

Choice of Antiarrhythmics used in Different Arrhythmias Encountered in Patients undergoing PTCA and Clinical Outcome: A Retrospective Observational Study

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ABSTRACT

Introduction: Percutaneous Transluminal Coronary Angioplasty (PTCA), is a minimally invasive procedure that opens blocked coronary arteries to improve blood flow to the heart muscle. It is indicated in angina patients unresponsive to maximal medical therapy and in ST elevated Myocardial Infarction (MI). A variety of arrhythmias and conduction disturbances can occur during and after Percutaneous Coronary Interventions (PCI), which can be risk factors for increased morbidity and mortality.

Aim: To evaluate the choice of antiarrhythmics use in different arrhythmias encountered in patients undergoing PTCA and to assess the outcome.

Materials and Methods: This retrospective observational study was conducted by analysing the data of 139 patients aged between 40 to 70 years who underwent PTCA in the year 2023. The study was carried out over eight months from January 2023 to August 2023 at the Cardiology Department of Max Hospital, Dehradun, Uttarakhand, India, located in Jakhan. All patients who underwent PTCA at Max Hospital, Dehradun (including stable and unstable angina patients not responding to medical therapy and Myocardial infarction cases), were included in the study. The sample size consisted of 139 patients aged 40 to 70 years who underwent PTCA. Age and gender ratios were considered as demographic factors. Computer records were reviewed for data collection. Additionally, the attending cardiologist was consulted for observations and the treatment plan followed. The outcomes were assessed at admission, after

10 days, and one and a half months, for all drugs. The collected data results were analysed in terms of percentage and mean.

Results: In the present study, the most common arrhythmias were ventricular premature complexes, occurring in all patients who underwent coronary angioplasty. The second most common arrhythmia was atrial fibrillation, present in 111 (80%) cases. The remainder consisted of atrial flutter 7 (5%), atrial tachycardia 1 (1%), Ventricular tachycardia 7 (5%), and ventricular fibrillation 0.6 (1%), as well as bradyarrhythmia/conduction defects in 69 (50%) cases. Drugs such as Amiodarone, Mexiletine, Lidocaine, Sotalol/Metoprolol, Flecainide, magnesium supplements, and Atropine were used based on the type of arrhythmias. The incidence of complications decreased at admission, after 10 days, one and half month, and the mortality rate decreased after the administration of all the drugs in the present study. Quality of life showed improvement.

Conclusion: The most common arrhythmias occurring after PTCA were reperfusion arrhythmias, which were mostly self-limiting and resolved without treatment. Amiodarone was the most commonly used drug for both atrial and ventricular arrhythmias. Mexiletine was used for Ventricular Tachycardia, Flecainide for supraventricular arrhythmias, and Lidocaine for ventricular tachycardia not responsive to Cordarone. β -blockers were well-tolerated drugs used concomitantly with other antiarrhythmic drugs. The use of antiarrhythmic reduced morbidity and mortality after PTCA and improved the quality of life score.

Keywords: Antiarrhythmics, Arrhythmias, Morbidity, Mortality, Percutaneous transluminal coronary angioplasty

INTRODUCTION

Cardiac arrhythmias are a class of conditions that describe abnormalities in the heart's normal rhythm. They are a leading cause of morbidity and mortality after coronary interventions and can lead to stroke, deterioration of ventricular function, and sudden cardiac death [1]. Atrial fibrillation may be transient and without consequences, though it may lead to serious complications such as an increased risk of acute kidney injury, haemodynamic instability, cardiac failure, stroke, and death. A variety of tachyarrhythmias can occur during PCI. Lethal ventricular arrhythmias, including serious ventricular tachycardia and ventricular fibrillation, have been reported to occur in 1.5-4.4% of patients undergoing coronary angioplasty [2]. Of all patients who have an acute coronary syndrome, about 90% develop some form of cardiac arrhythmias. In 25% of patients, such rhythm abnormalities occur within the first 24 hours [3]. Arrhythmias can cause hypotension, breathlessness, activity limitation, or cardiac failure. Abnormal automaticity or impaired conduction, or both, underlie cardiac arrhythmias. Ischaemia, electrolyte and pH imbalance, mechanical

injury, stretching (due to heart failure), neurogenic and drug influences can cause arrhythmias by altering electrophysiological properties of cardiac fibres. Important mechanisms of cardiac arrhythmias are ectopic pacemaker activity, early and after depolarisations, re-entry circuits [4]. The widely used traditional-Vaughan Williams classification is based on electrophysiological therapy. Understanding the details of membrane action potential is crucial for both effective treatment and fewer side-effects. There are individualised recommendations for pharmacological therapy based on the patient's characteristics. Reduction in renal and hepatic function may have important implications for antiarrhythmic therapy. Most of the antiarrhythmic may induce bradycardia or may cause Atrioventricular (AV) conduction block. Caution is warranted in all patients with a history of syncope, sinus bradycardia, or Atrioventricular (AV) conduction disturbances, including PR prolongation [5]. Postoperative arrhythmias treatment depends on the type and severity of the arrhythmia. In some cases of arrhythmia, no treatment is necessary. The clinical significance of each arrhythmia depends on its duration, ventricular response rate,

underlying cardiac function, and co-morbidities [6,7]. Treatment options include medications, lifestyle changes, invasive therapies, electrical devices, or surgery [8]. A variety of drugs are available to treat arrhythmias. Because everyone is different, it may take trials of several medications and doses to find the one that works best. Various patient-related risk factors for postoperative arrhythmias are age, underlying structural heart disease, co-morbidities like obesity, previous stroke, and a history of Chronic Obstructive Pulmonary Disease (COPD). The surgery-related risk factors include trauma and inflammation, haemodynamic stress, ischaemic injury, preoperative use of beta-blockers and digoxin, electrolyte disturbances [9].

In view of the availability of antiarrhythmics with different mechanisms of action, there was a need to conduct a study in the patient population of Uttarakhand, specifically in the district of Dehradun at the multispecialty Max Hospital, to evaluate the clinical usefulness of the various drugs. This evaluation includes their benefits, contraindications, side effects, and dose modifications in patients with co-morbidities. The study aimed to determine the choice of antiarrhythmic use in different types of arrhythmias encountered in cardiac patients after PTCA in this area's population, considering pharmacokinetic and pharmacodynamic criteria for usage, and to further investigate the outcomes after treatment of arrhythmias.

MATERIALS AND METHODS

A retrospective observational study was conducted at the Department of Cardiology, Max Hospital, Dehradun, Uttarakhand, India, involving 139 patients in the age group of 40 to 70 years, who experienced post-PTCA arrhythmias. The study took place between January 2023 and August 2023, spanning a period of eight months. Data collection occurred from January 2023 to August 2023 for six months, and the results were analysed in the following two months, from July 2023 to August 2023.

Inclusion criteria: The study included all patients who underwent PTCA at Max Hospital Dehradun, including stable and unstable angina patients not responding to medical therapy, as well as cases of myocardial infarction.

Exclusion criteria: Patients who had pacemakers implanted were excluded from the study.

Sample size calculation: A total of 2800 patients were screened for PTCA arrhythmias over the study period, and patients available during the study duration were included using convenient sampling. A total of 139 patients admitted to the Coronary Care Unit (CCU) after undergoing PTCA were included in the study.

Study Procedure

The treatment data was collected from medical record files, and the outcomes were tabulated from the computerised saved data records. The results were analysed in terms of the types of post-PTCA arrhythmias, their incidence, clinically effective drugs, their dosages, side effects, contraindications and dose adjustment in comorbidities. According to hospital protocol, the endpoints after administering antiarrhythmics- such as shortness of breath, angina at rest/exertion at the time of admission were assessed. The incidence of complications like syncope, Acute Kidney Injury (AKI), Myocardial Infarction (MI), stroke leading to hospital readmissions, left ventricular dysfunction, and Electrocardiogram (ECG) improvement were evaluated in relation to morbidity after 10 days of admission. This information was obtained through verbal discussions with the cardiologist. Additionally, the outcomes were analysed in terms of total hospital stay time, episodes of sudden cardiac death and mortality, and quality of life, which were assessed within one and a half months of admission. This periodic assessment was conducted following hospital protocol, and the cardiologist was consulted for outcome information.

Tools such as the Medical Research Grading (MRC) of dysnoea [10], Canadian Cardiovascular Society Angina grading [11], Dukes treadmill score [12], and the Quality of Life Questionnaire [13] were used to assess the improvement in quality of life with the use of antiarrhythmic.

Assessment of Quality of Life: It was assessed by:

- A. MRC-Modified Medical Research Council Dyspnoea scale [10]: The mMRC breathlessness scale ranges from grade 0 to 4.

I only get breathless with strenuous exercise.	0
I get short of breath when hurrying on level ground or walking up a slight hill.	1
On level ground, I walk slower than people of my age because of breathlessness, or I have to stop for breath when walking at my own pace on the level	2
I stop for breath after walking about 100 yards or after a few minutes on level ground.	3
I am too breathless to leave the house or I am breathless when dressing/undressing.	4

- B. Angina Canadian Cardiovascular Society grading [11]:

- Angina with strenuous exertion.
- Angina with moderate exertion like walking or climbing stairs rapidly, walking uphill or in cold or wind, or emotional stress.
- Angina with mild exertion like walking one or two blocks on the level and climbing one flight of stairs at a normal pace.
- Angina with any level of physical exertion.

- C. Treadmill exercise test-Dukes treadmill score [12]: The Duke treadmill score is calculated as follows: DTS=exercise time in minutes (5x ST elevation in mm)-(4x exercise angina) (where 0=no angina, 1=non limiting angina, 2=exercise-limiting angina) (5xST segment deviation in mm)-4x angina index. A Duke treadmill score of 5 indicates low risk for cardiovascular events (predicted 4-year survival was 99%). Individuals in this population do not require further investigation with coronary angiography. A score of less than -10 indicates high risk for cardiovascular events (predicted 4-year survival was 79%). These patients require further investigation with coronary angiography. A score between 4 and -10 indicates intermediate risk.

Quality of Life in Cardiovascular Surgery (QLCS) questionnaire:

This questionnaire asks for the patient's opinion about their health, how they feel, and their ability to perform daily activities in the last 45 days. Patients are asked to rate their responses on a scale of 1 to 5 (1=Too Bad, 2=Bad, 3=Good, 4=Very Good, 5=Great) for the following questions:

1. How is the patient's performance in daily activities/work/school?
2. How is the patient's health after surgery?
3. How is the patient's physical capacity after surgery?
4. From an emotional point of view, how is the patient feeling?
5. In the relationship with family members, how is the patient feeling? Total: ____/25.

STATISTICAL ANALYSIS

The data was represented in Microsoft excel, statistically in terms of percentages and numbers. The Chi-square test was applied to assess the association between hospital stay and four outcomes: syncope episodes, recurring hospital admissions due to complications, ECG improvement cases, and left ventricular function improvement cases. The level of significance considered was p <0.05.

RESULTS

Age and gender-related demographic data were presented in [Table/Fig-1]. The majority of patients who underwent PTCA were in the age group of 50-60 years, accounting for 83 (59.71%) cases, with 28 patients (20%) each from the age groups of 40-50 and 60-70 years.

Variables	n (%)
Age (in years)	
40-50	28 (20)
50-60	83 (59.71)
60-70	28 (20)
Gender	
Female	42 (30)
Male	97 (70)

[Table/Fig-1]: Demographic details of the study subjects.

In [Table/Fig-2], reperfusion arrhythmias were observed in all 139 cases, and they spontaneously resolved. Supraventricular arrhythmias included atrial fibrillation in 111 (79.85%) cases, atrial flutter in 7 (5%) cases, and atrial tachycardia in 1 (0.7%) case. These were treated with oral amiodarone or by infusion. Other drugs used were esmolol administered by intravenous infusion and oral sotalol. Ventricular tachycardia occurred in 5% of cases and was treated with slow intravenous Mexiletine or lignocaine infusion, or oral flecainide. Conduction defects were found in 50% of cases, which either resolved spontaneously or were treated with atropine. Ventricular fibrillation was present in 1% of cases and was treated with amiodarone or lignocaine. Torsades de pointes had a rare incidence, occurring in only 1% of cases, and were treated with intravenous magnesium sulphate.

As detailed in [Table/Fig-3], Amiodarone is a broad-spectrum drug used in various arrhythmias. Lignocaine is the least cardiotoxic with no proarrhythmic properties. Flecainide is used in nodal tachycardia. Beta-blockers such as esmolol and sotalol are well-tolerated drugs. Patients on amiodarone need to undergo testing for thyroid hormones. Mexiletene treatment requires liver function tests. Mexiletene is contraindicated in AV block, while Flecainide is not administered in

cases of cardiac failure, sick sinus syndrome, or myocardial infarction. Sotalol should not be given to patients with a prolonged QT interval. All conduction blocking agents are contraindicated with amiodarone, lignocaine, and magnesium supplements.

Shortness of breath was most commonly observed in 42 (30%) cases with supraventricular arrhythmias. Angina was predominantly present in 125 (90%) cases with ventricular premature beats and 97 (70%) cases with ventricular tachycardia [Table/Fig-4a].

In hospital stays of less than 7 days, syncopal episodes were only reported in 1 (0.7%) case of patients on beta blockers. Incidences of complications leading to hospital readmissions, such as myocardial infarction, stroke, and acute kidney injury, were found in only 14 (10%) cases. Improvement in Left Ventricular Function (LVF) was observed in 14 (10%) patients after 10 days post PTCA, with ECG improvement seen in 88 (63%) cases. For hospital stays exceeding 7 days, syncopal episodes were reported in 2 (1.4%) cases, recurring hospital admissions in 18 (13%) cases, LVF improvement in 10 (7.1%) cases, and ECG improvement in 30 (21%) cases [Table/Fig-4b].

The Chi-square test was utilised to determine the association between hospital stay duration and follow-up endpoints. The Chi-square values for the respective outcomes were 2.26 (p-value=0.132), 16.36 (p-value=0.000), 2.68 (p-value=0.101), and 2.66 (p-value=0.103). A statistically significant association was found between hospital stay duration and recurrent hospital admissions, as indicated by a p-value of 0.000 for the Chi-square value of 16.36. For the rest of the outcomes, no significant associations were observed.

The incidence of sudden cardiac death was 1-2 (0.7%), mortality 10 days after was 1 (0.7%), and within one and a half months was 7 (5%). The overall quality of life was assessed for all sample patients [Table/Fig-5a].

Type of arrhythmias after PTCA	Incidence	Drug and dose	No. of episodes
Ventricular premature beats/ reperfusion arrhythmias	139 (100%)	Spontaneously resolve by itself	2-3
Supraventricular-atrial fibrillation with fast/controlled ventricular rate, atrial flutter	A Fib-111 (79.85%) Atrial flutter-7(5%) Atrial tachycardia-1 (0.7%)	I.V Loading dose of Amiodarone 900 mg in 50 mL over 24 hours followed by 200 mg oral dose daily Esmolol 0.5 mg/kg i.v. in 1 min. followed by 0.05-0.2 mg/kg/min i.v. infusion. Sotalol-80-320 mg BD orally	1-2
Ventricular tachycardia	7 (5%)	Mexiletine 100-200 mg slow i.v. Lignocaine infusion-100 mg initial followed by 8 min×3 doses. Maintenance infusion-1-4 mg/min Flecainide-100-200 mg BD	1
Conduction defects-Left Bundle Branch Block (LBBB), Bradycardia	69 (50%)	Atropine 0.6-1.2 mg I.M	1-2
Ventricular-fibrillation	1 (0.7%)	Amiodarone, lignocaine	1
Torsades de pointes	1 (0.7%)	Magnesium sulphate 1-2 g i.v. over 15-20 min	1

[Table/Fig-2]: Type of arrhythmias and plan to action towards their treatment.

Drug	Benefits	Side-effects	Contraindications	Dose adjustment
Amiodarone	High and broad-spectrum efficacy, in long term reduces sudden cardiac death	Hypo/hyperthyroidism	All conduction blocking agents are contraindicated.	
Mexiletene	Used in VT not responding to lignocaine	Liver function tests, nausea, tremors	Bradycardia, hypotension, accentuation of AV block on iv inj.	Dose reduction was needed in hepatic dysfunction.
Lignocaine	Used in VF, VT. Least cardiotoxic with no proarrhythmic potential	Nystagmus, tremor, dysarthria, altered consciousness on chronic treatment, Seizures can occur on rapid infusion	All conduction blocking agents are contraindicated. Exaggerates heart block or Congestive Heart Failure (CHF) in MI.	Half-life prolonged in CHF, Dose reduction required in liver dysfunction.
Flecainide	Used in nodal tachycardia	Has arrhythmogenic potential	Contraindicated in cardiac failure, sick sinus syndrome and patients recovering from MI.	
B blockers-sotalol/ metoprolol	Used in VT, AF, AFI, SVT	Well tolerated	Sotalol is contraindicated in patients with long QT interval as may cause torsades de pointes.	None.
Magnesium supplements	To prevent recurrent torsades de pointes	None	All conduction blocking agents are contraindicated.	
Atropine	In bradycardia improves heart rate. AV block-increases conduction velocity in bundle of his, abbreviates Effective Refractory Period (ERP)	Tachycardia	contraindicated in glaucoma, thyrotoxicosis, fever, urinary tract obstruction, ileus.	

[Table/Fig-3]: Drug information obtained by verbal communication with the interventional cardiologist.

Type of arrhythmias	Shortness of breath	Angina at rest/exertion
Ventricular premature beats	6 (4.3%)	125 (90%)
Supraventricular arrhythmias	42 (30%)	28 (20%)
Ventricular tachycardia	6 (4.3%)	97 (70%)
Conduction defects	1 (0.7%)	96 (69%)
Ventricular fibrillation	1 (0.7%)	0
Torsades de pointes	1 (0.7%)	3 (2.1%)

[Table/Fig-4a]: Primary endpoints (incidence of symptoms present after PTCA and before administering antiarrhythmics, for assessing the benefit of antiarrhythmics in decreasing their incidence).

Follow-up endpoints	Hospital stay <7 days	Hospital stay >7 days	Chi-square value	p-value
Episodes of syncope	1 (0.7%) (Can occur with b blockers in)	2 (1.4%)	$\chi^2=2.26$	$p=1.132$
No of recurring hospital admissions after antiarrhythmics (No MI, stroke, AKI)	14 (10%)	18 (13%)	$\chi^2=16.36$	$p<0.001$
Improvement in left ventricular function	14 (10%)	10 (7.1%)	$\chi^2=2.68$	$p=0.101$
ECG improving	88 (63%)	30 (21%)	$\chi^2=2.66$	$p=0.103$

[Table/Fig-4b]: Follow-up end points to assess benefit of antiarrhythmics for duration 10 days post PTCA.

Sudden cardiac death	Mortality within 10 days	Mortality within one and half months	Quality of life
1-2 (0.7%)	1 (0.7%)	7 (5%)	By dyspnoea grade, Canadian society angina grade, Dukes treadmill score, Questionnaire method

[Table/Fig-5a]: The outcome after treatment of arrhythmias in unstable angina and Post PTCA after one and half months of admission.

According to [Table/Fig-5b], the improvement in quality of life for all patients was graded based on the presence of dysapnoea, angina, treadmill test scores, MRC grading of dyspnoea (grade-1), Canadian Cardiovascular Society angina grade (2 or 3), Duke treadmill score (low-risk score >5), and questionnaire method (grade 3-good).

Dyspnoea grade	Angina grade	Treadmill exercise time at one and half months	Quality of life
1	2 or 3 grade	>5 score	Grade-3-good criteria

[Table/Fig-5b]: Quality of life assessed overall for all the patients.

DISCUSSION

The PCI has been the fastest-growing major invasive procedure in the past decade. Along with its obvious benefits, there are certain risks, including cardiac arrhythmias. A variety of arrhythmias and conduction disturbances can occur during PCI.

In the present study, according to the data in [Table/Fig-1], the most common age group that underwent PTCA was 50-60 years, while the rest of the age groups, from 40-50 years and 60-70 years, accounted for 20% of the sample population. As shown in [Table/Fig-3], 70% were males and 30% were females. The most common arrhythmia was ventricular premature complexes, which occurred in all patients who underwent coronary angioplasty. It is a manifestation of reperfusion arrhythmias. Similarly, in a previous study, the most frequently observed arrhythmias were reperfusion arrhythmias after revascularisation procedures during acute myocardial infarction [14]. The second most common arrhythmia was atrial fibrillation, occurring in 80% of cases. Atrial fibrillation usually occurs with inferior wall ischaemia, but lately, it can also occur in patients with electrolyte imbalances [15]. The third most common arrhythmia was atrial flutter, occurring in 5% of cases. Atrial tachycardia, observed in 1% of cases, is uncommon. Ventricular tachycardia and ventricular fibrillation were

seen in 5% and 0.5% of cases, respectively. According to a study by Mehta RH et al., lethal ventricular arrhythmias, including serious Ventricular Tachycardia (VT) and Ventricular Fibrillation (VF), have been reported to occur in 1.5-4% of patients undergoing coronary angioplasty [16]. In the present study, bradyarrhythmias/conduction defects were observed in 50% of cases, mostly transient in nature. Left bundle branch block was the most common conduction defect, followed by 1st degree and 3rd degree AV block. In a study by Gorenek B, new conduction defects occurred in only 0.9% of patients undergoing coronary angioplasty [17]. Of these, right bundle branch block was the most common, followed by 1st degree AV block. Ventricular premature complexes resolves by themselves and required no treatment. Similarly most of the conduction defects like bradycardia and AV blocks resolved spontaneously. Left bundle branch block also required no treatment.

Antiarrhythmics [17]: Amiodarone-It is a class III drug that widens the action potential. Resistant VT and recurrent VF are the most important indications for its use. The i.v. infusion rapidly terminates ventricular and supraventricular arrhythmias. It is administered once a day due to its very slow elimination, and the recurrence of arrhythmias does not occur if 1-2 doses are missed. It is considered safe in hepatic, renal, and cardiac dysfunction. The only side-effects to be monitored are related to thyroid function tests to detect hypo/hyperthyroidism. In a study by Galperin J et al., oral Amiodarone similarly restored sinus rhythm in 1/3 of patients with atrial fibrillation, increased the success rate of electric cardioversion, decreased the number of relapses, and delayed their occurrence [18]. In another study by Tuset SV et al., high-dose i.v. amiodarone maintenance treatment of 100 mg/hr following a loading dose of 300 mg/min represented effective treatment in atrial fibrillation/flutter [19].

Mexiletine: It is a sodium channel blocker, a class Ib drug that blocks more in the activated state. It is used in ventricular arrhythmias not responding to lignocaine and in ventricular tachycardia. Dose adjustment is required in liver dysfunction as it is metabolised by the liver. Hepatic function monitoring is necessary. In a study [20], patients with refractory VT and amiodarone use showed a significant reduction in sustained VT/VF when treated with mexiletine. In another study by Gao D et al., patients with refractory VT on amiodarone therapy underwent the addition of mexiletine [21].

Lignocaine: It is a sodium channel blocker, a class Ib drug. It is used for the acute termination of ventricular arrhythmias via the i.v. route. To maintain therapeutic plasma concentration, a loading dose is required followed by maintenance i.v. infusion. Dose adjustment is necessary in hepatic dysfunction as it is metabolised by the liver after redistribution. In a study by Yasmeen M et al., lidocaine i.v. in an average dose of 1.5 mg/kg in 30 sec was effective in suppressing ventricular arrhythmias in 80% of cases [22].

Flecainide: It is a class Ic drug, the most potent Na⁺ channel blocker with a more prominent action on the open state. It is used in paroxysmal atrial fibrillation and in any condition leading to tachycardia. It is utilised in arrhythmia without any heart disease as it has arrhythmogenic potential. In a study, it is recommended as one of the first-line therapies for pharmacological conversion as well as maintenance of sinus rhythm in patients with atrial fibrillation and/or supraventricular tachycardias without structural heart disease [23].

Beta blockers: Well-tolerated drugs like sotalol, esmolol, and metoprolol had no accompanying side-effects, drug interactions, or dose adjustments. B blockers can be used alone or with other antiarrhythmics. Metolar XR was used at doses of 12.5 mg or 25 mg twice a day. The initial dose of sotalol was 80 mg twice daily, with a gradual titration to 240 mg per day. The drug was discontinued if the heart rate was <65 or blood pressure was <120/80. Sotalol was contraindicated in patients with a long QT interval due to the risk of causing torsades de pointes. Sotalol was used for ventricular tachycardia and to maintain sinus rhythm in atrial fibrillation/flutter.

It was more effective for arrhythmias where other beta blockers didn't work due to its additional potassium channel blocking action, leading to the prolongation of the action potential. Esmolol was used as an i.v. infusion in emergencies to control ventricular rate in atrial fibrillation/flutter and supraventricular tachycardia. In a study by Mary-Rabine L et al., [24], sotalol was effective in suppressing ventricular premature complexes, non sustained, and sustained ventricular tachyarrhythmias. In a study by Nergårdh AK et al., the treatment strategy of metoprolol CR before cardioversion in combination with prompt second cardioversion in case of early relapse of atrial fibrillation significantly increased the proportion of patients in sinus rhythm during six months of follow-up [25].

Atropine- is an anticholinergic drug used to correct sinus bradycardia and type 2 and 3 AV blocks. Atropine increases heart rate and improves AV conduction by blocking vagal influences on the heart. In a study by Scheinman, Thorburn and Abott, 56 patients with acute MI complicated by sinus bradycardia were treated with iv atropine and monitored in coronary care unit. Atropine administration was associated with improved AV conduction in 11 of 13 (85%) patients with acute inferior MI associated with 2nd or 3rd degree atrioventricular block. Ventricular tachycardia was one of significant side effects [26].

Magnesium sulphate: Given to correct underlying hypokalemia, it was administered as a 50% injection of 2 mL i.v. twice a day. In a study by Ramesh T et al., i.v. magnesium, 5g or less, was administered in conjunction with standard care [27]. Similarly, it was effective for rate control and modestly effective for the restoration of sinus rhythm in rapid atrial fibrillation without clinically significant side-effects.

Sudden cardiac death occurred in 1% of cases, with mortality rates of 1% after 10 days of admission and 5% within one and a half months of admission. In a study by Brediau CE et al., no complications were recorded in 3116 (89%) cases, isolated minor complications occurred in 241 (6.9%), and major complications (emergency surgery, myocardial infarction, death) were observed in 145 (4.1%). The overall myocardial infarction rate was 94/3500 (2.6%). There were two non surgical deaths, giving a total mortality rate of 4/3500 (0.1%) [28]. Additionally, in another study compared with a median length of hospital stay of 2.0 days after PTCA for the entire cohort of patients, the length of stay was more strikingly increased in patients who experienced major or minor PTCA complications, such as emergency bypass surgery {9.0 days (8.0, 18.0); p-value <0.001}, Q-wave or non Q-wave myocardial infarction {8.0 (6.0, 15.5); p-value <0.001}, transfusion unrelated to bypass surgery {8.0 (4.0, 12.0); p-value <0.001}, or abrupt vessel closure {6.0 (3.0, 10.5); p-value <0.001} [29].

The quality of life was assessed as per [Table/Fig-5b], based on the breathlessness grade as follows: Grade 1- patients experienced breathlessness on strenuous exercise and more than daily routine activity; Angina Canadian Cardiovascular Society grading, Grade 11- patient had angina with moderate exertion like walking or climbing stairs rapidly, walking uphill or in cold or wind; or Grade 111- patient had angina with mild exertion like walking one or two blocks on the level and climbing one flight of stairs at a normal pace, and had a treadmill exercise score >5, indicating a low risk of cardiovascular disease. The Quality of Life Questionnaire in terms of the patient's performance in daily activities, the patient's health, the patient's physical capacity, emotional well-being, self-confidence, self-esteem, interest in life, and the relationship with family members were assessed as good-grade 3. The observations of this study warrant a large multicentre observational study of patients who underwent coronary angioplasty at a tertiary care centre to investigate the most common arrhythmias after interventions and devise strategies to identify and treat them. Currently, Cordarone is the most common antiarrhythmic drug being used, which has adverse effects on the thyroid, eyes, and lungs. Safer antiarrhythmics for atrial fibrillation like ibutilide/dofetilide should be used more frequently to avoid these side-effects.

Limitation(s)

The present is a single-centre observational study done in a specific subset of patients; hence, the application of results to other diseased populations remains questionable.

CONCLUSION(S)

Ventricular premature beats, supraventricular arrhythmias, ventricular tachycardia, ventricular fibrillation, and conduction disturbance arrhythmias are the arrhythmias that generally occur after PTCA. Atrial fibrillation accounts for 80% of all arrhythmias that have occurred in 139 cases. Amiodarone is a broad-spectrum, highly efficacious drug used in almost all types of arrhythmias. Lidocaine and esmolol were used as i.v. infusions in ventricular and atrial arrhythmias, respectively. Beta-blockers were well-tolerated drugs with sotalol being contraindicated in cases of prolonged QT interval. Magnesium supplements were given to correct the reversible underlying cause of hypokalemia. With the judicious use of antiarrhythmics, life-threatening complications can be avoided post surgery, and the duration of hospital stay is reduced, leading to an improvement in the quality of life.

REFERENCES

- [1] Klabunde RE. Arrhythmias. cardiovascular physiology concepts. Richard E Klabunde (ed): 3rd edition, Wolter kluwer, 2021:7 chapters.
- [2] Yeung-Lai-Wah JA, Qi A, McNeill E, Abel JG, Tung S, Humphries KH. New Onset Sustained: New-onset sustained ventricular tachycardia and fibrillation early after cardiac operations. *Ann Thoracic Surg.* 2004;77(6):2083-88.
- [3] Salaminia S, Sayehmiri F, Angha P, Sayehmiri K, Motedayen M. Evaluating the effect of magnesium supplementation and cardiac arrhythmias after acute coronary syndrome: A systematic review & meta-analysis. *BMC Cardiovasc Disord.* 2015;18(1):129.
- [4] Tripathi KD. Antiarrhythmic drugs. *Essentials of Medical Pharmacology.* 8th edition. New Delhi: Jaypee Publishers. 2019; Pp.571-83.
- [5] Gregory SK, Goyal A, Grigorova Y, Hashmi MF. Antiarrhythmic medications. 2023 Feb 19. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK482322/>
- [6] Peretto G, Durante A, Limite LR, Cianflone D. postoperative arrhythmias after cardiac surgery: Incidence, risk factors, and therapeutic management. *Cardiol Res Pract.* 2014;2014:615987. Available from: <https://doi.org/10.1155/2014/615987>.
- [7] Herzog L, Lynch C. Arrhythmias accompanying cardiac surgery. In: Lynch C, editor. *Clinical Cardiac Electrophysiology.* 3rd edition. Philadelphia, Pa, USA: JB Lippincott; 1994. pp. 231.
- [8] Mathew JP, Fontes ML, Tudor IC, Ramsay J, Duke P, Mazer CD, et al. A multicenter risk index for atrial fibrillation after cardiac surgery. *The Journal of the American Medical Association.* 2004;291(14):1720-29.
- [9] Creswell LL, Schuessler RB, Rosenbloom M, Cox JL. Hazards of postoperative atrial arrhythmias. *Ann Thorac Surg.* 1993;56(3):539-49. PubMed.
- [10] Primary care respiratory society. MRC Dyspnoea scale. Last retrieved on 5 Jan 2024. Available from: <https://www.pcrs-uk.org/mrc-dyspnoea-scale>.
- [11] Campeau L. Grading of angina pectoris. *Circulation.* 1976;54(3):522. Available from: <https://www.ahajournals.org/doi/epdf/10.1161/circ.54.3.947585>.
- [12] Mark DB. Duke Treadmill Score [Internet]. Last retrieved on 5 Jan 2024. Available from: <https://www.mdcalc.com/calc/3991/duke-treadmill-score#creator-insights>.
- [13] Bond MMK, Oliveira JLR, Souza LCB, Farsky PS, Amato VL, Togna DJD, et al. Quality of life in cardiovascular surgery: Elaboration and initial internal validation of a quality of life questionnaire. *J Cardiovascular Surgery.* 2018;33(5):476-82.
- [14] Tatli E, Guray A, Ali B, Mustafa YM. Arrhythmias following revascularization procedures in the course of acute myocardial infarction: Are they indicators of reperfusion or ongoing ischemia? *The Scientific World Journal.* 2013;2013:01-07.
- [15] January CT, Wann LS, Alpert JS, Calkins H, Cigarroa JE, Cleveland JC Jr, et al. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: Executive summary: A report of the American College of Cardiology/American Heart Association Task Force on practice guidelines and the Heart Rhythm Society. *J Circulation.* 2014;130(23):2071-104.
- [16] Mehta RH, Starr AZ, Lopes RD. Incidence & outcomes associated with ventricular tachycardia or fibrillation in patients undergoing primary percutaneous intervention. *JAMA.* 2009;301(17):1779-89.
- [17] Gorenek B. Management of Cardiac Arrhythmias in Post-PCI Patients. In: Gulizia, M.M. (eds) *Emerging Pathologies in Cardiology.* Springer, Milano . 2005: 231–39. Available from: https://doi.org/10.1007/88-470-0341-5_27. Last retrieved on 1.2.2023.
- [18] Galperin J, Elizari MV, Chiale PA, Molina RT, Ledesma R, Scapin AO, et al. Efficacy of Amiodarone for termination of chronic atrial fibrillation and maintenance of sinus rhythm: A prospective, multicenter, randomized, controlled, double blind trial. *J Cardiovasc Pharmacol Ther.* 2001;6(4):341-50.
- [19] Tuset SV, Jaatun HJ, Dickstein K. Amiodarone infusion in the treatment of acute AF/Fl: High versus low dose treatment. *Heart J.* 2005;91(7):964-65.
- [20] Sobeich M, Lewandowski M, Zaja D, Maciag A, Syska P, Ateriska-Pawlowska J, et al. Efficacy and tolerability of mexiletine treatment in patients with recurrent ventricular tachyarrhythmias and implantable cardioverter-defibrillator shocks. *Kardiologia Pol.* 2017;75(10):1027-32.

[21]

Gao D, Van HH, Alshengeiti L, Dorian P, Mangat I, Korley V, et al. Mexiletine as an adjunctive therapy to amiodarone reduces the frequency of ventricular tachyarrhythmia events in patients with an implantable defibrillator. *J Cardiovasc Pharmacol.* 2013;62(2):199-204.

[22]

Daraz YM, Abdelghffar OH. Lidocaine infusion: An antiarrhythmic with neurologic toxicities. *Cureus.* 2022;14(3)e23310.

[23]

Andrikopoulos GK, Pastromas S, Tzeis S. Flecainide: Current status & perspectives in arrhythmia management. *World J Cardiol.* 2015;7(2):76-85.

[24]

Mary-Rabine L, Soumagne D, Stiels B. Long-term sotalol therapy in patients with ventricular arrhythmias. *Acta cardiol.* 1986;41(2):89-97.

[25]

Nergårdh AK, Rosenqvist M, Nordlander R, Mats Frick M. Maintenance of sinus rhythm with metoprolol CR initiated before cardioversion and repeated cardioversion of atrial fibrillation: A randomized double-blind placebo-controlled study. *Eur Heart J.* 2007;28(11):1351-57.

[26]

Scheinman MM, Thorburn D, Abott JA. Use of atropine in patients with acute myocardial infarction and sinus bradycardia. *Circulation.* 1975;52:627-33.

[27]

Ramesh T, Lee PYK, Mitta M, Allencherril J. Intravenous magnesium in the management of rapid atrial fibrillation. *J Cardiol.* 2021;78(5):375-81.

[28]

Brediau CE, Roubin GS, Leimgrub PP, Douglas JS, King SB, Gruentzig AR. In hospital mortality in patients undergoing elective coronary angioplasty. *Circulation.* 1985;72(5):1044-52.

[29]

Wolfe MW, Roubin GS, Schweiger M, Isner JM, Ferguson JJ, Cannon AD, et al. Length of hospital stay and complications after percutaneous transluminal coronary angioplasty. Clinical and procedural predictors. Heparin Registry Investigators. *Circulation.* 1995;92(3):311-19.

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