



Seek Wisdom, Elevate your Intellect and Serve Humanity

Addis Ababa University
አዲስ አበባ ዩኒቨርሲቲ



COLLEGE OF HEALTH SCIENCE

DEPARTMENT OF ANESTHESIOLOGY

CRITICAL CARE AND PAIN MEDICINE

INCIDENCE AND ASSOCIATED FACTORS OF INTRAOPERATIVE
ARRHYTHMIA IN ADULT SURGICAL PATIENTS AT TIKUR ANBESA

SPECIALIZED HOSPITAL, 2025.

THE THESIS IS TO BE SUBMITTED TO ADDIS ABABA UNIVERSITY,
DEPARTMENT OF ANESTHESIOLOGY, CRITICAL CARE AND PAIN
MEDICINE FOR THE PARTIAL FULFILLMENT OF THE REQUIREMENTS
OF A SPECIALTY CERTIFICATE IN ANESTHESIOLOGY, CRITICAL CARE
AND PAIN MEDICINE.

BY: DR. EYERUS YAREGAL (FINAL YEAR ACCPM RESIDENT)

APRIL, 2025

ADIS ABABA, ETHIOPIA

INCIDENCE AND ASSOCIATED FACTORS OF INTRAOPERATIVE
ARRHYTHMIA IN ADULT SURGICAL PATIENTS AT TIKURANBESA
SPECIALIZED HOSPITAL, 2025.

BY: DR. EYERUS YAREGAL (FINAL YEAR ACCPM RESIDENT)

ADVISORS: DR. NURA (ASSISTANT PROFESSOR OF ACCPM)

DR. SEMIRA (ASSISTANT PROFESSOR OF ACCPM)

APRIL 2025

ADIS ABABA, ETHIOPIA

APPROVAL SHEET

Addis Ababa University College of Health Sciences School of Medicine
Department of anaesthesiology, critical care and pain medicine I, the undersigned
anaesthesiology, critical care and pain medicine resident, declare that I have
submitted my original work titled “INCIDENCE AND ASSOCIATED FACTORS
OF INTRAOPERATIVE ARRHYTHMIA IN ADULT SURGICAL PATIENTS AT
TIKURANBESA SPECIALIZED HOSPITAL, 2025”.

Submitted by:

Dr. Eyerus Yaregal_ _____ _____
Name Signature Date

For advisors’ approval

Approved by

1. Dr. Nura Kedir _____ _____
Name of 1st Advisor Signature Date

2. Dr. Semira Idris _____ _____
Name of 2nd Advisor Signature Date

Contents

Abbreviation and acronym	0
Abstract.....	1
Acknowledgment.....	2
1. Introduction	3
1.1 Background.....	3
1.2 Statement of the problem.....	5
1.3 Significance of the Study.....	5
2. Literature review.....	6
2.1 Conceptual framework.....	9
3. Objectives	10
3.1 General Objective	10
3.2 Specific objectives	10
4. Methods and materials.....	10
4.1 Study setting and period	10
4.2 Study design	11
4.3 Source population	11
4.4 Study population.....	11
4.5 Sample size and sampling technique	11
4.6 Sampling technique	14
4.7 Inclusion criteria	14
4.8 Exclusion criteria.....	14
4.9 Study variable	14
4.9.1 Dependent variables.....	14
4.9.2 Independent variable.....	14
4.10 Operational definition.....	15
4.11 Data collection, analysis and interpretation	16
4.12 Ethical consideration	16
5. Result.....	16
5.1 Socio-demographic characteristics of the study participants.....	16
5.2 Anesthesia and surgical characteristics of the study participants	18
5.3 Intraoperative characteristics related to the procedure	19
5.4 Heart rate and rhythm characteristics of the study participants.....	20

5.5 Incidence of intraoperative arrhythmia.....	23
5.6 The relation between types of surgery and intraoperative arrhythmia.....	24
5.7 The determinant factors of intraoperative arrhythmia	24
6. Discussion.....	26
7.Strengths and limitations of the study.....	27
8.Conclusion.....	28
9. Recommendation.....	28
10. Reference	30
11. Annexes.....	34
Annex I: Questionnaire.....	34
Questionnaire	35

List of Table

Table 1: Number of cases of 03 month each table and with their stratified respectively.....	12
Table 2: The sociodemographic characteristics of the study participants among adult surgical patients at Tikur Anbessa Specialized hospitals, 2025.....	16
Table 3: The anesthetic and surgical characteristics of the study participants.....	17
Table 4: Intraoperative finding related characteristics the procedure	18
Table 5: Heart rate and rhythm characteristics of the study participants.....	20
Table 6: The bivariate and multivariate association between independent variable and intraoperative arrhythmia among adult surgical patients at Tikur Anbessa Specialized hospitals, 2025.....	24

List of Figure

Figure 1: Conceptual framework for prevalence and associated factors of intraoperative arrhythmia among patients who underwent surgical procedure at Tikur Anbesa Specialized Hospital, Addis Ababa, Ethiopia, 2025.....	9
Figure 2: Incidence of intraoperative arrhythmia among adult surgical patients at Tikur Anbesa Specialized hospitals, 2025.	22
Figure 3: The types of surgical procedure and intraoperative arrhythmia.....	23

Abbreviation and acronym

AF Atrial Fibrillation

AOR Adjusted odd ratio

CABG Cardiopulmonary Bypass Graft

COPD Chronic Obstructive Pulmonary Disease

CVP Central Venous Pressure

ECG electrocardiography

HR Heart Rate

LOS Length of Stay

LVEF Left Ventricular Ejection fraction

PFT Pulmonary Function Test

POAF Postoperative Atrial Fibrillation

PVCs Premature Ventricular Contractions

TASH Tikur Anbessa Specialized Hospital

Abstract

Background: Intraoperative arrhythmia are frequent, with nearly 11% of patients experiencing abnormal heart rates or rhythms during general anesthesia. While most are transient and clinically insignificant, some may signal underlying pathology or result from procedure-specific or medication-specific aetiologies, leading to hemodynamic instability. This research will enhance perioperative assessments and enable tailored interventions to prevent arrhythmia-related complications, ultimately improving perioperative care and patient outcomes.

Objective: To assess the incidence and associated factors of intraoperative arrhythmia among patients undergoing surgical procedures at TASH from January 01 to March 30,2025, Addis Ababa, Ethiopia.

Methods: An institution-based prospective observational study was conducted among adult patients who underwent elective surgery. Sample size was determined with single proportion formula and using stratified random sampling technique, and analysed using SPSS 27 software, with associations between independent and dependent variables assessed via logistic regression. A p-value of <0.05 at 95% confidence intervals was considered statistically significant.

Results: Arrhythmias was observed in 126 (42%) of 303 patients. The multivariate logistic regression revealed that the odds of ASA III were 1.9 times higher for intraoperative arrhythmia compared to those of ASA I (AOR=1.9, 95% CI=1.69, 5.22). Additionally, the odds of receiving general anesthesia were 2.4 times higher for intraoperative arrhythmia compared to those of spinal anesthesia (AOR=2.4, 95% CI=1.29, 4.43). The odds of transfusing blood were 1.7 times higher for intraoperative arrhythmia compared to the opposite compartment (AOR=1.7, 95% CI=1.22, 2.21).

Conclusion and Recommendation: Arrhythmias can occur anytime during the procedure hence comprehensive preoperative evaluation, prompt recognition and response to arrhythmic events, and interdisciplinary collaboration throughout the perioperative period is essential.

Acknowledgment

I would like to express my heartfelt thanks, appreciation, and acknowledgments to my advisors Dr Nura (Assistant Professor) and Dr Semira (Assistant Professor), for their invaluable constructive comments, guidance, and timely feedback in the course of the research.

1. Introduction

1.1 Background

Intraoperative arrhythmias, defined as abnormal heart beats and rhythms occurring during surgery, can lead to serious complications, including hemodynamic instability, prolonged hospital stays, and increased postoperative morbidity and mortality. Adult surgical patients are particularly vulnerable to these arrhythmias due to various predisposing factors such as underlying cardiovascular diseases, electrolyte imbalances, the type of surgery, anesthesia related factors, and intraoperative stress (11, 14, 15).

Surgical feasibility has been expanded by advances in surgical techniques, safer anesthesia practices, and improved intensive care. As a result, a wider range of patients including the elderly, those with comorbidities, and those with advanced oncological conditions are now candidates for surgery. Intraoperative arrhythmias, common in the perioperative period remain a significant clinical burden (1).

Arrhythmias are among the most common cardiovascular complications during anesthesia, affecting up to 70% of patients undergoing general anesthesia across various surgical procedures (2-3).

Arrhythmias occurring from hospitalization through discharge remain a persistent, potentially preventable clinical issue. The incidence varies, from 5% in elective orthopaedic surgeries to 11% in vascular surgery and 17-64% in esophagectomy patients, with supraventricular arrhythmias being the most common finding. (4-6)

Intraoperative tachyarrhythmia and bradyarrhythmia are common, with nearly 11% of patients experiencing abnormal heart rate or rhythm during general anesthesia. While most intraoperative arrhythmias are transient and clinically insignificant, some may indicate underlying pathology or

result from procedure specific or medication specific causes. In certain cases, these arrhythmias can lead to intraoperative hemodynamic instability (9-10).

Potential contributors to the development of arrhythmias can often be detected during the preoperative assessment or may arise and be addressed during the intraoperative phase. Existing electrocardiographic(ECG) abnormalities may reveal underlying arrhythmias such as atrial fibrillation(AF),premature ventricular contractions(PVCs) or other irregularities that could increase the risk of arrhythmias occurring during surgery (11).

Intraoperative supraventricular arrhythmias are associated with a higher mortality rate, longer stay in intensive care units, and prolonged hospital stay (7, 12). A number of risk factors for intraoperative arrhythmias in patients under general anaesthesia were identified like increased age, reduced left ventricular function, preoperative arrhythmias, ejection fraction less than 40%, coronary artery disease, cardiomegaly, preoperative hypokalaemia, intraoperative adverse events and taking aspirin preoperatively (13-15).

Intraoperative arrhythmia can arise from different factors related to the patient, the surgical procedure, or the anaesthesia used. Individuals with pre-existing heart conditions are significantly more likely to experience arrhythmias during surgery than those without such conditions. Additionally, patients with brain disorders may exhibit abnormal ECG findings. Post operative atrial fibrillation is common in older adult when compared to younger individuals. Cardiac surgeries with direct manipulation of heart or the use of cardiopulmonary bypass, can increase the risk of arrhythmias. Strabismus surgery may trigger severe bradycardia due to oculocardiac reflex. surgical stimulation either directly or indirectly of the vagus nerve can also lead to bradycardia or heart block. anaesthetic related factors play a crucial role in the development of arrhythmias. Many anaesthetic drugs have arrhythmogenic properties, and it is essential to assess their impact on ventricular repolarization, as some can lead to serious ventricular arrhythmias like torsade de pointes (16).

1.2 Statement of the problem

At Tikur Anbessa Specialized Hospital, one of the largest referrals center in Ethiopia, the incidence of intraoperative arrhythmias is underexplored, and little is known about the specific risk factors contributing to this condition in this setting. Given the increasing complexity of surgeries performed at this hospital and the diverse patient population, understanding the incidence and associated factors of intraoperative arrhythmias is crucial for improving patient safety and outcomes. Therefore, it is essential to investigate the incidence, types, and contributing factors for intraoperative arrhythmias among adult surgical patients at Tikur Anbessa Specialized Hospital to guide interventions aimed at reducing their occurrence and improving perioperative care.

1.3 Significance of the Study

Understanding the incidence and risk factors of intraoperative arrhythmias will enable healthcare providers to identify high-risk patients early. This, in turn, will allow for improved preoperative assessments and tailored interventions to prevent arrhythmia related complications, ultimately enhancing perioperative care and patient outcomes.

By identifying the common types of arrhythmias and their contributing factors, this study will contribute to the development of protocols for intraoperative monitoring and management. The findings will provide essential data to inform evidence-based guidelines for managing intraoperative arrhythmias in adult surgical patients. These guidelines could be applied not only at Tikur Anbessa Specialized Hospital but also at other healthcare institutions across Ethiopia and beyond.

Identifying modifiable risk factors may help reduce the occurrence of intraoperative arrhythmias, leading to more cost-effective care and optimized resource use. There is limited research on intraoperative arrhythmias in low-resource settings like Ethiopia. This study will add to the body of knowledge on the incidence and risk factors of intraoperative arrhythmias in these contexts, filling gaps in the existing literature and providing a foundation for future research.

The findings of this study will enhance the ability of anaesthesiologists, surgeons, and perioperative care teams to effectively identify and manage intraoperative arrhythmias. In a tertiary hospital like Tikur Anbessa, where complex surgeries are routinely performed, addressing these arrhythmias is vital for ensuring patient safety and improving health outcomes. Furthermore, this study has the potential to inform initiatives aimed at enhancing the quality of anesthesia care, with significant implications for broader public health policies.

2. Literature review

Intraoperative Incidence of Arrhythmias

A prospective observational study conducted in Kelambakkam, India investigated the occurrence of intraoperative arrhythmias in patients undergoing non-cardiac surgeries under general anesthesia. Arrhythmias were detected in 70 out of 80 patients, accounting for an incidence of 87.5%. Sinus tachycardia was the most frequently observed type, found in 40 patients (50%), followed by sinus bradycardia in 13 patients (16.25%). Other arrhythmias included premature ventricular contractions and supraventricular tachycardia, each observed in 5 patients (6.25%). Sinus arrhythmia was reported in 4 patients (5%), while atrial ectopic beats and atrial fibrillation were identified in 2 (2.5%) and 1 patient (1.3%), respectively. Sinus tachycardia primarily occurred during intubation or extubation and typically resolved on its own without intervention. Bradycardia was most commonly associated with surgical manipulation (17).

A case-control study conducted in Serbia involving 147 patients undergoing elective non cardiovascular, non-thoracic surgeries under general inhalation anesthesia found that 57 patients (39%) experienced at least one episode of intraoperative arrhythmia. The types of arrhythmias observed included sinus tachycardia in 23 patients (40%), supraventricular extrasystoles in 20 patients (35%), paroxysmal supraventricular tachycardia in 9 patients (16%), and ventricular extrasystoles in 12 cases (21%). Among those with arrhythmias, 7 patients (12%) exhibited more than one type. A strong correlation was identified between intraoperative arrhythmias and a prior history of cardiac arrhythmias. Additional risk factors included abnormal pulmonary ventilation test results before admission, administration of hydroxyethyl starch, and the use of certain

medications such as loop diuretics, aminophylline, digoxin, antiplatelet agents, and organic nitrates, as well as a history of abnormal ECG findings (21).

A retrospective study done in China indicated that the overall incidence of intraoperative atrial fibrillation was 3.27%, with increasing age, male sex, and certain surgical techniques identified as risk factors. The highest incidence occurred during lymph node dissection (26).

Factors associated with arrhythmia

Volatile Inhalational Induction

A large single-center retrospective study conducted in Seoul, South Korea, examined the occurrence of arrhythmias and the factors contributing to their development during the induction of general anesthesia using sevoflurane. Among 950 adult patients, 164 (17.3%) experienced arrhythmias, with sinus tachycardia (heart rate >120 bpm) being the most common type, observed in 77 patients (47.0%). Multivariable logistic regression identified four independent risk factors: older age, presence of coronary artery disease, an initial high sevoflurane concentration of 8 vol%, and the continued administration of this concentration after the loss of the eyelash reflex. Additionally, patients who developed arrhythmias had a higher likelihood of experiencing hypotension, although their blood pressure returned to normal once the sevoflurane concentration was adjusted (18%).

Esophagectomy

A retrospective study conducted in Seoul, South Korea, focused on patients undergoing esophagectomy and found that the incidence of intraoperative arrhythmia was 17.1%, with the recurrence rate of 37.2% within the first three days after surgery. Both univariate and multivariate analyses identified several independent predictors of intraoperative arrhythmia: pre-existing heart disease, impaired pulmonary function tests (PFTs), cervical anastomosis, elevated central venous pressure (CVP), and the use of higher doses of ephedrine (20).

Postoperative Arrhythmia

An observational study conducted in India analysed patients who developed postoperative atrial fibrillation (POAF). Among this patient, 50% were under the age of 60, 50.6% had diabetes, 50.7% had a history of myocardial infarction (MI), and 19.7% had a left ventricular ejection fraction (LVEF) below 40%. Additionally, 82.6% were not receiving β -blocker therapy, 66.7% had an aortic cross-clamp time exceeding 60 minutes, and 60% had cardiopulmonary bypass (CPB) durations longer than 100 minutes. Of the surgeries performed, 38.8% were coronary artery bypass grafting (CABG) procedures, while 43.1% involved valve surgery. The study found a significant association between POAF and factors such as reduced LVEF (<40%), prior MI, use of inotropic support for more than 10 minutes after bypass, and the need for mechanical ventilation for over 24 hours (22).

Thoracoscopic Lung Surgery

A retrospective study done in China, intraoperative atrial fibrillation during thoracoscopic lung surgery reported an incidence of 1.2%. Factors such as age ≥ 60 , male sex, diabetes, lesion diameter, and specific surgical procedures were identified as independent risk factors. Patients with intraoperative AF experienced longer ICU and hospital stays (24).

Cardiac Surgery

A retrospective study done in Thailand in patients undergoing cardiac surgery, a high incidence of cardiac arrhythmias was noted (91.3%), with premature ventricular contractions being the most common (57.9%). Preoperative EKG findings, types of operations, and use of heart-lung machines significantly differed between patients with and without arrhythmias (25).

Cesarean Section

A prospective cross-sectional study done in Taiwan examining arrhythmias during spinal anesthesia for cesarean sections, various degrees of atrioventricular block and severe bradycardia were reported, with age being a significant factor in potentially dangerous arrhythmias (27).

2.1 Conceptual framework

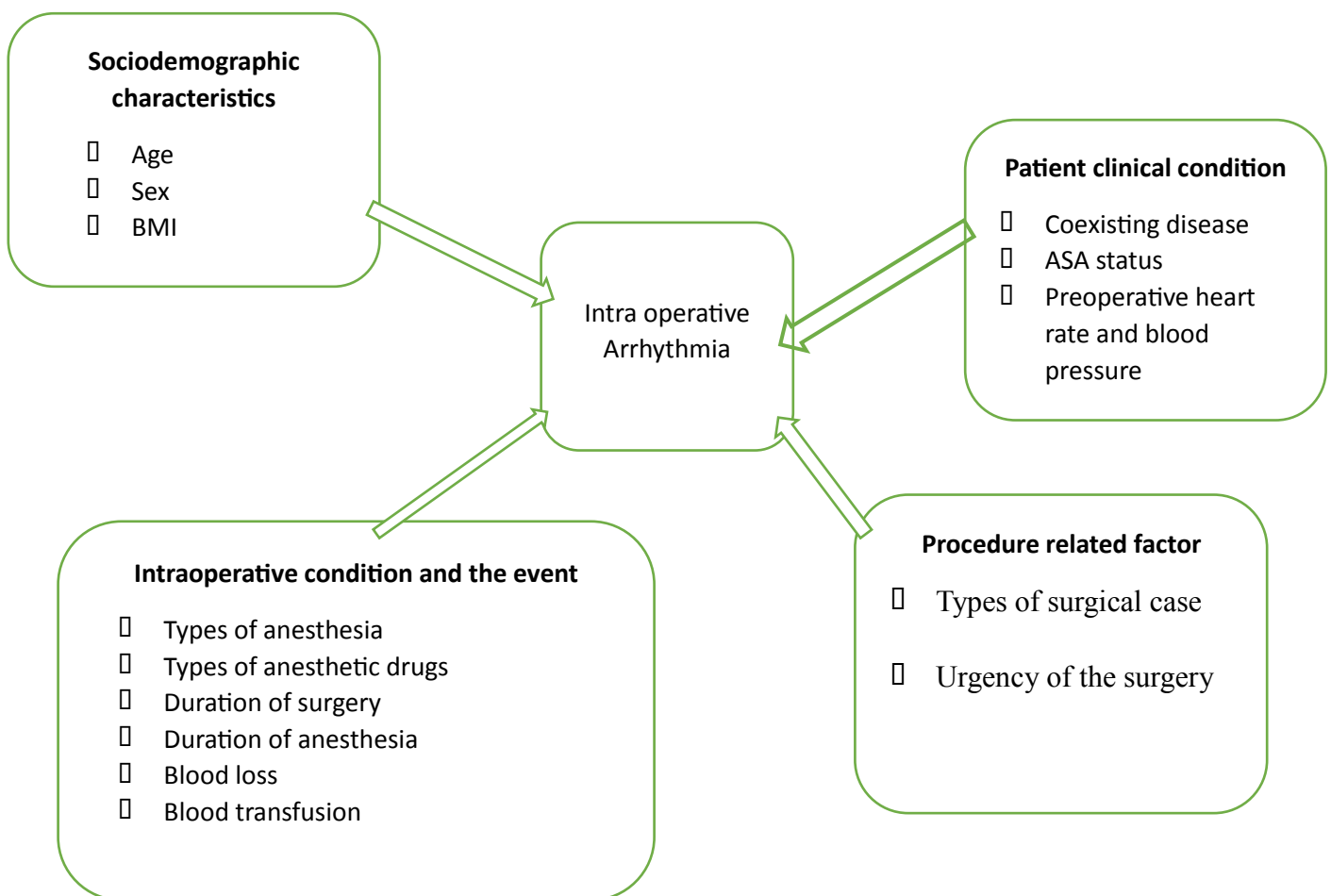


Figure 1. Conceptual framework for incidence and associated factors of intraoperative arrhythmia among adult patients who underwent surgical procedure at Tikur Anbesa Specialized Hospital, Addis Ababa, Ethiopia, 2025.

(17-27)

3.Objectives

3.1 General Objective

To determine incidence and associated factors of intraoperative arrhythmia among patients who undergo surgical procedure at Tikur Anbesa Specialized Hospital from January 1 to March 30, Addis Ababa, Ethiopia, 2025.

3.2 Specific objectives

- To determine the incidence of intraoperative arrhythmia among patients who undergo surgery at Tikur Anbesa Specialized Hospital from January 01 to March 30,2025.
- To identify factors associated with intraoperative arrhythmia among patients who undergo elective surgery at Tikur Anbesa Specialized Hospital from January 01 to March 30, 2025.

4. Methods and materials

4.1 Study setting and period

The study was conducted at Tikur Anbesa specialized hospital (TASH), located in the central part of Addis Ababa, the capital city of Ethiopia, from January to March30, 2025.The research took place specifically in the hospital's operating room. TASH is a tertiary- level healthcare facility that provides services to referred patients from specialized and referral hospitals across the country. The hospital is equipped with thirteen elective operating tables and four designated for emergency surgeries.

4.2 Study design

Institution based, prospective observational study design was employed

4.3 Source population

All adult patients who were admitted for surgical intervention at Tikur Anbesa specialized hospital from January 01 to March 30, 2025.

4.4 Study population

All adult patients who underwent surgical procedure at TASH from January 1 to March 30, 2025, and fulfilled the inclusion criteria.

4.5 Sample size and sampling technique

Sample size was determined by using single population proportion formula with the following assumption. From previous study done at Serbia, the incidence of intraoperative arrhythmia was 39% (20), Confidence interval 95%, margin of error 5%,

$$Sample\ size\ n = \frac{[(z_{\alpha/2})^2 \times p(1-p)]}{d^2}$$

Where: -

Z= Standard normal distribution value at 95% CI= (1.96)²

p= proportion of intraoperative arrhythmia; 39% (0.39)

d= margin of error (0.05) n= sample size

Therefore, n= [(1.96)² × (0.39) × (1-0.39)]/ (0.05)²= 366

Another 10% will added for non-respondents making total n=402

Since population size is <10,000 it is adjusted using finite population correction formula

$$n = \frac{n_0}{1 + \frac{n_0}{N}}$$

n=corrected sample size

n₀=initial sample size

N=total population size

The final sample size is 312

Stratified random sampling technique is used to select study participants. The total previous surgery per 3 months on the log book, 1400 patients were operated on an elective and emergency schedule. The population is divided into eleven distinct strata based on the department available to ensure comprehensive representation across different operation table.

Sample size formula using proportionate stratified random sampling for each stratum

Where: -

$$n_h = n \frac{N_h}{N}$$

n_h=sample size from stratum h

n =total sample size

N_h = population size of stratum h

N=total population size

Table 1. Number of cases of 03 month each table and with their stratified respectively.

Department	No of cases per 03 month	Sample size stratified
ENT	97	21
Cardiothoracic surgery	86	18
Vascular surgery	85	18
Neurosurgery	67	14
Gastrointestinal surgery	102	22
Gynecology	97	20
Urology	165	36
Endocrine surgery	64	14
Obstetrics	117	25
Emergency	350	78
Orthopaedics	170	37

4.6 Sampling technique

A stratified random sampling method was employed to select study participants from both daily emergency and elective surgical cases. Based on the average number of surgeries recorded over the previous three months, approximately 1,400 patients had undergone operations. The sampling interval (K) was calculated using the formula $K = N/n$, where N represents the total population over three months (1,400), and n is the desired sample size (312). This resulted in a sampling interval of 4 (i.e., $1400/312 = 4$). To determine the starting point, a random selection was made using the lottery method within each stratum. Following that, every fourth patient undergoing surgery was included in the study throughout the data collection period.

4.7 Inclusion criteria

Selected adult patients who underwent surgical procedure from January01-March30, 2025 G.C was included in the study.

4.8 Exclusion criteria

Patients who had preoperative arrhythmia with specifically rhythm disturbance.

4.9 Study variable

4.9.1 Dependent variables

- Intraoperative arrhythmia.

4.9.2 Independent variable

- Sociodemographic characteristics
 - Age
 - Sex
- Intraoperative condition and the event

- Types of anaesthesia
- Types of anaesthetic drugs
- Duration of surgery
- Duration of anaesthesia
- Blood loss
- Blood transfusion
- Patient clinical condition
 - Coexisting disease
 - ASA status
 - Preoperative heart rate and rhythm
- Procedure related factor
 - Urgency of the surgery
 - Types of procedure

4.10 operational definition

- **Intraoperative arrhythmia:** Refers to any disturbance in the rate or rhythm of a person's heartbeat that occurs during a surgical procedure. (17)
- **Surgical urgency;** is defined as the need for immediate(emergency) or scheduled(elective) intervention based on the potential risk to the patient's life or health if delayed.
- **Intraoperative blood loss;** is defined as the total volume of blood lost by a patient during the course of a surgical procedure.
- **Unstable arrhythmia;** patients who has arrhythmia and leads to compromised cardiac output and symptoms such as hypotension, chest pain, desaturation, change in mentation and signs of shock.

4.11 Data collection, analysis and interpretation

Data were collected at Tikur Anbesa Specialized hospital using an interviewer- administered semi- structured questionnaire, after the data collector had received training and obtained verbal informed consent from the participant. Socio-demographic data like the patient's age, sex, and ASA physical status, duration of anesthesia and surgery, type of procedure, timing of surgery, and associated coexisting illnesses was taken from the patient chart. The intraoperative rhythm of the heart of the participants was measured on the day of surgery.

Participants' cardiac rhythms were initially monitored in the operating room prior to the induction of anesthesia. During surgery, rhythm monitoring continued and was recorded 15 minutes after induction and then at 15-minute intervals until the end of the procedure. All questionnaire responses were entered, coded, and analysed using SPSS Version 27. Binary logistic regression was used to identify associations between variables. A p-value of less than 0.05 and a 95% confidence interval were used to determine statistical significance.

4.12 Ethical consideration

Ethical approval for the study was obtained from the Department of Anesthesiology, Critical care, and Pain medicine at the College of Health Sciences, Addis Ababa University. An official support letter was submitted to Tikur Anbessa Specialized Hospital, and permission for data collection was granted by the hospital administration. The objectives of the study was clearly explained to each participant, and verbal informed consent was secured. Participant confidentiality was upheld throughout the study by employing an anonymous questionnaire.

5. Result

5.1 Socio-demographic characteristics of the study participants

Majority of the study participants had a mean and SD age of 39.87 ± 12.71 . Fifty-seven percent of the participants were female and 53.5% were ASA class II. Thirty-seven percent of the participants had coexisting medical illness, of which 56.3% were hypertensive followed by DM and cardiac disease as shown table 2. Below.

Table 2. The sociodemographic characteristics of the study participants among adult surgical patients at Tikur Anbessa Specialized hospitals, 2025.

variable	frequency	percent
Age in years		
18-30	55	18.2
31-40	133	43.9
41-50	58	19.1
51-60	34	11.2
>60	23	7.6
Sex		
Male	130	42.9
Female	173	57.1
ASA classification		
ASA I	92	30.4
ASA II	162	53.5
ASA III	44	14.5
ASA IV	5	1.7
Coexisting medical illness		
Yes	112	37
no	191	63
Types of coexisting medical illness (n=112)		
Hypertension	62	56.3
Diabetes	30	26.8
cardiac	19	16.9
CKD	4	3.6
HAI	2	1.8
COPD	2	1.8

Asthma	1	0.9
RVI	2	1.8
pheochromocytoma	2	1.8

5.2 Anesthesia and surgical characteristics of the study participants

Seventy-three percent of the procedure were elective surgery and majority of the procedure were orthopaedics followed by urology (13.2%) and GI (13.2). 48.8% of the procedure was done by general anesthesia as shown the table 2 below.

Table 3. The anesthetic and surgical characteristics of the study participants

Variable	frequency	Percent
Urgency of surgery		
Emergency	82	27.1
elective	221	72.9
Types surgery		
Endocrinology	12	4.0
ENT	20	6.6
Gastrointestinal	40	13.2
Gynecology	18	5.9
Neurosurgery	23	7.6
Obstetric	38	12.5
Orthopaedics	59	19.5
Thoracic	23	7.6
Urology	40	13.2
Vascular	30	9.9

Anesthesia		
SA	102	33.7
GA	148	48.8
Combined	35	11.6
Others	18	5.9
Types of combination (n=35)		
CSE	17	48.6
General anesthesia with epidural	18	51.4

5.3 Intraoperative characteristics related to the procedure

Half of the study participant had intraoperative blood loss of 250-500ml and 14.2% of them were blood transfused and 72.1% were transfused <500ml. 86.5% of the procedure were take more than 2 hours of duration and 11.9% were develop complication. among those complication, massive bleeding accounts 69.8% followed by bradycardia.

Table 4. Intraoperative finding related characteristics the procedure

Variable	frequency	Percent
Amount of intraoperative blood loss in ml		
<250	86	28.4
250-500	151	49.8
500-1000	30	9.9
>1000	36	11.9
Blood transfused		
Yes	43	14.2
no	260	85.8

Amount of blood transfusion in ml		
<500	31	72.1
>500	12	27.9
Duration of surgery in in hrs.		
<2	41	13.5
>2	262	86.5
Surgical related complication		
Yes	36	11.9
no	267	88.1
Types of complication(n=43)		
Arrythmia	8	18.6
Massive bleeding	30	69.8
Bradycardia	4	9.3
Esophageal injury	3	6.9

5.4 Heart rate and rhythm characteristics of the study participants

Prior to surgery, 15% of the participants exhibited tachycardia and 23.4% were found to be hypertensive. Among the arrhythmias recorded, sinus tachycardia was the most common, observed in 52 patients (41.3%), followed by sinus bradycardia in 37 patients (29.4%). Premature ventricular contractions combined with sinus tachycardia were identified in 15 cases (11.8%). Additionally, sinus arrhythmia was seen in 9 patients (7.2%), atrial fibrillation in 7 patients (5.5%), supraventricular tachycardia in 3 patients (2.4%), and atrial ectopic beats in another 3 patients (2.4%). Intraoperatively, 23% of the participants developed hypertension, while 7.6% experienced episodes of hypotension.

Table 5. Heart rate and rhythm characteristics of the study participants

Variable	frequency	Percent
----------	-----------	---------

Preoperative heart rate		
<60bpm	3	1.0
60-100bpm	253	83.5
100-120bpm	46	15.2
120-140bpm	1	.3
Preoperative blood pressure		
Normotensive	232	76.6
hypertensive	71	23.4
First hour intraoperative heart rate		
<60bpm	34	11.2
60-100bpm	222	73.3
100-120bpm	41	13.5
120-140bpm	3	1.0
>140bpm	3	1.0
Second hours intraoperative heart rate (n=293)		
<60bpm	9	3.1
60-100bpm	248	84.6
100-120bpm	32	10.9
120-140bpm	3	1
>140bpm	1	0.3
Third intraoperative heart rate (n=250)		
<60bpm	2	0.8
60-100bpm	222	88.8
100-120bpm	21	8.4
120-140bpm	5	2
Forth hours Intraoperative heart rate (n=156)		
<60bpm	1	0.6
60-100bpm	146	93.6
100-120bpm	7	4.5

120-140bpm	1	0.6
>140bpm	1	0.6
The remaining hours intraoperative heart rate(n=89)		
60-100bpm	84	94.4
100-120bpm	4	4.5
120-140bpm	1	1.1
Intraoperative blood pressure		
Hypotensive	23	7.6
Normotensive	210	69.3
hypertensive	70	23.1

5.5 Incidence of intraoperative arrhythmia

In this study, 42%(n=126) of the participants were a list one episodes of intraoperative arrhythmia as shown the figure 1 below.

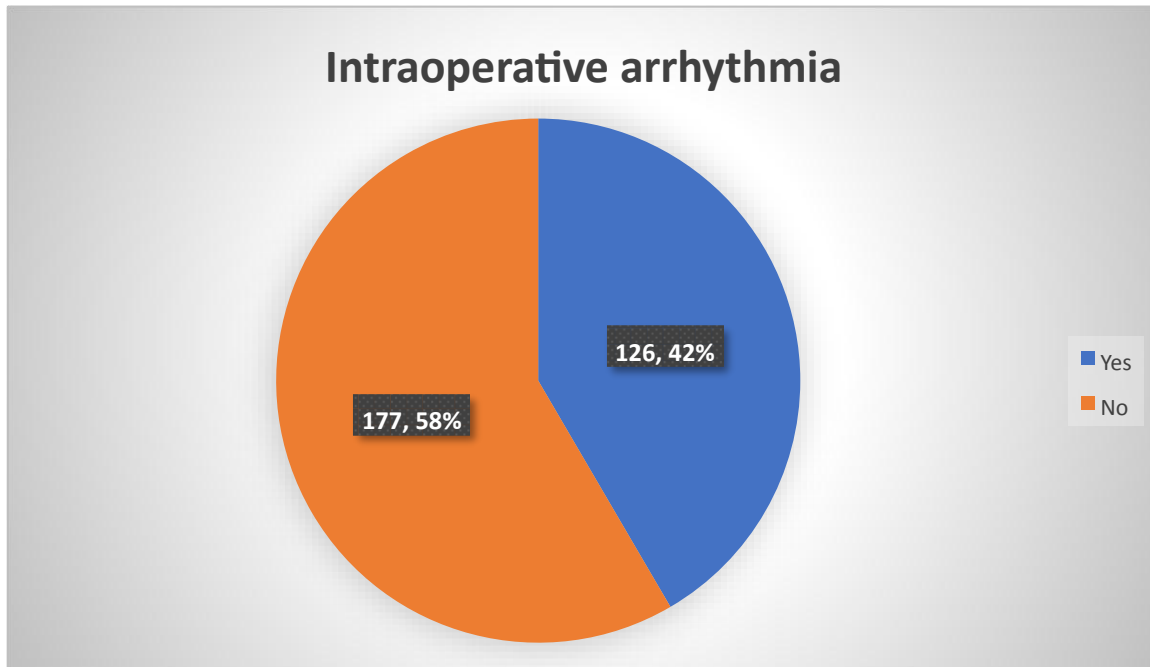


Figure 2. The incidence of intraoperative arrhythmia among adult surgical patients at Tikur Anbessa Specialized hospitals, 2025.

5.6 The relation between types of surgery and intraoperative arrhythmia

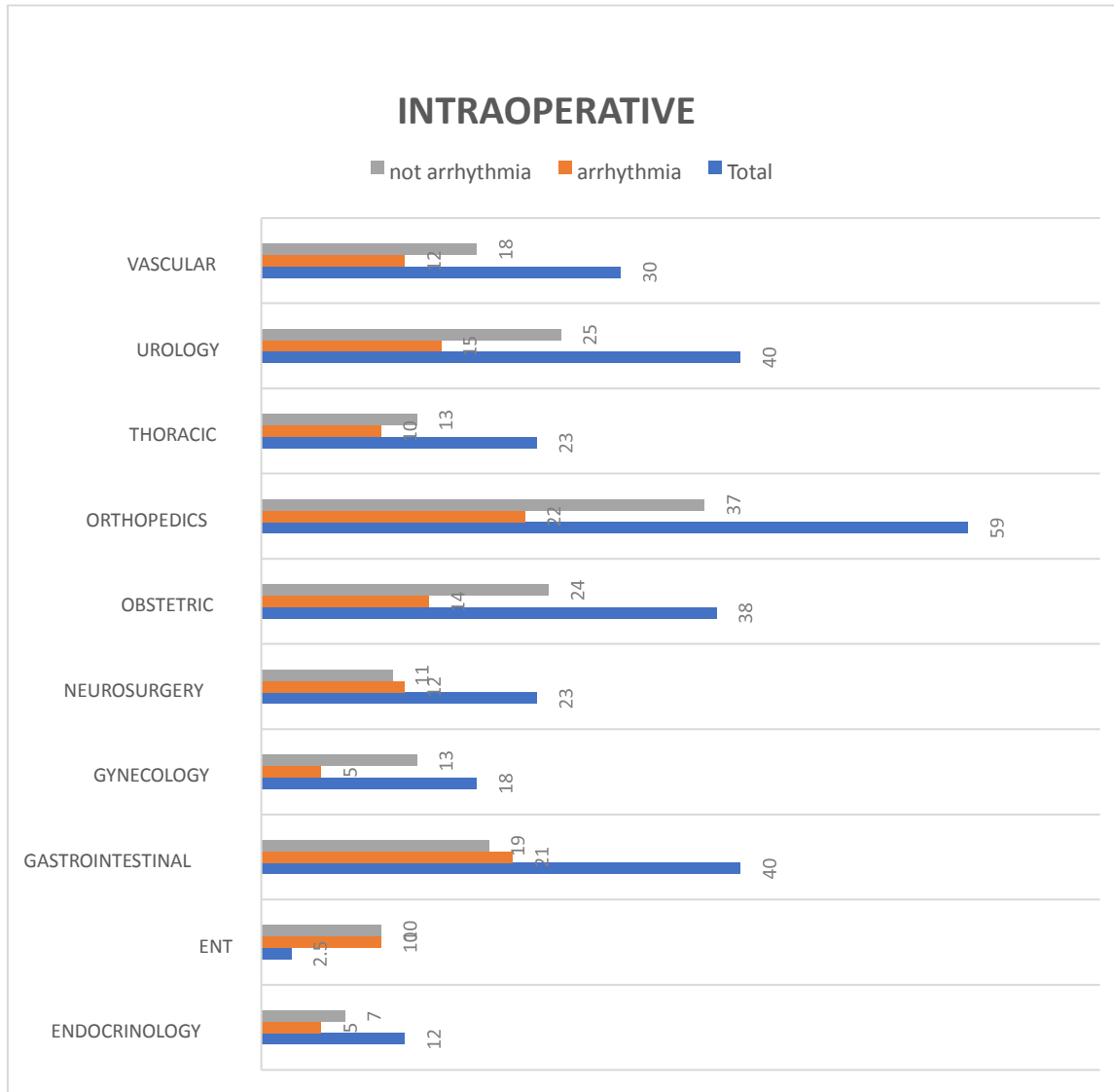


Figure 3. Types of surgical procedure and intraoperative arrhythmias

5.7 Factors that determine intraoperative arrhythmia

Age, ASA class, coexisting medical illness, anesthesia type, blood loss and blood transfusion had association with intraoperative anesthesia by bivariate logistic regression. The multivariate logistic regression revealed that the odds of ASA III were 1.9 times higher for intraoperative

arrhythmia compared to those of ASA I (AOR=1.9, 95% CI=1.69, 5.22). Additionally, the odds of receiving general anesthesia were 2.4 times higher for intraoperative arrhythmia compared to those of spinal anesthesia (AOR=2.4, 95% CI=1.29, 4.43). The odds of transfusing blood were 1.7 times higher for intraoperative arrhythmia compared to the opposite compartment (AOR=1.7, 95% CI=1.22, 2.21).

Table 6. The bivariate and multivariate association between independent variable and intraoperative arrhythmia among adult surgical patients at Tikur Anbessa Specialized hospitals, 2025.

	Intraoperative arrhythmia		Pvalue	COR with 95%CI	Pvalue	AOR with 95%CI
	Yes	no				
Age in years						
18-30	18	37	1		1	
31-40	54	79	0.313	1.4(0.73, 2.72)	0.744	0.88(0.42, 1.86)
41-50	33	25	0.011	2.7(1.26, 5.84)	0.122	1.9(0.84, 4.57)
51-60	15	19	0.281	1.6(0.67, 3.92)	0.533	0.73(0.27, 1.977)
>60	6	17	0.563	0.73(0.24, 2.15)	0.066	0.32(0.09, 1.08)
ASA classification						
ASAI	27	65	1		1	
ASAI	71	91	0.024	1.9(1.09, 3.24)	0.272	1.5(0.74, 2.88)
ASAI	25	19	0.002		0.012	1.9(1.69, 5.22)
ASAI	3	2	0.172	3.6(0.57, 22.84)	0.436	2.3(0.28, 17.99)
Coexisting medical illness						
Yes	60	52	0.001	2.2(1.36, 3.52)	0.021	1.7(1.18, 3.32)
no	66	125	1		1	
Anesthesia type						
SA	25	77	1		1	
GA	78	70	0.000	3.4(1.97, 5.98)	0.006	2.4(1.29, 4.43)
Combined	17	18	0.009	2.9(1.31, 4.53)	0.072	2.3(0.93, 5.64)
others	6	12	0.433	1.5(0.52, 4.53)	0.619	1.3(0.42, 4.24)
Blood loss in ml						

<250	41	45	1		1	
250-500	44	107	0.005	0.45(0.26, 0.78)	0.740	0.79(0.21, 3.03)
500-1000	15	15	0.826	1.1(0.48, 2.52)	0.065	0.30(0.09, 1.08)
>1000	26	10	0.015	2.9(1.23, 6.63)	0.348	0.56(0.17, 1.87)
Blood transfusion						
Yes	29	14	0.000	3.5(1.75, 6.91)	0.047	1.7(1.22, 2.21)
no	97	163	1		1	

6. Discussion

In this study, intraoperative arrhythmias were identified in 126 out of 303 patients, representing an incidence of 42%. The most frequently observed arrhythmia was sinus tachycardia, occurring in 52 patients (41.3%), followed by sinus bradycardia in 37 patients (29.4%), and premature ventricular contractions combined with sinus tachycardia in 15 patients (11.8%). Sinus tachycardia commonly appeared during endotracheal intubation or extubation and typically resolved on its own without requiring intervention. Bradycardia was mainly observed during surgical stimulation or abdominal manipulation.

This finding was lower than the study done by Dr. Lakshmi, Krishna. S, et al., (January 2023) (87.5%) (17) and was higher than the study done by Milivoje P, et al., (2012) (39%) (21) and study done by Ka[^] muran A, et al., (1999) 36% (23) and the study done by De-hua Wu, et al., (2012) (3.27%) (26). This difference may be due to TASH study might have included a different patient demographic or specific group, which could lead to a different result of incidence of arrhythmias since patients with preoperative rhythm disturbance are intentionally excluded in this study. In contrast, other studies might have included a higher proportion of patients with existing cardiovascular diseases or higher risk factors, which are more likely to develop intraoperative arrhythmias. Variations in how the studies were conducted, such as the types of surgeries, mode of anesthesia, intraoperative monitoring methods could influence the rates of arrhythmias observed.

The odds of ASA III were 1.9 times increase its intraoperative arrhythmia compared to those of ASA I (AOR=1.9, 95%CI=1.69, 5.22). This finding is consistent with the study done by Chaoyang Tong, Qi Zhang, et al., (2010) (24). This may be due to Comorbid diseases significantly increase the risk of intraoperative arrhythmia due to their direct and indirect effects on the cardiovascular system, metabolic balance, and the body's overall physiological stability. These conditions impair the body's ability to respond to surgical and anesthetic stress, making the heart more susceptible to electrical instability.

This may be due to ASA III and IV patients often have moderate to severe systemic disease. These conditions make the heart more susceptible to stress, electrolyte imbalances, and changes in oxygenation during surgery.

The odds of receiving general anesthesia were 2.4 times increase its intraoperative arrhythmia compared to those of SA (AOR=2.4, 95%CI=1.29, 4.43). This finding was supported with the study done by De-hua Wu, et.al., (2012) (26) and also with the study one by Yoon J, et al., (Jan 2021) (18). This is due to general anesthesia can trigger significant physiological stress responses, such as increased heart rate and blood pressure, which may precipitate arrhythmia, Spinal anesthesia, while still capable of causing autonomic disturbances, generally produces less pronounced stress responses.

The odds of transfusing blood were 1.7 times increase its intraoperative arrhythmia compared to its opposite compartment (AOR=1.7, 95%CI=1.22, 2.21). Again, this study is supported with the study done by Yoon J, et al., (Jan 2021) (18). Blood transfusions can contribute to an inflammatory response, which is linked to the development of arrhythmia. Additionally, the transfused blood itself can contain substances like potassium that can disrupt the heart's electrical activity, leading to arrhythmias.

7.Strengths and limitations of the study

The strength of this study is in its assessment of risk factors associated with intraoperative arrhythmia by using Google Forms for efficient, accurate data collection and continuous ECG

monitoring with other standard ASA monitoring enhances the study's credibility and the validity of its findings.

On the contrary, the limitations of this study were not following patient outcomes and not fully equipped ECG and blood pressure in the PACU during the study period, which potentially influenced the extent of the research.

The other limitation that was observed not adequate information about patient especially in emergency patients with specifically the preoperative heart rate and rhythm status of the patient.

8. Conclusion

The incident of intraoperative arrhythmia is high among patients above ASA III, patients who received general anesthesia, old age patients, patients with coexisting medical illness and patients who had either surgical or anesthesia related complications.

These findings underscore the importance of tailored interventions to mitigate arrhythmia risk in surgical settings, particularly among elderly patients with comorbidities as well as patients with high risk.

9. Recommendation

Intraoperative arrhythmia is a major concern in patients undergoing surgical procedure. The occurrence of this incident is high in patient with comorbid illness, high risk surgery, the type of anesthesia used and also ASA classification of a patient.

Anesthetic plans should be individualized with consideration given to more regional techniques over general anesthesia in indicated patients to minimize arrhythmogenic triggers.

Transfusion practices should follow evidence-based protocols, with careful monitoring to prevent arrhythmia -inducing imbalances.

It is recommended that a comprehensive preoperative evaluation to be conducted as well as intraoperative monitoring with preparation for all the adverse events anticipated.

Prospective multicentre studies are needed to better understand intraoperative arrhythmia and to develop targeted preventive strategies.

Finally, having clear intraoperative protocols and trained personnel ready to manage arrhythmias can significantly reduce perioperative complications and improve patient outcome.

10. Reference

1. Dobrev D, Aguilar M, Heijman J, Guichard JB, Nattel S. Postoperative atrial fibrillation: mechanisms, manifestations and management. *Nat Rev Cardiol.* 2019;16(7):417-436. doi: 10.1038/s41569-019-0166-5.
2. Forrest JB, Cahalan MK, Rehder K, Goldsmith CH, Levy WJ, Strunin L, et al. Multicenter study of general anesthesia. II. Results. *Anesthesiology* 1990; 72: 262-8.
3. Forrest JB, Rehder K, Cahalan MK, Goldsmith CH. Multicenter study of general anesthesia. III. Predictors of severe perioperative adverse outcomes. *Anesthesiology* 1992; 76: 3-15.
4. (Butte N, Böttiger BW, Teschendorf P. Amiodaron. for treatment of perioperative cardiac arrhythmia: a broad spectrum antiarrhythmic agent? *Anaesthesist* 2008; 57:1183-92.
5. Pavone V, Johnson T, Saulog PS, Sculco TP, Bottner. F. Perioperative morbidity in bilateral one-stage total knee replacements. *Clin Orthop Relat Res* 2004; 421:155-61.
6. Winkel TA, Schouten O, Hoeks SE, Hampton D, Kirchhof P, van Kuijk JP, Lindemans J, VerhagenHJ, Bax JJ, Poldermans D. Risk factors and outcome of new-onset cardiac arrhythmias in vascular surgery patients. *Am Heart J* 2010; 159:1108-15.

7. Ngamprasertwong P, Kositanurit I, Yokanit P, Lerdsirisopon S, Pulnitiporn A, Klanarong S. The Thai Anesthesia Incident Monitoring study (Thai AIMS): perioperative arrhythmia. *J Med Assoc Thai* 2009; 92:342-50.
8. Hartmann B, Junger A, Röhrig R, Klasen J, Jost A, Benson M, Braun H, Fuchs C, Hempelmann G. In-tra-operative tachycardia and peri-operative outcome. *Langenbecks Arch Surg* 2003; 388:255-60.
9. Forrest JB, Cahalan MK, Rehder K, et al. Multicenter study of general anesthesia. II. Results. *Anesthesiology* 1990; 72:262.
10. Forrest JB, Rehder K, Cahalan MK, Goldsmith CH. Multicenter study of general anesthesia. III. Predictors of severe perioperative adverse outcomes. *Anesthesiology* 1992; 76:3.
11. Kusumoto FM, Schoenfeld MH, Barrett C, et al. 2018 ACC/AHA/HRS Guideline on the Evaluation and Management of Patients with Bradycardia and Cardiac Conduction Delay: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *J Am Coll Cardiol* 2019; 74: e51.
12. Hartmann B, Junger A, Röhrig R, Klasen J, Jost A, Benson M, Braun H, Fuchs C, Hempelmann G. In-tra-operative tachycardia and peri-operative outcome. *Langenbecks Arch Surg* 2003; 388:255-60.
13. O'Kelly B, Browner WS, Massie B, Tubau J, L, Mangano DT. Ventricular arrhythmias in patients undergoing noncardiac surgery. The Study of Perioperative Ischemia Research Group. *JAMA* 1992;268:217-21.
14. Halm EA, Browner WS, Tubau JF, Tateo IM, Mangano DT. Echocardiography for assessing cardiac risk in patients having noncardiac surgery. Study of Perioperative Ischemia Research Group. *Ann Intern Med* 1996; 125:433-41.
15. Burris JM, Subramanian A, Sansgiry S, Bakaeen FG, Awad SS. Perioperative atrial arrhythmias in noncardiothoracic patients: a review of risk factors and treatment strategies in the veteran population. *Am J Surg* 2010; 200:601-5.
16. Staikou C, Stamelos M, Stavroulakis E. Impact of anaesthetic drugs and adjuvants on ECG markers of torsadogenicity. *Br J Anaesth* 2014; 112: 217-30.

17. Dr. Lakshmi, Krishna. S., Prof. Dr. Anand. S, Ms. Anusuya T. intra-operative incidence of arrhythmias in patients undergoing non-cardiac surgeries under general anesthesia– a prospective observational study”. Indian journal of applied research .13 (01) 2023 ISSN No 2249 - 555X. DOI : 10.36106/ija.
18. Yoon J, Baik J, Cho MS, Jo JY, Nam S, Kim SH, Ku S, Choi SS. Arrhythmia incidence and associated factors during volatile induction of general anesthesia with sevoflurane: a retrospective analysis of 950 adult patients. *Anaesth Crit Care Pain Med.* 2021 Jun;40(3):100878. doi: 10.1016/j.accpm.2021.100878. Epub 2021 May 5. PMID: 33964484.
19. Kwon CH, Kim SH. Intraoperative management of critical arrhythmia. *Korean Journal of Anesthesiology.* 2017 Apr 1;70(2):120-6.
20. Tae-Soo HAHM; Jeong-Jin LEE; Mi-Kyung YANG; Jie-Ae KIM. Risk Factors for an Intraoperative Arrhythmia during Esophagectomy. *Yonsei Medical Journal.*474-479, 2007. ID: wpr-71492.
21. Milivoje P. Dostić, Marina T. Tomović, Marija T. Popović-Milenković, Srđan M. Stefanović, Slobodan M. Janković. Risk factors for intraoperative arrhythmias in general surgery patients operated under general anesthesia: our one-year experience. *Med Glas Ljek komore Zenickodobojskog kantona* 2012; 9(2):204-210.
22. Dave, Sona; Nirgude, Anand; Gujjar, Pinakin; Sharma, Ritika. Incidence and risk factors for development of atrial fibrillation after cardiac surgery under cardiopulmonary bypass. *Indian Journal of Anaesthesia* 62(11):p 887-891, November 2018. | DOI: 10.4103/ija.IJA_6_18.
23. Kaur A. Kadipasaoglu, PhD, Michele Sartori, MD, Takafumi Masai, MD, Hasan B. Cihan, MD, Fred J. Clubb, Jr, DVM, PhD, Jeff L. Conger, BS, and O. H. Frazier, MD. Intraoperative Arrhythmias and Tissue Damage During Transmyocardial Laser Revascularization. *Ann Thorac Surg* 1999;67:423–31.
24. Chaoyang Tong, Qi Zhang, Yuan Liu, Meiyang Xu, Jingxiang Wu, Hui Cao. Risk factors and outcomes of intraoperative atrial fibrillation in patients undergoing thoracoscopic anatomic lung surgery. *Ann Transl Med* 2021;9(7):543 | <http://dx.doi.org/10.21037/atm-20-5035>.
25. Yotda J, Khuwatsamrit K, Siripitayakunkit A. Factors related to arrhythmias in patients undergoing heart surgery. *Thai J Cardio-Thorac Nurs.* [Internet]. 2022 Mar. 12 [cited 2024

Sep.17];32(2):174-85.Available from:<https://he02.tci-thaijo.org/index.php/journalthaicvnurse/article/view/246606>

26. De-hua Wu, MD, Mei-ying Xu, MD, Teng Mao, MD, Hui Cao, MD, Dong-jin Wu, MD, and Yao-feng Shen, MD. Risk Factors for Intraoperative Atrial Fibrillation: A Retrospective Analysis of 10,563 Lung Operations in a Single Center. *Ann Thorac Surg* 2012;94:193– 8.
27. Chih-Long Shen MD, Yung-Yuan Ho MD , Yu-Chun Hung MD , Ping-Lung Chen MD. Arrhythmias during spinal anesthesia for Cesarean section. *CAN J ANESTH* 2000 / 47: 5 / pp 393–397.

11. Annexes

Annex I: Questionnaire

Addis Ababa University college health sciences, school of graduate studies, department of anesthesiology, critical care and pain medicine

Questionnaire prepared to assess the incidence of intraoperative arrhythmia and its risk factors

Consent form

Hi, good morning/afternoon.

My name is -----, I am here on behalf of Dr. Eyerus., a student in Addis Ababa University School of medicine, department of anesthesiology, critical care and pain medicine. she is conducting a research thesis on “incidence of intraoperative arrhythmia and its risk factors among patients who underwent surgery at TASH, Addis Ababa Ethiopia. She has got formal permission from Addis Ababa University School of medicine and TASH officials to conduct the study.

You have been selected to take part in this study. While there is no immediate personal benefit from participating, the findings may assist policymakers, program developers, and researchers in

the future by drawing attention to key issues and guiding the development of targeted treatment strategies.

All information collected will be treated with strict confidentiality, using code numbers to anonymize the data and storing it securely. Only the research team will have access to the uncoded information, and it will not be used for any purpose other than this study. Your cooperation and active involvement are crucial to the success of this research.

If you need any further information or explanation regarding to the study, you can have this address to contact.

Would you be willing to participate? [put "x" mark] Yes _____ No _____

Name: Dr. Eyerus Tel- +251-973028768,

Questionnaire

Part I: Questions on socio-demographic characteristics of the patients

1. Age in years _____ year
2. Sex of participants
 - I. Male
 - II. Female
3. ASA physical status
 - I. ASA I
 - II. ASA II
 - III. ASA III
 - IV. ASA IV
 - V. ASA V
 - VI. ASA VI
4. Is there any co existing medical disease?
 - I. Yes
 - II. No
 4. If yes; specify the disease _____
5. Urgency of the surgery

- I. Elective
- II. emergency

Part II: Questions about anesthetic and surgical characteristics of the patient.

6. Type of surgery

I. Orthopedics

- II. Neurosurgery
- III. ENT
- IV. Gastrointestinal
- V. Gynecology
- VI. Thoracic
- VII. Urology
- VIII. Vascular
- IX. Obstetrics
- X. Endocrinology

7. Types of anesthesia used

- I. GA
- II. SA
- III. Sedation
- IV. Combined (specify it)

8. Types of anesthesia drug

- I. Total intravenous anesthesia
- II. Inhalation
- III. Intravenous and inhalation

Part III. Question about preoperative heart rhythm

9. Preoperative heart rate _____

10. Preoperative blood pressure _____

Part IV: Questions about intra operative characteristics of patients

11. Total amount fluids administered _____ ml

12. Is administered fluid warmed?

I. Yes

II. No

13. Amount of intraoperative blood loss in ml _____

14. Is blood transfused?

I. Yes

II. No

15. If yes, Amount of blood transfused in ml

I. ≤ 500 ml

II. >500 ml

16. Duration of surgery in minute _____

17. Duration of anesthesia in minute _____

18. Complication of surgery if any _____

19. Complication of anesthesia, if any _____

Part V. Question about Intraoperative heart rhythm

20. Intraoperative heart rate (measure every 15 minute) I. 1st fifteen minute

II. 2nd fifteen minute

III. 3rd fifteen minute

IV. 4th fifteen minute

V. 5th fifteen minute

VI. 6th fifteen minute

21. If the heart rate is >100 and <60 , what is the reason _____

22. Intraoperative blood pressure _____

23. Intraoperative rhythm of the heart (every fifteen minute)

I. Sinus rhythm

II. Not sinus rhythm

24. If not sinus rhythm, what is the reason _____

25. Hemodynamic status of a patient during the arrhythmia episode

I. Stable

II. Unstable

26. Another sign and symptoms of instability

- I. Desaturation from baseline
- II. Change in mentation
- III. Sign and symptoms of myocardial ischemia
- IV. Other
- V. None