Original Article

DOI: 10.7860/JCDR/2024/67217.19224

Anaesthesia Section

Perioperative Dysrhythmias in Adult Patients for Non Cardiac Surgery: A Prospective Cohort Study

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ABSTRACT

Introduction: The vulnerable perioperative period is prone to the development of a heterogeneous group of conditions characterised by abnormal electrical activity in the heart, termed as cardiac dysrhythmias.

Aim: To determine the incidence of dysrhythmias in the perioperative period, identify predisposing factors, evaluate the effect of anaesthesia, analyse haemodynamic consequences, and document the treatment provided.

Materials and Methods: A prospective cohort study involving 9666 adult patients undergoing non cardiac surgery was conducted in the Department of Anaesthesiology at Lokmanya Tilak Municipal College and General Hospital, Sion, Mumbai, Maharsahtra, India from January 2012 to December 2013. Parameters studied included preoperative clinical data (history, examination, and relevant investigations), type of anaesthesia, occurrence of dysrhythmias, and clinical outcomes of persistent dysrhythmias or those requiring treatment. Data was collected prospectively and analysed using Statistical Package for Social Sciences (SPSS) software version 15.0.

Results: The overall incidence of dysrhythmias was 1.2%. Consistent factors included age over 40 years (68.1%), male gender (52.59%), gastrointestinal and orthopaedic procedures (65.5%), preoperative hypertension (25%), and patients receiving general anaesthesia (61.2%). Most patients were classified as American Soceity of Anaesthesiologists (ASA) Class-I and II (93.97%) and underwent elective surgery (61.21%). The majority (81.89%) of dysrhythmias occurred intraoperatively and were ventricular in origin (68.97%). Unstable haemodynamic conditions [Systolic Blood Pressure (SBP) <90 mmHg, Heart Rate (HR) <50/min and/or Ventricular Premature Contraction (VPCs) >5/min or multifocal VPCs)] were observed in 56.9% of patients. Of patients with ventricular dysrhythmias, 57% exhibited unstable haemodynamics. Treatment was provided to 84.48% of patients, with 74.14% responding positively, leading to the termination of dysrhythmias. Anticholinergics were used in 40.52% of treatment modalities. The majority of dysrhythmias were transient 80 (68.9%) patients, and 83 of patients had a favourable outcome. Unfortunately, 5 (6.9%) of patients could not be revived, with three patients 3 (2.5%) succumbing in the operating room. Mortality was not directly linked to the dysrhythmia but was due to underlying causes.

Conclusion: Transient intraoperative ventricular cardiac dysrhythmias are common in adult patients undergoing noncardiac surgeries. Therefore, it is crucial to identify high-risk patients, analyse contributing factors, and promptly correct issues under expert medical guidance.

Keywords: Analysis, Arrhythmias, Ventricular cardiac dysrhythmias

INTRODUCTION

The groundbreaking work of August Desir Waller (1856-1922) and Willem Einthoven (1860-1927) revolutionised the study of dysrhythmias with the introduction of the Electrocardiogram (ECG). Through the utilisation of the ECG, cardiac rhythm disorders were initially characterised [1]. Dysrhythmias are commonly observed in the perioperative period among patients undergoing non cardiac surgery, with reported incidences of new-onset dysrhythmias ranging from 0.37% to 20% [2]. While dysrhythmias are often benign, transient, and self-limiting, they can also result in haemodynamic instability necessitating prompt intervention, underscoring the importance of accurate diagnosis and treatment by the anaesthesiologist [3].

Moreover, the identification of high-risk patients, outpatient cardiological follow-up, and the implementation of personalised perioperative monitoring are essential for ensuring patient safety [4]. Existing literature reveals significant discrepancies regarding the types of arrhythmias studied, patient groups, monitoring techniques, and associations considered, thus hindering interpretation [5,6]. Therefore, the present study was undertaken to determine the incidence, predisposing factors, critical periods, impact of anaesthesia, haemodynamic instability, and treatment approaches for perioperative dysrhythmias.

MATERIALS AND METHODS

A prospective cohort study was conducted at Lokmanya Tilak Municipal Medical College and General Hospital, Sion, Mumbai, Maharsahtra, India,from January 2012 to December 2013, following Ethics Committee approval and written informed consent from all participants. All procedures adhered to the ethical guidelines of the Declaration of Helsinki, with Ethics Committee Approval number SRS101144.

Inclusion and Exclusion criteria: A total of 9,666 adult patients who underwent non cardiac surgery during the specified period were included in the study. Inclusion criteria comprised individuals aged 18 years and above, of any gender, scheduled for non cardiac surgery, and administered general anaesthesia with an endotracheal tube, Laryngeal Mask Airway (LMA), central neuraxial blockade {Subarchnoid Block (SAB), Combined Spinal Epidural (CSE)}, or Total Intravenous Anaesthesia (TIVA). Obstetric and paediatric patients were excluded from the study.

Study Procedure

Preoperative evaluation included demographic data [age, sex, Body Mass Index (BMI)], medical history of co-morbidities (hypertension, diabetes mellitus, ischaemic heart disease, cerebrovascular accident), addiction history (smoking, alcoholism), and relevant family history, along with a comprehensive physical examination. Routine investigations such as haemogram, blood sugar levels, liver and renal function tests, and specific tests like serum electrolytes, chest X-ray, ECG, and echocardiogram were conducted based on history and examination findings. Patients on chronic medications received their morning doses as appropriate. In the operating room, monitors were attached, and vital parameters were recorded. The type of anaesthesia, perioperative care, invasive monitoring, Intensive Care Unit (ICU) referral, and clinical decisions were at the discretion of the managing anaesthesiologist. Monitoring included Peripheral Oxygen Saturation (SPO_2), pulse rate, heart rate, blood pressure, End-tidal Carbon Dioxide ($EtCO_2$), Central Venous Pressure (CVP), ECG, and temperature, tailored to the patient's condition and surgical requirements. For central neuraxial blocks, the achieved block level was documented. Dysrhythmias were monitored throughout the procedure, with a separate analysis sheet utilised whenever dysrhythmias occurred.

Definitions: Normal sinus rhythm was defined as the default heart rhythm with pacemaking impulses originating from the sinoatrial node, resulting in a regular, narrow-complex heart rhythm on ECG at 60-100 bpm (beats per minute), with each QRS complex preceded by a normal P-wave axis. Any deviation from this was considered an irregular rhythm and an abnormal preoperative ECG finding [5,7]. Normal blood pressure was within the range of 90/60 mmHg to <140/90 mmHg, with hypertension defined as 140/90 mmHg or higher and hypotension as below 90/60 mmHg. These categories were based on Blood Pressure (BP) readings confirmed by two or more readings (averaged) made on atleast two separate occasions [5,8]. Unstable haemodynamics during dysrhythmias necessitating intervention were characterised as symptomatic bradycardia (pulse rate <50 bpm), systolic blood pressure <90 mmHg, a drop in blood pressure of 30% or more from baseline, and significant Ventricular Premature Contractions (more than 5 VPCs per minute).

STATISTICAL ANALYSIS

Data entry was performed using Excel, and data analysis was conducted using SPSS Software version 15.0. The results were analysed utilising descriptive statistics, and qualitative data were presented through frequency and percentage tables.

RESULTS

A total of 9,666 adult patients underwent non cardiac surgery over a two-year period. Among them, 116 patients developed dysrhythmias, accounting for an overall incidence of 1.2%. Demographically, 68.10% of the patients were over 40 years of age, with a slightly higher male preponderance compared to females. Among patients with dysrhythmias, 75.86% had Body Mass Index (BMI) values within the normal range [Table/Fig-1].

Parameters	Frequency	Percentage (%)
Age (years)		
Less than 40	37	31.9
40 to 65	58	50
More than 65	21	18.1
Gender		
Male	61	52.59
Female	55	47.41
BMI (kg/m²)		
< 18.5	9	7.76
18.5-27	88	75.86
>27	19	16.38

[Table/Fig-1]: Demographic characteristics of the patient.

Other co-morbidities included valvular heart disease in 2 (1.72%) patients, hypothyroidism in 2 (1.72%) patients, pulmonary Koch's in 4 (3.45%) patients, hyperthyroidism in 2 (1.72%) patients, bronchial asthma in 6 (5.17%) patients, epilepsy in 1 (0.86%) patients, and myasthenia gravis in 1 (0.86%) patients.

Of the patients who developed arrhythmias, 39.7% had no co-morbidities, and 65% had no addiction history. Most patients had normal preoperative parameters such as pulse rate, blood pressure, preoperative ECG, and serum potassium levels. Preoperatively, 99 patients (85.34%) were normotensive on the day of surgery. The majority of patients belonged to American Society of Anaesthesiologists (ASA) Class I and II, with only 6% falling under ASA Class III and IV [Table/Fig-2].

Parameters	Frequency	Percentage (%)
Co-morbidities		
Hypertension	29	25.00
Diabetes milletus	13	11.20
Ischaemic heart disease	6	5.17
Cerebrovascular accident	4	3.45
Others*	18	15.49
None	46	39.69
Addiction		
Alcoholic	7	6.03
Smoker	21	18.10
Tobacco chewer	12	10.34
Nil	76	65.52
Preoperative pulse rate (/min)		
Bradycardia (<60)	2	1.72
Normal (60-100)	98	84.48
Tachycardia (>100)	16	13.79
Rhythm		
Regular	107	92.24
Irregular	9	7.76
BP (mmHg)		
Hypotension	5	4.31
Normal (<140/90)	99	85.34
Hypertension	12	10.34
Preoperative ECG findings		
Within normal limits	79	68.10
Abnormal	37	31.90
Serum potassium		
Normal (3.3-5.4 mmol/L)	103	88.79
Hypokalaemia	11	9.48
Hyperkalaemia	2	1.72
ASA grade		
I	63	54.31
II	46	39.66
III and IV	7	6.03

[Table/Fig-2]: Preoperative factors and dysrhythmias [9].

The majority of dysrhythmias occurred during gastrointestinal procedures, followed by orthopaedic surgeries. Among the patients, 61% were undergoing elective surgery, while 39% had emergency surgery. Patients receiving general anaesthesia had a higher occurrence of dysrhythmias (56%) compared to those receiving neuraxial blockade. In three patients, surgery was postponed due to dysrhythmias occurring preinduction. Factors such as duration of surgery, blood loss, or fluid infusion volume did not appear to contribute to dysrhythmias [Table/Fig-3].

Parameters	Frequency	Percentage
Type of surgery		
Gastrointestinal	50	43.10
Orthopaedic	26	22.41
Gynaecological	14	12.07
Others	26	22.42
Nature of surgery		
Elective	71	61.21
Emergency	45	38.79
Choice of anaesthesia		
Anaesthesia not given	3	2.59
#GA with endotracheal intubation	65	56.03
SAB	31	26.72
CSE	8	6.90
GA with epidural	6	5.17
TIVA	3	2.59
Duration of surgery		
Procedure abandoned	10	8.62
Less than 3 hours	55	47.41
3 to 5 hours	38	32.76
More than 5 hours	13	11.21
Blood loss		
Less than 300 mL	53	45.69
300 to 1000 mL	41	35.34
More than 1000 mL	12	10.34
Surgery postponed	10	8.62
Intravenous fluid infusion		
Upto 1000 mL	50	43.10
1000 to 2000 mL	54	46.55
More than 2000 mL	12	11.21

[Table/Fig-3]: Effect of surgery and anaesthesia [25].
#GA: General anaesthesia; SAB: Subarachnoid block; CSE: Combined spinal epidural; TIVA: Total intravenous anaesthesia

Ventricular dysrhythmias, primarily VPCs, occurred in 80 patients, with two patients experiencing both atrial and ventricular dysrhythmias. A total of 95 patients developed dysrhythmias intraoperatively, with one patient experiencing dysrhythmia in the preoperative, intraoperative, and postoperative periods. Postoperatively, 10 (8%) patients had dysrhythmias, all occurring within six hours postoperatively. Haemodynamic instability was noted in 66 (57%) patients. Total 80 (68.9%) patients had transient dysrhythmias lasting less than 30 minutes, while 36 patients had persistent dysrhythmias with a maximum duration of 48 hours postoperatively [Table/Fig-4].

Parameters	Frequency	Percentage
Type of dysrhythmia		
Atrial	34	29.31
Atrial+Ventricular	2	1.72
Ventricular	80	68.97
Occurrence of dysrhythmia		
Prior to induction	11	9.48
Intraoperatively	95	81.89
Postoperatively	10	8.62
Haemodynamics parameters		
Stable	50	43.10
Unstable	66	56.90
Treatment received		
Yes	98	84.48
No	18	15.52
Duration of dysrhythmias		
Persistent	36	31.03
Transient	80	68.97

[Table/Fig-4]: Dysrhythmia analysis.

Anticholinergic agents (inj. Glycopyrrolate and inj. Atropine) were the most commonly used treatment in 47 (40.52%) patients, with 86 (74.14%) patients responding well to the treatment received. Treatment modalities for transient dysrhythmias included a single dose of anticholinergics, beta blockers, lignocaine, intravenous fluid bolus, deepening the plane of anaesthesia, and continued monitoring. For persistent cases, continuous infusion of inotropes and amiodarone in addition to a single bolus dose were administered. Simple maneuvers such as changing ventilatory settings, slight withdrawal of the endotracheal tube, and local anaesthetic infiltration of the surgical site helped terminate dysrhythmias in 24 patients who did not require treatment [Table/Fig-5].

Treatment received	Frequency	Percentage
B- blockers (Inj. Metoprolol/Esmolol)	4	3.45%
Cardiopulmonary Resuscitation (CPCR)	4	3.45%
Direct current shock 200 J	3	2.59%
Deepened plane of anaesthesia	5	4.31%
Inj. Adrenaline	10	8.62%
Inj. Aminophylline	1	0.86%
Inj. Amiodarone	5	4.31%
Inj. Atropine	22	18.97%
Inj. Glycopyrrolate	25	21.55%
Inj. Potassium chloride	12	10.34%
Inj. Lignocaine hydrochloride	21	18.10%
Inotropes	10	8.62%
Intravenous Fluid Bolus (IVF)	13	11.21%
Vasopressor (Inj. Dopamine/Noradrenaline)	6	5.17%
No treatment	24	20.69%

[Table/Fig-5]: Distribution as per treatment received.

Total 83 (71.55%) patients had a good outcome and were discharged from the Post Anaesthesia Care Unit (PACU). Total 25 patients required postoperative mechanical ventilatory support based on their general condition, co-morbidities, or surgical pathology. Total 5 (6.9%) patients eventually died while on ventilatory support, with 3 (2.5%) deaths occurring during surgery due to bone cement implantation syndrome, blood loss leading to unstable haemodynamics, and fluid shifts causing unstable haemodynamics.

DISCUSSION

Cardiac dysrhythmias are abnormalities in the normal activation sequence of the myocardium [2]. The overall incidence of dysrhythmias in the study was found to be 1.2%. The incidence ranges from 10-40% in cardiothoracic surgery and 4-20% in major non cardiothoracic surgery according to Walsh SR et al., with an incidence of greater than 90% for cardiac surgery and between 16.3 to 61.7% for non cardiac surgery [5,6].

Demographically, 58 patients who developed dysrhythmias belonged to the age group of 40-65 years. However, an increased incidence was noted in the age group of more than 60 years, with a predominance of supraventricular dysrhythmia [6,9,10]. A marginally higher number of male patients, compared to female patients, developed dysrhythmias. Walsh SR et al., Polanczyk CA et al., and Mathew B et al., have all identified male gender as a risk factor [6,9-11]. Approximately 76% of the patients had a BMI between 18.5-27 kg/m^2. However, a QTc interval of more than 0.42 seconds, an increased resting heart rate, and decreased heart rate variability are all predictors of sudden cardiac death and ventricular dysrhythmias in obese individuals [12]. The risk of atrial fibrillation and the number of abnormalities on Signal-averaged Electrocardiography (SAECG) increase with BMI [13]. This is possibly because the Institute where the study was carried out caters to patients from low socioeconomic strata and those who are nutritionally poor [Table/Fig-1].

Total 29 patients were hypertensive. Yildirir A et al., also found an increased incidence of ventricular premature beats and complex ventricular dysrhythmias in hypertensive patients [14]. Thirteen patients in the study had diabetes mellitus. Diabetes is a risk factor for myocardial infarction and ventricular dysrhythmias [15]. The autonomic neuropathy and sympathoadrenal discharge induced by hypoglycemia contribute to cardiac dysrhythmias. No patient developed hypoglycemia during the study period. Six patients had ischaemic heart disease. With myocardial ischaemia, there is a surge of sympathetic activity which is proarrhythmic, leading to supraventricular and ventricular tachydysrhythmias [16]. Four patients in the study had a history of cerebrovascular accident preoperatively. Patients with acute cerebrovascular lesions have a high incidence of dysrhythmias and ECG abnormalities according to the study by Francis DA et al., [17]. A total of 76 patients did not have an addiction, while 21 patients were smokers and seven were alcoholics. Cigarette smoking has been shown to accelerate atrioventricular node conduction, contributing to supraventricular dysrhythmias. There is a strong association between alcohol and dysrhythmias, mostly atrial fibrillation. Chronic alcohol abuse also produces electrolyte abnormalities. A total of 98 patients in the study had a preoperative pulse rate between 60-100 beats/min. Two different studies conducted by Amar D et al., collectively concluded that a faster preoperative heart rate, a lower vagal tone before surgery, and postoperative adrenergic hyperactivity or vagal withdrawal have been implicated in the pathogenesis of postoperative dysrhythmias [18,19]. Two patients had bradycardia and nine had an irregular rhythm in the preoperative period, which suggests that in the remaining 107 patients, there was the occurrence of new-onset dysrhythmias either intraoperatively or postoperatively. In contrast, the study by Walsh SR et al., suggests that new-onset dysrhythmias affect about 7% of patients following major non cardiothoracic surgery [6]. Low serum potassium (K+) levels can predict the development of perioperative dysrhythmias, and about one-third of new dysrhythmias had abnormal magnesium, sodium, or potassium levels in patients following colorectal surgery as shown in the study by Batra GS et al., [20]. ECG abnormalities like premature atrial complexes and left anterior hemiblock have been identified as risk factors for the development of postoperative dysrhythmias as concluded by Walsh SR et al., and Amar D et al., [6,18]. A total of 93.97% of patients belonged to ASA Class-I and II. However, ASA Class-III or IV as well as emergency surgery are identified as independent risk factors by Polanczyk CA et al., [Table/Fig-2] [9].

A total of 65.51% of dysrhythmias developed in gastrointestinal and orthopaedic procedures. The preponderance of dysrhythmias in gastrointestinal surgery can be attributed to major fluid shifts, electrolyte disturbances, sepsis, infection, and contributions from surgical pathology such as postoperative ileus, pain causing diaphragmatic splinting, traction on mesentery, or anastomotic leak as shown in a review based on pertinent publications by Pecha S et al., [4]. The orthopaedic patients are usually old, bedridden, and with multiple co-morbidities. Accordingly, Polanczyk CA et al., found a strong correlation for the development of supraventricular dysrhythmia depending on the type of procedure performed [9].

Total 56% of patients receiving general anaesthesia developed dysrhythmias intraoperatively in the study. Neuraxial blockade has physiological effects and benefits such as reducing the afterload of the heart, improved blood flow, improved ability to breathe free of pain, and reduction in surgical stress responses. The alteration of stress response is due to the use of neuraxial blockade rather than the avoidance of general anaesthesia. An overall reduction in mortality by a third was attributed to neuraxial blockade. There were reductions in deep vein thrombosis, pulmonary embolism, transfusion requirements, pneumonia, myocardial infarction, and renal failure [21]. Bratanow N and Atlee JL concluded that the incidence of significant dysrhythmias during general anaesthesia and surgery was found to be 61.7% [22].

Premature systoles have been observed with all anaesthetic techniques and agents (ether, cyclopropane, and halothane) as shown in a study by Barnes BJ and Hollands JM [23]. Ketamine can cause nodal dysrhythmia. Isoflurane causes ventricular dysrhythmias, while desflurane increases the heart rate. Sevoflurane, halothane, and isoflurane delay ventricular repolarisation and prolong the QT interval [3,5]. Halothane can sensitise myocardium to catecholamines. Bronchodilators stimulate adrenergic receptors and can exacerbate dysrhythmias. Drugs that induce brady dysrhythmias include beta-blockers, calcium channel blockers, amiodarone, clonidine, and dexmedetomidine [3,5].

As the duration of surgery prolongs, hypothermia sets in, trauma from tissue dissection, fluid shifts all result in acid-base and electrolyte disturbances that may lead to dysrhythmias as concluded by Pecha S et al., and Christians KK et al., [4,24]. They also inferred that intraoperative blood loss of 1 L or more is an independent correlate of supraventricular tachycardia in non cardiac thoracic surgery [24]. In contrast, the present study had 53 patients with blood loss of 300 mL or less. Twelve subjects received intravenous fluid of more than 1000 mL intraoperatively. A positive fluid balance was identified as a risk factor for atrial fibrillation as well as postoperative complications and in-hospital mortality was gathered by Moller AM et al., [Table/Fig-3] [25].

Ventricular dysrhythmias were observed in the majority of patients at 68.97%. Atrial fibrillation is the single most common dysrhythmia encountered following major non cardiothoracic surgery. Pooled data suggests that ventricular dysrhythmias are rare [6]. However, two small series from the United Kingdom (UK) suggest that ventricular dysrhythmias affect about 10% of patients, although most of these are simple ectopic beats. Malignant ventricular dysrhythmias (fibrillation or tachycardia) occurred in 3% of patients. Since ventricular premature contractions occur during the course of more serious dysrhythmias, their overall incidence is underestimated [20,26]. An article on postoperative dysrhythmias in general surgical patients concluded that haemodynamic compromise is uncommon and only a few patients require urgent cardioversion. In 20-30% of patients, no therapeutic intervention was required and the dysrhythmias were self-limiting [2].

Haemodynamic instability was found in 66 patients. A total of 98 patients received treatment because there is always a possibility of deterioration of rhythm and dysrhythmias turning into a more malignant form subsequently. Patients either received a single drug or combination depending on the response to treatment. The majority received anticholinergics. Therapeutic intervention was not required in 24% of patients. Simple maneuvers like changing the ventilatory settings, withdrawal of the endotracheal tube slightly helped terminate the dysrhythmias. A 72% of patients had a good outcome and were discharged. This is in accordance with Walsh

SR et al., that over 80% of patients with new-onset dysrhythmias revert to sinus rhythm prior to discharge [6]. They also concluded that the patients with dysrhythmia may warrant a longer duration of stay in critical care unit though it may be due to other underlying complication [9]. Although Polanczyk CA et al., did not report mortality, others reported a mortality of 20-50% in patients with new-dysrhythmias [9]. Of note, the dysrhythmia itself is rarely the cause of death but most patients succumb as a result of the primary cause thought to have evoked the dysrhythmia. In present study, in three patients there was death on table. In one patient, it was due to bone cement implantation syndrome, in other two, due to blood loss leading to unstable haemodynamics and fluid shifts [Table/Fig-4,5].

Usually, most intraoperative dysrhythmias are caused by simple, reversible factors [Table/Fig-6] [3,5,6,10,12,22,23,27,28]. The factors contributing to perioperative dysrhythmias are enumerated below:

- In the presence of catecholamines and hypercapnia, halothane potentiates dysrhythmias. Inhalational anaesthetics induce junctional rhythm. Pancuronium and gallamine, which are vagolytic, can cause tachycardia. Fentanyl, vecuronium, dexmedetomidine, and propofol may cause bradycardia. Repeated doses of suxamethonium can lead to sinus bradycardia, junctional rhythm, ventricular dysrhythmias, and asystole.
- Routine measures for preventing all intraoperative dysrhythmias include ensuring adequate oxygenation and ventilation, optimal $PaCO_2$, $PaCO_2$, acid-base balance, electrolyte levels, and temperature, as well as maintaining the depth of anaesthesia [27].
- The initial goal is haemodynamic stability. Treatment of tachydysrhythmias aims to slow the ventricular response. In cases of problematic bradydysrhythmias, the ventricular rate must be increased. The next goal is to restore sinus rhythm. If sinus rhythm cannot be achieved, preparations for antiarrhythmic drugs, anti-ischaemic drugs, pacing, and Direct Current (DC) shock should be made for treatment and prevention of complications [28].

Factors	Characteristics
Patient-related factors	Old age, anxiety, electrolyte disturbances, Hypertension, ischaemic heart disease, valvular heart disease, diabetes miletus-II, congestive heart failure
Surgery-related factors	Traction on mesentery, pressure on eyes, traction on extraocular muscles, blood loss, hypothermia, direct pressure on the vagus nerve, surgical stimulus in lighter planes of anaesthesia, full bladder, misplaced central lines, intravascular absorption of adrenaline
Anaesthesia-related factors	Laryngoscopy and tracheal intubation, inadequate pain relief, anaesthetic agents, haemodynamic changes (hypovolemia, hypoxemia, hypercarbia, acidosis, alkalosis), hypoglycaemia, mechanical irritation (by thoracic tube, endotracheal tube touching carina), Local Anaesthetic Systemic Toxicity (LAST)

[Table/Fig-6]: Causative factors of perioperative dysrhythmias [3,5,6,10,12,22,23, 27,28].

Limitation(s)

The present study had a few limitations. During the preoperative period, some episodes of dysrhythmias may have been missed since continuous Holter monitoring was not available. Although postoperative dysrhythmias can occur up to the first week, patients could not be kept in the Postanaesthesia Care Unit (PACU) for a week due to bed constraints. Patients were only admitted until their haemodynamic condition required it. Additionally, preoperative investigations were conducted according to institutional protocols and the patients' co-morbidities were taken into consideration. Furthermore, while there is a significant amount of literature on dysrhythmias in cardiac surgery, there has been limited research done on non cardiac surgery cohorts.

CONCLUSION(S)

New-onset intraoperative ventricular dysrhythmias are common in adult patients undergoing non-cardiothoracic surgery. Most of these dysrhythmias are transient and may not require treatment, but continuous observation is necessary. Symptomatic dysrhythmias that lead to unstable haemodynamic conditions should be promptly treated. Therefore, anaesthesiologists must integrate information from the patient's history, physical examination, and investigations to assess perioperative cardiac risk factors for dysrhythmias and provide individualised perioperative care. A clear understanding of the pathophysiology is essential for guiding future research on prophylactic, acute, and long-term interventions.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Aug 30, 2023
- Manual Googling: Nov 23, 2023
- iThenticate Software: Jan 26, 2024 (10%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Aug 28, 2023**
Date of Peer Review: **Nov 14, 2023**
Date of Acceptance: **Jan 30, 2024**
Date of Publishing: **Apr 01, 2024**