on a similar population done in Ethiopia.

8. Conclusion

The prevalence of preoperative anemia among adult elective major orthopedic surgery patients was 37.6% of the total participants. Furthermore, preoperative anemia in adult elective major orthopedics surgical patients was significantly associated with patients with ASA class, history of malignancy, trauma, and history of previous surgery.

9. Recommendation

The following are the study's recommendations, based on the findings:

For Anesthesia and surgical team

The prevalence of preoperative anemia is high, so all elective orthopedics surgical patients should be screened as much as possible so that surgery can be scheduled while the patient's hemoglobin and iron stores are optimized.

For researchers

Researchers should expand their research to include more factors with the collaboration of the laboratory, increase sample sizes, and compare to different specialties. Further search the link between preoperative anemia and perioperative complications, as well as focus on preoperative anemia treatment.

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11. Annexes

11.1: Information sheet

Title of the research

Prevalence of preoperative anemia and its associated factors among major elective orthopedics surgical patients in selected governmental hospital, Addis Ababa, Ethiopia, February,1 to April 30, 2021

Name of principal investigator: Dawud Ahmed

Name of Advisors:

Leulayehu Akalu (Assistant professor)

Meron Abrar (BSc, MSc)

Name of the Organization: Department of Anesthesia

Name of sponsor: AAU

Introduction

I am Mr. Dawud Ahmed Msc in anesthesia final year student conducting a research entitled the prevalence of anemia among major orthopedics surgical patients and associated factors. The lead investigator, four data collectors, and two advisors from Addis Ababa University's College of Medicine and Health Science's Department of Anesthesia make up the research team.

Risk

All documents relating to the patient's privacy were kept private. The names of the patients were not recorded in the form/checklist, but rather by code. Any recorded personal information or privacy was not copied or shared with other organizations. All information pertaining to the patient's privacy was kept private.

Right to refusal

They had the right to reject to take part in the study.

Benefits

This study did not provide any rewards or incentives to patients. The data was gathered for this study, and only the researcher and research assistant had access to it. The AAU's ethical committee gave permission and approved this research project.

You can contact us at the following phone number if you have any questions or need more information.

Tel: +251922901239

E-mail:dawudahmed5274@gmail.com

11.2: Consent form

Dear participant: Hello! Good morning/afternoon?

My name is------. I am a data collector for Dawud Ahmed who is working a research on prevalence of the preoperative anemia and associated factors in major elective orthopedics surgical patients in selected governmental hospitals, Addis Ababa, Ethiopia.

The goal of this study is to find out how common preoperative anemia is and what factors contribute to it in major elective orthopedic surgery patients in a government hospital in Addis Ababa, Ethiopia. A survey questionnaire/checklist will be used to record the response. The name of the patient is not written. All patient information will be kept private by utilizing only code numbers and will be maintained in closed file cabinets/places, accessible only by the chief investigator, and will be removed as soon as the study is completed. Participation in the study is will be based voluntary. I find from this study will be used to get important information necessary for the planning to improve monitoring of preoperative anemia and to prevent associated factors of preoperative anemia in elective orthopedics surgical patients in a selected governmental hospital, Addis Ababa, Ethiopia. Your honest and genuine is very important & highly appreciated. Participation in this data collection should be fully voluntary however we hope that you will participate fully in this study.

Would you willing to participate in the study, please? YES/NO

Thank you for taking part in the study!!!!

For further question ask the investigator and phone number

Tel: +251922901239

E-mail:dawudahmed5274@gmail.com

የመጠይቅ ፈቃድ

የተከበራችሁ የጥናቱ ተሳታፊዎች/

የዚህ ጥናት ዋና አላማ በ2013 ዓ.ም -----ሆስፒታል አፕራሲዮን ክፍል በአጥንት በቀዶ ህክምና የሚታከሙ ታካሚዎች ከቀዶ ህክምናዉ በፊት ስላከው የደም ማነስ ችግር እና የችግር መባባስ ምክንያት የሚሆኑ ነገሮች በጥናቱ መረጃ ለመሰባሰብ ነው። እርስዎ በዚህ ጥናት እንዲሳተፉ ተመርጠዋል።የዚህ ጥናት ዋና አላማ እርስዎ በሚሰጡት ምላሽ መሰረት በመረጃዎች በሚገኘዉ ዉጤት መሰረት መረጃዎችን በማጠናቀር ውጤቱን ከሌሎች ዉጤቶች ጋር ለማነጻጸር ነዉ ። ጥናቱ በትክክል አላማውን እንዲመታ የእርሶዎን ድጋፋ እንጠይቃለን።የማንኛውም ግለሰብ ስም አይመዘገብም እንዲሁም ሀሳቡ ብቻውን ይፋ እንዲዎጣ አይደረግም። ሙሉ በሙሉ በሚስጥር የተጠበቀነው።በጥናቱ መሳተፍ አለመሳተፍ የራስዎ መብት ብቻ ነዉ።ግልፅ የሆነ ምላሽንና ከልብ የመነጨ ተሳትፎዎን እንዲሰጡን በአክብሮት እንጠይቃለን።

ልመሳተፍ ፈቃድኛነዎት ? ሀ/ አዎ ፊርማ _____ ለመሳተፍ ፈቃደኛ ስለሆኑ እናመሰግናለን።

ለ/ አይደለሁም

11.4 II Questionnaires checklists

Part I: Questions on Socio-demographic characteristics

Name of hospital.....

Variable	Possible responses	Variable	Possible responses
Sex	1. Male 2. Female	Level of income	1. High
Age	_____ Year		2. Medium
			3. Low
Weight in kg	_____ kg	Religion	1. Orthodox
			2. Muslim
Height in meter	_____ m		3. Protestants
		4. Catholics	
		5. Other(specify_____)	
ASA	1. ASA I	Occupation	1. Civil servant
	2. ASA II		2. Daily laborer
	3. ASA III		3. Merchant
	4. ASA IV		4. Housewife
	5. ASA VI		5. Farmer
	6. Student		
	7. Not employed		
Residence	1. Urban 2. Rural		
Marital status	1. Single 2. Married 3. Divorced 4. Widowed		
Educational level	1. No formal schooling 2. From grade 1-8 grade 3. From grade 9-12 grade 4. College and university		

Part II: preoperative clinical co-morbidities

Question	Response	Question	Response
Hypertension	Yes	Malignancy	Yes
	No		No
DM	Yes	Malaria	Yes
	No		No
Peptic ulcer	Yes	Smoking	Yes. Packs/day_____
	No		No
Asthma	Yes	HIV status	Positive
	No		Negative
Renal failure	Yes		
	No		

Part III: Medication/treatment factors

Drug	Response	
If the patient is cancerous and take Chemotherapy	1. Yes 2. No	
NSAD	1. Yes 2. No	
HIV positive patients with ART medication	1. Yes 2. No	

Part IV: Surgical indication

Trauma	Variables	Response	
	Trauma related	Yes	No

Part V previous surgery

previous surgery	Yes	Specify date	
	No		

Part VI: Hematologic parameter

Lab	Value	Date of laboratory
Hemoglobin	_____g/dl	