



“INTRA-OPERATIVE INCIDENCE OF ARRHYTHMIAS IN PATIENTS UNDERGOING NON-CARDIAC SURGERIES UNDER GENERAL ANAESTHESIA– A PROSPECTIVE OBSERVATIONAL STUDY”

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ABSTRACT **Background:** General anesthesia (GA) has been considered a safe anesthetic technique for surgery. Intraoperative cardiac arrhythmias are common in patients receiving general anesthesia due to various factors. These arrhythmias mostly have stable hemodynamics and only very few needs treatment. In our study we investigated the incidence of arrhythmia and the precipitating factors which is significant in causing arrhythmia. **Methods:** This prospective, observational study was conducted in 80 patients who received general anesthesia for various surgical procedures. Patient's data such as age, gender, weight, height, comorbidities, laboratory tests, ECG reports were collected. **Result:** Arrhythmias were observed in 70 (87.5%) of 80 patients. The most occurred arrhythmia was Sinus tachycardia in 40 patients (50.0%), Sinus bradycardia was seen in 13 patients (16.25%) followed by PVCs and sinus tachycardia in 5 cases (6.25%), Supraventricular tachycardia in 5 (6.25%), Sinus arrhythmia in 4 (5.0%), Atrial ectopic in 2 (2.5%), Atrial fibrillation in 1 (1.3%). 10 patients developed no arrhythmias intraoperatively. **Conclusion:** Arrhythmias are common under general anesthesia. In our study on 80 patients who received general anesthesia for non-cardiac surgeries, the incidence of intraoperative arrhythmias was 87.5% (70 patients). It can occur anytime during the procedure hence continuous close monitoring of the hemodynamics is mandatory.

KEYWORDS : General anesthesia, arrhythmias, endotracheal intubation, atrial fibrillation.

INTRODUCTION

General anaesthesia is a state achieved when a patient is given drugs that induce amnesia, analgesia, muscle paralysis, sleepiness¹.

Triad of General anaesthesia

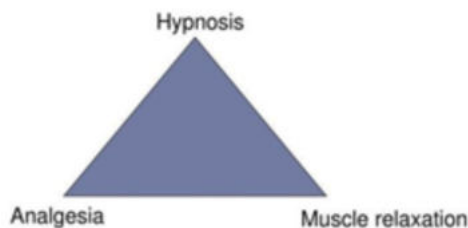


Figure 1: Triad Of General Anesthesia

Endotracheal intubation is a technique in which the endotracheal tube is inserted between the vocal cords through the trachea to provide ventilation^{1,2}. Early in the 1900's the endotracheal tube was first consistently utilized³. Endotracheal tubes are available in different sizes ranging from 2.5 to 10.5 mm internal diameter. For normal healthy adult male 8.5 size tube is used and for normal healthy female 7.5 tube is used⁴

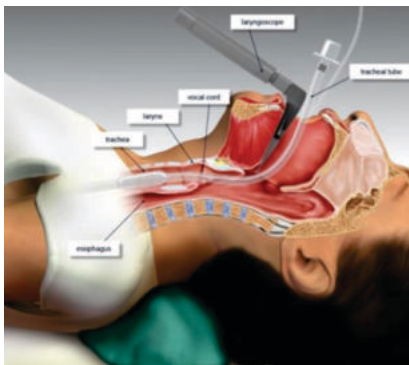


Figure 2: Representation Of Endotracheal Intubation

One of the most commonly occurring cardiovascular complications during anaesthesia is arrhythmia⁶. Compared to spinal anaesthesia, the incidence of peri- operative arrhythmias is higher in general anaesthesia. Under general anaesthesia arrhythmias are quite common and most of these peri-operative arrhythmias are hemodynamically stable and only few of them need treatment⁷. It has been found to occur in 70% of patients receiving general anaesthesia⁸ with a multifactorial origin⁹.

ARRHYTHMIA:

The term "arrhythmias" refers to an abnormal heartbeat. Heart rhythms other than a normal sinus rhythm are considered abnormal. The normal sinus rhythm involves the generation of an impulse in the sinoatrial (SA) node, transmission via and slowing of the impulse through the atrioventricular node (AV), then it travels through the bundle of His to its left and right branches, and then ultimately to the Purkinje fibres. Any deviation from this conduction pathway is referred as arrhythmia¹⁰. Arrhythmias can be categorized using several factors. The most typical way to classify them is based on the rate of conduction, which can be divided into

1. Bradycardia (HR < 60 beats/ minute(bpm) with irregular rhythm)
2. Tachycardia (HR >100 beats/ minute with irregular rhythm).



Figure:3 Normal Sinus Rhythm

Tachycardia:

An irregular rhythm with a ventricular heart rate (HR) of 100 beats/ minute or above is referred to as a tachycardia. In accordance with the source of the arrhythmia, it can also be divided into:

Supraventricular Tachycardia (SVT): Arrhythmia originating above the AV node (from atrial origin or AV junction origin). Types include

- Atrial fibrillation
- Atrial flutter
- Atrial tachycardia
- Atrial premature complex
- Atrioventricular nodal reentrant tachycardia (AVNRT)
- Atrioventricular reentrant tachycardia (AVRT)
- AV junctional extrasystoles^{11,12}

During atrial fibrillation (AF), the atria discharge at a rate between 300

and 600 bpm. F waves are present instead of the P waves¹³. Atrial fibrillation is the most encountered arrhythmia in the United States. More than 20% of the general population will experience it at some point in their lives¹⁴. Incidence of AF in the perioperative period is higher among the elderly group of patients¹⁵. It can complicate the perioperative period¹⁶. In atrial flutter the atria discharge at a rate between 250 and 300 per minute and there will be no isoelectric line between atrial deflections or F waves leading to sawtooth appearance, which is seen in lead II, III and avF. It is less common compared to AF¹⁷

Atrial Fibrillation (AF)



Figure:4 Atrial Fibrillation

Ventricular Tachycardia (VT): The AV node is below where the arrhythmia originates.

- Ventricular fibrillation
- premature ventricular beats (PVC)
- Ventricular tachycardia (sustained or non-sustained)¹⁸

The following categories of tachyarrhythmias can be made based on the duration of the QRS complex:

When the duration of QRS is < 120 milliseconds, there is a narrow QRS complex tachycardia.

- Sinus tachycardia
- Atrial tachycardia
- Atrial flutter
- Tachycardia with atrioventricular nodal reentrant (AVNRT)
- Reentrant atrioventricular tachycardia (AVRT)

Sinus tachycardia is referred as HR > 100 bpm following a regular rhythm. Pain, fever, hypercarbia and hypovolemia or inadequate anesthetic depth are major causes of sinus tachycardia.



Figure:5 Sinus Tachycardia

Wide QRS complex tachycardia, also known as monomorphic ventricular tachycardia, polymorphic ventricular tachycardia, or ventricular fibrillation, is characterized by a QRS duration of <120 milliseconds.

BRADYARRHYTHMIAS:

Bradycardia, which includes atrioventricular (A-V) blocks and sinus node abnormalities, is characterized by a HR <60 bpm¹⁹.

- Sinus Bradycardia

It is referred as HR < 60 bpm with a regular rhythm. Athletes may experience it physiologically²⁰. It is usually present without symptoms. If pathological, it may cause dizziness. Autonomic disruption, particularly vasovagal stimulation, is the most frequent cause of sinus bradycardia. Hypoxia increases ICP, hypothermia is also associated with bradycardia²¹.



Figure 6: Sinus Bradycardia

- Atrioventricular Blocks:

Depending on the conduction of atrial impulses to the ventricles, it is classified into first-, second- and third-degree AV blocks.

1. First degree AV block

The conduction of the atrial impulse to the ventricles is delayed and results in P-R interval prolongation.

2. Second degree AV block

The conduction of atrial impulses to ventricles is intermittently blocked. It is further classified into Mobitz type I also called as Wenkebach and Mobitz type II block.

3. Third degree AV block

It occurs when the conduction of atrial impulses to the ventricles is completely blocked²².

CAUSES OF INTRAOPERATIVE ARRHYTHMIA:

Three categories-patient, surgical procedure, and anesthesia can cause intraoperative arrhythmia. It is substantially more common in patients with cardiac illness than in those who are healthy. Patients with intracranial illness could have abnormal(ECGs)²³. Electrolytes or blood gas abnormalities, Central venous cannulation, stimulation of the autonomic nervous system can result in arrhythmias. Endotracheal intubation is one of the precipitating factors in causing intraoperative arrhythmia which accompanies hemodynamic disturbances by autonomic reflexes.²⁴

AIMS AND OBJECTIVES

AIM:

The aim of this prospective study is to monitor the incidence of intraoperative arrhythmias in patients undergoing non cardiac surgeries under General anesthesia.

OBJECTIVES:

PRIMARY OUTCOME:

The objective of the study is to monitor the incidence of intraoperative arrhythmias

SECONDARY OUTCOME:

- To observe the ECG changes to identify which arrhythmia occurs most commonly in the intraoperative period
- To determine the precipitating factor which contributes more to causing arrhythmias in non-cardiac patients.

MATERIALS AND METHODS

Study Design: A prospective observational study

Study Period: Period of five months between February to June 2022

Study Population: Patients who underwent non cardiac surgeries general anaesthesia

Inclusion Criteria:

- Age >18 years
- ASA physical status I-IV
- Both elective and emergency surgeries
- Both male and female patients

Exclusion Criteria:

- Surgeries under spinal anaesthesia and peripheral nerve blocks are excluded.
- Ophthalmic surgeries.
- Cardiac surgeries.
- Pregnant patients were excluded in the study

Ethical Clearance:

Obtained from Institutional Human Ethics Committee (Ref No IHEC-I/0626/22).

Study Procedure:

This prospective study was conducted for a period of five months in the Department of Anesthesiology and critical care, CHRI, Kelambakkam. Informed consent was obtained from all the patients who were enrolled in this study. The study included both major and minor type of surgeries under general anesthesia. Pre anesthetic checkup will be done, and all necessary investigations were taken for the patients who were assessed under ASA I – I, planned to receive general anesthesia were included in this study.

Once the patient is received in pre-operative unit, patients were assessed again and shifted to operation theatre for proposed surgery. All hemodynamic monitors like pulse oximetry (SpO₂), 3 lead ECG, automatic non-invasive blood pressure at three-minute intervals was connected and closely monitored. Patients were pre-oxygenated for 3 minutes followed by premedication drugs, induction agents, skeletal muscle relaxants given to the patients according to an anesthesiologist preference. Lead II of ECG detects arrhythmia in patients so it was continuously monitored for analyzing the incidence of arrhythmia. Arrhythmias can occur anytime during surgery, so ECG waveforms was closely monitored to detect arrhythmias and any form of abnormalities was noted. After analyzing the ECG waveforms, the type of arrhythmia was documented.

RESULTS
Descriptive Statistics, Frequency And Chi-square Test .

Table 1 Frequency Table For Age Groups

Age group (In years)	Frequency	Percent	Valid Percent
> 60	10	12.5	12.5
18-30	27	33.8	33.8
31-45	31	38.8	38.8
46-60	12	15.0	15.0
Total	80	100.0	100.0

The above table (1) describes the frequencies for different age groups. 12.5% patients were aged above 60 years, 33.8% were aged between 18-30 years, 38.8 % were aged between 31- 45 years, 15.0% were between 46-60 years.

Table 2: Frequency Table For BMI

BMI ranges	Frequency	Percent	Valid Percent
Normal weight = 18.5-24.9	34	42.5	42.5
Obesity= >30	18	22.5	22.5
Overweight= 25-29.9	25	31.3	31.3
Underweight = <18.5	3	3.8	3.8
Total	80	100.0	100.0

The table (2) shows that among 80 patients, 42.5% (34patients) have normal BMI value, 22.5% had obesity, 31.3 % had overweight, 3.8% have underweight.

Table 3: Frequency Table For Diabetes Mellitus

DM	Frequency	Percent	Valid Percent
No	70	87.5	87.5
Yes	10	12.5	12.5
Total	80	100.0	100.0

The table (3) shows that only 10 patients had Diabetes mellitus and other 70 patients had no Diabetes mellitus in this study.

Table 4: Frequency Table For Hypertension

Hypertension	Frequency	Percent	Valid Percent
No	65	81.3	81.3
Yes	15	18.8	18.8
Total	80	100.0	100.0

The table (4) shows that among 80 patients, 65 (81.3%) have hypertension and 15 patients had no hypertension.

Table 5: Frequency Table For Induction Agent

Induction agent	Frequency	Percent	Valid Percent
Etomidate	1	1.3	1.3
Propofol	78	97.5	97.5
Thiopentone sodium	1	1.3	1.3
Total	80	100.0	100.0

The table (5) shows that etomidate was used in 1 (1.3%), propofol was used in 78(97.5%), Thiopentone sodium was used in 1 (1.3%).

Table 6: Frequency Table For Types OfARRHYTHMIAS

Type of arrhythmia	Frequency	Percent	Valid Percent
Atrial ectopic	2	2.5	2.5
Atrial fibrillation	1	1.3	1.3
Nil	10	12.5	12.5
Premature ventricular contractions (PVC), ST	5	6.3	6.3
Sinus arrhythmia	4	5.0	5.0

Sinus bradycardia	13	16.3	16.3
Sinus tachycardia	40	50.0	50.0
Supraventricular tachycardia (SVT)	5	6.3	6.3
Total	80	100.0	100.0

Table (6) shows that 2.5 % patients had atrial ectopic, 1.3% had atrial fibrillation, 12.5% had no arrhythmias, 6.3% had PVC and Sinus tachycardia, 5.0% had sinus arrhythmia, 16.3% had sinus bradycardia, 50.0% had sinus tachycardia and 6.3 % had supraventricular tachycardia.

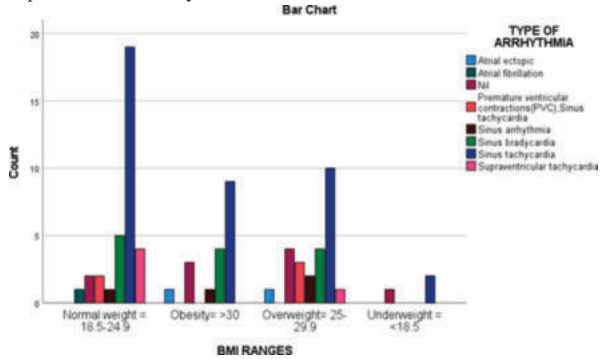


Figure 7: Graphical Representation Of Type Of Arrhythmias Between Different BMI Groups.

Table 7: Cross Tabulation Between Asa And Type Of Arrhythmia

ASA	TYPE OF ARRHYTHMIA							Total	
	Atrial ectopic	Atrial fibrillation	Nil	PVC ST	Sinus arrhythmia	Sinus bradycardia	ST SVT		
I	0	0	3	0	2	5	14	5	29
II	0	1	5	3	1	7	21	0	38
III	2	0	2	2	1	1	5	0	13
Total	2	1	10	5	4	13	40	5	80

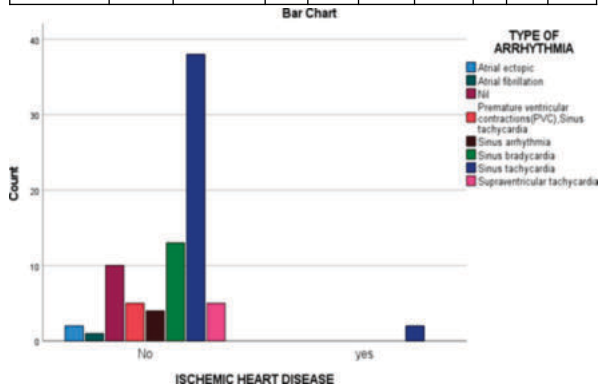


Figure 8: Graphical Representation Of Type Of Arrhythmias In IHD

The above figure shows that the significant value is 0.957 which is greater than 0.005. Therefore, there is significant relationship between IHD and arrhythmias.

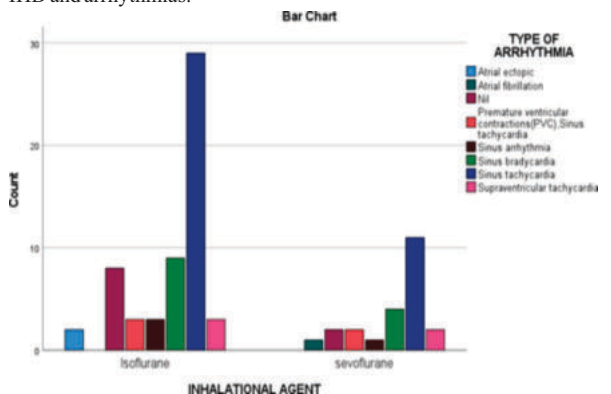


Figure 9: Graphical Representation Of Type Of Arrhythmias Between Inhalational Agents.

DISCUSSION

General anesthesia has been considered as safest anesthetic technique for various surgeries. Intraoperative cardiac arrhythmias are common in patients receiving general anesthesia due to various factors. These arrhythmias mostly have stable hemodynamics and only very few needs treatment. In this prospective study the incidence of intraoperative arrhythmias was observed in 70 (87.5%) of 80 patients. Among these most of them were Sinus tachycardia which was seen in 40 patients (50.0%), followed by Sinus bradycardia which was seen in 13 patients (16.25%) followed by Premature ventricular contractions and sinus tachycardia in 5 cases (6.25%), Supraventricular tachycardia in 5 (6.25%), Sinus arrhythmia in 4 (5.0%), Atrial ectopic in 2(2.5%), Atrial fibrillation in 1 (1.3%). In most of the cases sinus tachycardia occurred during endotracheal intubation or during extubation which reverted spontaneously without any treatment. Bradycardia was noted during surgical stimulations or in response to abdominal manipulations.

J L Seltzer et al studied 20 adult patients and reported that tachycardia was seen in 16 patients and bradycardia were seen in 3 patients during traction on the abdominal mesentery. The study also showed that no severe bradycardia was seen during the traction.

In our study, one patient with a history no comorbidities developed severe sinus bradycardia (HR- 35 bpm) during surgery which was treated with Injection atropine 0.6mg iv.

Jungpil Yoon et al (2017) conducted a study associated with factors during volatile induction of general anesthesia with sevoflurane on 950 adult patients and discovered that 164 patients (17.3%) out of 950 patients had developed arrhythmia. Premature ventricular contractions were seen in 17 patients (10.4%), sinus bradycardia in 15 patients (9.1%), premature atrial contractions in 11 patients (6.7%), and sinus tachycardia in 77 patients (47.0%) and junctional rhythm in 46 patients (28.0%). Age, CAD, COPD, induction with a maximum concentration of 8% volume of sevoflurane, and its persistence following the loss of eyelid reflex were all independently linked with the incidence of arrhythmia during induction with sevoflurane, according to the analysis of this study. This study showed that Sinus tachycardia is the most frequently encountered arrhythmia in the intraoperative period. Compared with our study, age, CAD, COPD, use of higher concentrations of sevoflurane during induction has no significant relationship in causing arrhythmias.

Gaurav Agarwal et al studied the prevalence of different types of arrhythmias in 100 patients (60 males and 40 females) of type 2 DM. Sinus tachycardia (ST) was the most common arrhythmia which was seen in 32% of individuals. 20% of patients had atrial fibrillation, 15% had sinus bradycardia, and 10% had complete heart block (AF). 10% of patients had Ventricular Premature Complexes (VPCs), and 3% had Atrial Premature Complexes (APCs). 1% had Paroxysmal Supra Ventricular Tachycardia (PSVT), 1% had Ventricular Tachycardia, and 3% had first-degree AV block (VT). Arrhythmias were more common when diabetes and co-morbidities were poorly managed. The study showed that arrhythmia incidence was greater in hypertension or IHD patients, especially for atrial fibrillation and VPCs. Similarly, this study shows that Diabetes mellitus (DM) is one of the precipitating factors in causing arrhythmias intraoperatively, the factor showed significant relationship (p value = 0.002)

Majority of inhalational anesthetics are associated with cardiac arrhythmias. Halothane use is linked to numerous arrhythmias, such as atrial, nodal, or ventricular tachycardia when used to induce or maintain anesthesia²⁵. However halothane is not used in current day practice due to its disadvantages. **D.H. Green et al** reported incidence of nodal rhythm (20%) and bradycardia during inhalation induction of anesthesia with sevoflurane in healthy unpremeditated infants²⁶. Our study shows use of sevoflurane or isoflurane during induction has no significant relationship in causing arrhythmia.

Higher the ASA grade, the risk of developing arrhythmias is increased. ASA has significant relationship in causing arrhythmia (p value=0.024). These intraoperative arrhythmias have a multifactorial origin. Most of the cases in our study had stable hemodynamics and not needed any treatment, only very few cases needed treatment.

CONCLUSION

Arrhythmias are common under general anesthesia. In our study on 80 patients who received general anesthesia for non-cardiac surgeries, the

incidence of intraoperative arrhythmias was 87.5% (70 patients). The statistical analysis of our study has showed that the factor ASA and diabetes mellitus have significant relationship in causing intraoperative arrhythmias. These arrhythmias can occur anytime during the surgery without any warning signs hence continuous close monitoring of the hemodynamics is mandatory to detect arrhythmias and rule out the precipitating factor.

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