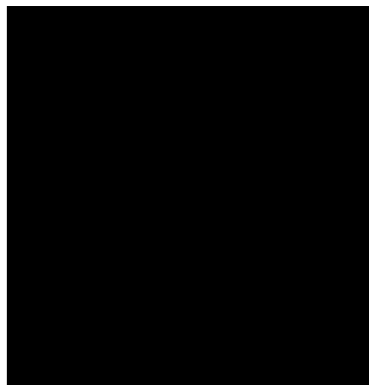


**“PRE OPERATIVE LEFT ATRIAL STRAIN TO PREDICT POST
OPERATIVE ATRIAL FIBRILLATION IN PATIENTS UNDERGOING
OFF-PUMP CORONARY ARTERY BYPASS GRAFTING”**



FACULTY OF CARDIOLOGY



**IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE AWARD OF DEGREE OF**



BY



UNDER THE GUIDENCE OF

DR



**“PRE OPERATIVE LEFT ATRIAL STRAIN TO PREDICT
POST OPERATIVE ATRIAL FIBRILLATION IN PATIENTS
UNDERGOING OFF-PUMP CORONARY ARTERY BYPASS
GRAFTING”**

DR



CERTIFICATE OF HEAD OF INSTITUTE

This is to certify that the work contained in this thesis entitled **“STUDY OF INCIDENCE AND CLINICAL FACTORS OF DEVICE DETECTED ATRIAL FIBRILLATION IN PATIENTS WITH CARDIAC IMPLANTABLE ELECTRICAL DEVICES”**

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Date:

CERTIFICATE OF HEAD OF DEPARTMENT

This is to certify that the work contained in this thesis entitled **“STUDY OF INCIDENCE AND CLINICAL FACTORS OF DEVICE DETECTED ATRIAL FIBRILLATION IN PATIENTS WITH CARDIAC IMPLANTABLE ELECTRICAL DEVICES”** [REDACTED]

[REDACTED]
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CERTIFICATE OF THE GUIDE

This is to certify that the work contained in this thesis entitled “**STUDY OF INCIDENCE AND CLINICAL FACTORS OF DEVICE DETECTED ATRIAL FIBRILLATION IN PATIENTS WITH CARDIAC IMPLANTABLE ELECTRICAL DEVICES**”

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Date:

DECLARATION BY THE CANDIDATE

Dissertation on “**STUDY OF INCIDENCE AND CLINICAL FACTORS OF DEVICE
DETECTED ATRIAL FIBRILLATION IN PATIENTS WITH CARDIAC
IMPLANTABLE ELECTRICAL DEVICES**”

[REDACTED]

[REDACTED]

[REDACTED]

Date:

DECLARATION CUM UDERTAKING FOR FRESH THESIS

I, **Dr.UJJWALA TULLURI**, hereby declare that this thesis entitled " **STUDY OF INCIDENCE AND CLINICAL FACTORS OF DEVICE DETECTED ATRIAL FIBRILLATION IN PATIENTS WITH CARDIAC IMPLANTABLE ELECTRICAL DEVICES** " [REDACTED]

[REDACTED]

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Date:

Candidate Signature :

Candidate Name: [REDACTED]

Specialty: [REDACTED]

Registration Number: [REDACTED]

COUNTERSIGNED & VERIFIED

(Guide Signature)

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[REDACTED]

ABSTRACT

Background: Postoperative atrial fibrillation (POAF) is a common complication following coronary artery bypass grafting and is associated with increased morbidity, prolonged hospitalization, and higher healthcare costs [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Aim: [REDACTED]
[REDACTED]

Methods: [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Results: [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Conclusion: [REDACTED]
[REDACTED] . It

provides superior predictive value compared to conventional echocardiographic parameters and can be effectively utilized for preoperative risk stratification and optimization of perioperative management.

Keywords: Postoperative atrial fibrillation, left atrial strain, speckle tracking echocardiography, OPCABG, Left atrial reservoir strain, Risk stratification, Coronary artery bypass grafting, Atrial dysfunction, Echocardiography, Cardiac surgery

LIST OF ABBREVIATIONS

AF – Atrial fibrillation

ASE – American Society of Echocardiography

AUC – Area under the curve

BMI – Body mass index

BSA – Body surface area

CABG – Coronary artery bypass grafting

CAD – Coronary artery disease

CKD – Chronic kidney disease

COPD – Chronic obstructive pulmonary disease

CPB – Cardiopulmonary bypass

DICOM – Digital Imaging and Communications in Medicine

ECG – Electrocardiogram

EACVI – European Association of Cardiovascular Imaging

EDV – End-diastolic volume

EF – Ejection fraction

eGFR – Estimated glomerular filtration rate

ESV – End-systolic volume

GLS – Global longitudinal strain

ICU – Intensive care unit

IQR – Interquartile range

LA – Left atrium

LAS – Left atrial strain

LAS-CD – Left atrial conduit strain

LAS-CT – Left atrial contractile strain

LAS-R – Left atrial reservoir strain

LAVI – Left atrial volume index

LV – Left ventricle

LVDD – Left ventricular diastolic dysfunction

LVEF – Left ventricular ejection fraction

MI – Myocardial infarction

OPCABG – Off-pump coronary artery bypass grafting

PASP – Pulmonary artery systolic pressure

POAF – Postoperative atrial fibrillation

POD – Postoperative day

ROC – Receiver operating characteristic

RR – R to R interval

SPSS – Statistical Package for the Social Sciences

STE – Speckle tracking echocardiography

TAPSE – Tricuspid annular plane systolic excursion

TDI – Tissue Doppler imaging

TR – Tricuspid regurgitation

TTE – Transthoracic echocardiography

WHO – World Health Organization

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INTRODUCTION

The World Health Organization (WHO) defines atrial fibrillation (AF) as “a supraventricular tachyarrhythmia characterized by uncoordinated atrial activation with consequent deterioration of atrial mechanical function” [1]. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] Despite advances in surgical techniques, anesthesia, and perioperative care, the incidence of POAF has remained consistently high [4].

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] LAS has been shown to correlate with atrial fibrosis and impaired atrial compliance, making it a valuable marker of early atrial dysfunction. Several studies have

demonstrated the utility of reduced LAS in predicting AF occurrence, recurrence, and persistence in various clinical settings ^[10].

[REDACTED]

[REDACTED]

[REDACTED] By identifying subclinical atrial dysfunction preoperatively, LAS may serve as a robust, non-invasive tool for risk stratification and individualized patient care.

Epidemiology Of Atrial Fibrillation

Global Epidemiology

[REDACTED]

Epidemiology in India

In India, the prevalence of AF in the general population is lower than in Western countries, ranging from 0.5–1%, but is steadily increasing due to demographic transition and rising burden of coronary artery disease [REDACTED]

[REDACTED]

AIMS AND OBJECTIVES

Aim:

[REDACTED]

Objectives:

[REDACTED]

REVIEW OF LITERATURE

Atrial Fibrillation

[REDACTED]

Classification of atrial fibrillation

Classification of atrial fibrillation (AF) is clinically important as it guides expectations regarding spontaneous termination, recurrence, treatment strategies, and long-term rhythm control [2]. [REDACTED]

[REDACTED]

Postoperative Atrial Fibrillation (POAF)

[REDACTED]

Clinical Consequences of POAF in Cardiac Surgical Patients

[REDACTED]

[REDACTED]. This increases the risk of complications such as ischemic stroke, further aggravated by postoperative inflammation and hypercoagulability [19].

Pathophysiology of POAF

Atrial Structural Remodeling

Atrial structural remodeling provides the substrate that predisposes patients to POAF. Chronic exposure to factors such as elevated left ventricular filling pressures, hypertension, ischemic heart disease, and aging leads to left atrial enlargement and altered geometry [20].

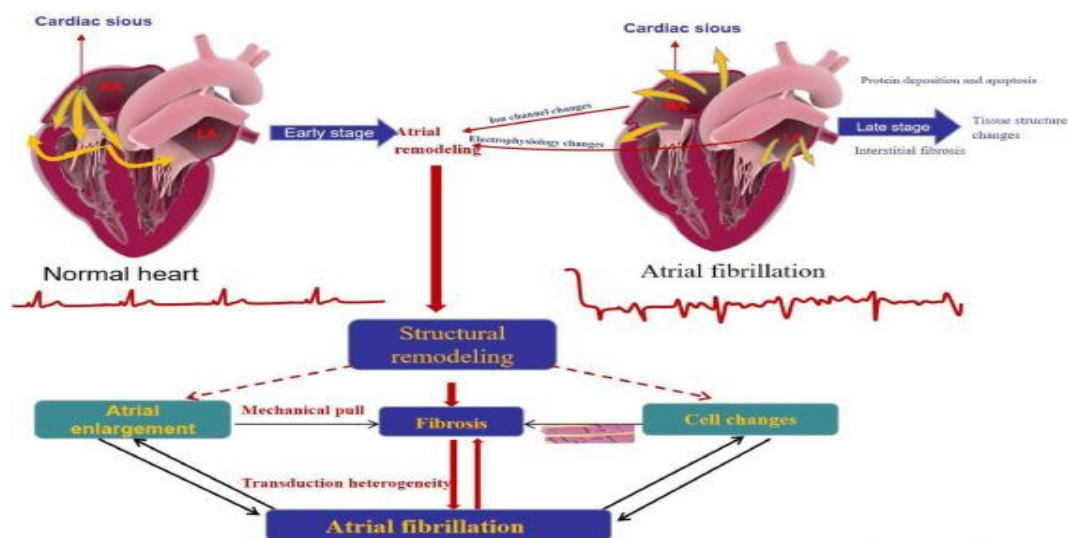


Fig 1: Atrial Structural Remodeling

Electrical Remodeling and Atrial Conduction Delay

Atrial Fibrosis and Extracellular Matrix Changes

Atrial fibrosis is a key structural change that increases susceptibility to atrial fibrillation by causing disorganized conduction through fibrotic tissue.

Inflammatory Response and Oxidative Stress

Inflammation and oxidative stress play a crucial role in the development of POAF by altering atrial electrophysiology and myocardial function. [REDACTED]

Autonomic Nervous System Dysregulation

Autonomic imbalance contributes significantly to POAF by causing fluctuations in sympathetic and parasympathetic activity after surgery. [REDACTED]

Myocardial Ischemia and Atrial Stretch

[REDACTED]

Perioperative and Surgical Triggers

POAF occurs when perioperative triggers act on a vulnerable atrial substrate. [REDACTED]

Determinants and Risk Factors for POAF

Patient-Related Determinants

[REDACTED]

Cardiac Structural and Functional Determinants

[REDACTED]

Perioperative and Procedural Determinants

Perioperative and procedural factors contribute to POAF by creating acute physiological stress that destabilizes atrial electrophysiology. [REDACTED]

[REDACTED]

Left Atrium: Structural and Functional Role in Cardiac Physiology

Anatomical Characteristics of the Left Atrium

[REDACTED]

Mechanical Coupling between Left Atrium and Left Ventricle

The left atrium and left ventricle function as a closely coupled unit, with atrial performance dependent on ventricular systolic and diastolic function. [REDACTED]

[REDACTED]

Phasic Function of the Left Atrium

[REDACTED]

Left Atrial Remodeling in Coronary Artery Disease

Left atrial remodeling in coronary artery disease is a progressive process driven by chronic ischemia, microvascular dysfunction, and metabolic stress, leading to structural and functional changes in the atrium.

Echocardiographic Evaluation of the Left Atrium

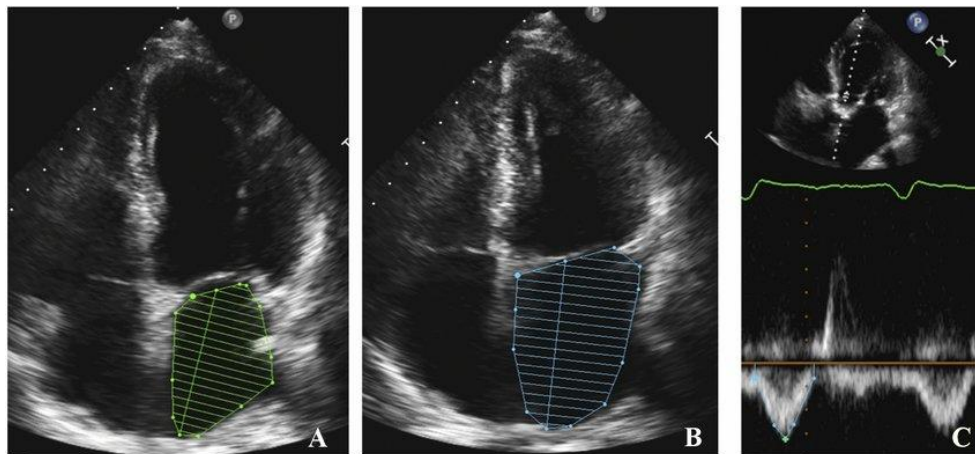


Fig 2: Echocardiographic assessment of the left atrial volume index. Assessment of the left atrial function index using the pre-procedural transthoracic echocardiography.

Conventional Two-Dimensional Echocardiographic Parameters

Doppler and Tissue Doppler Assessment of Atrial Function

. Together, these parameters help interpret atrial remodeling and its hemodynamic impact ^[32].

Limitations of Conventional Echocardiographic Parameters

[REDACTED]

Speckle Tracking Echocardiography (STE)

Principles of myocardial deformation imaging

[REDACTED]

[REDACTED] These speckles arise from ultrasound interaction with cardiac tissue and create unique patterns. By following them frame by frame, STE provides accurate evaluation of myocardial motion throughout the cardiac cycle ^[33].

Technical considerations in atrial strain analysis

[REDACTED]

Reproducibility and standardization

[REDACTED]

Left Atrial Strain (LAS): Concept and Measurement

Physiological Basis of Left Atrial Strain

[REDACTED]

Methodology of LAS Assessment

Left atrial strain is assessed using two-dimensional speckle tracking echocardiography from standard apical grayscale images. [REDACTED]
[REDACTED]. Accurate results require careful image acquisition and post-processing to avoid technical artifacts and ensure true representation of atrial mechanics [37].

Reference Point Selection and Timing of LAS Curves

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Segmental versus Global LAS Measurement

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Components of Left Atrial Strain

Left Atrial Reservoir Strain (LAS-R)

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Left Atrial Conduit Strain (LAS-CD)

Left atrial conduit strain (LAS-CD) reflects passive emptying of the left atrium during early ventricular diastole, when blood flows directly into the left ventricle. [REDACTED]

Left Atrial Contractile Strain (LAS-CT)

Left atrial contractile strain (LAS-CT) reflects active atrial contraction during late diastole, contributing to ventricular filling. It indicates atrial contractile reserve and depends on intact electrical activity and myocardial integrity.

Left Atrial Strain as a Marker of Atrial Myopathy

Relationship with atrial fibrosis

Association with elevated left ventricular filling pressures

Elevated left ventricular filling pressures impose a chronic hemodynamic burden on the left atrium, contributing to atrial myopathy.

Correlation with diastolic dysfunction severity

Diastolic dysfunction leads to progressive impairment of ventricular relaxation and increased stiffness, placing greater workload on the left atrium.

Interaction Between Left Ventricular Function and LAS

LV Systolic Function and Global Longitudinal Strain

LV Diastolic Dysfunction and LA–LV Coupling

Left ventricular diastolic dysfunction significantly affects left atrial function by altering pressure gradients and atrioventricular coupling.

Impact on Atrial Mechanics

Left ventricular systolic and diastolic dysfunction together significantly influence atrial mechanics and its response to hemodynamic stress.

Coronary Artery Bypass Grafting and Atrial Arrhythmogenesis

Pathophysiological Basis of POAF after CABG

Comorbidities like coronary artery disease, hypertension, diabetes, and diastolic dysfunction promote atrial remodeling and conduction abnormalities.

Cardiopulmonary Bypass versus Off-Pump Surgery

Residual Mechanisms of POAF in OPCABG

Off-Pump Coronary Artery Bypass Grafting (OPCABG): Cardiac Implications

Hemodynamic alterations during cardiac displacement

During OPCABG, mechanical displacement of the heart to access coronary vessels can transiently alter venous return and ventricular geometry. [REDACTED]

Atrial ischemia and stretch during OPCABG

During OPCABG, patients with underlying coronary artery disease may experience additional atrial ischemia due to transient reductions in coronary perfusion during surgery. [REDACTED]

Inflammatory response despite avoidance of CPB

Although OPCABG avoids cardiopulmonary bypass, perioperative inflammation still occurs due to surgical trauma [REDACTED]

Left Atrial Strain in the Setting of OPCABG

Preoperative atrial substrate assessment

Preoperative assessment of the atrial substrate is important in OPCABG as underlying atrial vulnerability influences response to surgical stress [REDACTED]

LAS as a predictor of postoperative atrial arrhythmias

Left atrial strain is a strong predictor of postoperative atrial arrhythmias, reflecting the atrium's mechanical and electrical readiness for fibrillation. [REDACTED]

[REDACTED]

[REDACTED]

Pathophysiological relevance in off-pump surgery

In OPCABG, absence of cardiopulmonary bypass reduces but does not eliminate arrhythmogenic stressors [REDACTED]

[REDACTED]

[REDACTED]

Clinical Utility of Preoperative LAS Assessment

Risk stratification before OPCABG

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Identification of high-risk patients

Identifying high-risk patients for POAF allows targeted prevention and improved postoperative care. [REDACTED]

[REDACTED]

[REDACTED]

Implications for perioperative monitoring and prophylaxis

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Limitations and Challenges of LAS Assessment

Image quality and foreshortening

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Inter-vendor variability

Inter-vendor variability is a major limitation in LAS assessment due to differences in ultrasound systems and software algorithms. [REDACTED]

[REDACTED]

[REDACTED]

Load dependency and heart rate influence

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Knowledge Gaps and Rationale for the Present Study

Postoperative atrial fibrillation remains common after CABG despite advances in care, and accurate preoperative risk prediction remains challenging. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Research Studies

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] investigated the integrative assessment of atrial function and electromechanical coupling as predictors of postoperative atrial fibrillation in patients undergoing cardiac surgery. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] The findings support the routine use of left atrial strain as an adjunct to conventional echocardiographic evaluation, particularly in identifying patients at increased risk for atrial arrhythmias [39].

[REDACTED]

[REDACTED] provided an updated overview of postoperative atrial fibrillation, focusing on epidemiology, pathophysiology, risk factors, prevention, and management strategies. The review underscored the need for improved risk stratification models incorporating atrial functional assessment. [REDACTED]

[REDACTED]

[REDACTED] summarized contemporary evidence on postoperative atrial fibrillation following cardiac surgery. [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]. The review concluded that improved characterization of atrial pathology using functional imaging markers could enhance perioperative risk stratification and guide targeted preventive strategies for postoperative atrial fibrillation [4].

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED] evaluated the association between preoperative left atrial strain abnormalities and the development of postoperative atrial fibrillation following isolated coronary artery bypass grafting. [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]

[REDACTED]

[REDACTED]

The study reinforced the clinical impact of postoperative atrial fibrillation and highlighted the importance of identifying patients at higher risk to improve perioperative management and outcomes following coronary artery bypass surgery ^[13].

[REDACTED]

The authors reviewed observational and interventional studies evaluating demographic, clinical, and procedural predictors. The findings underscored the limitations of existing risk stratification tools and supported a more comprehensive approach to perioperative atrial fibrillation risk assessment ^[47].

[REDACTED]

MATERIAL AND METHODS

Study design:

[REDACTED]

Study site:

[REDACTED]

Duration of study:

[REDACTED].

Eligibility criteria:

Inclusion criteria:

Patients were included in the study if they met the following criteria:

- The patient was an adult

[REDACTED]

[REDACTED]

[REDACTED]

Exclusion criteria:

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

- Unfeasible speckle tracking echocardiography (STE) analysis

Methods

Sample size calculation:

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

A single trained and experienced operator performed transthoracic echocardiography (TTE) 24 hours prior to surgery during the preoperative anesthesia consultation. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

In addition to comprehensive TTE, left ventricular global longitudinal strain (GLS) was measured using AutoStrain software from apical [REDACTED], and long-axis views. The average GLS value was obtained using bull's-eye representation.

Comprehensive assessment of left ventricular diastolic dysfunction (LVDD) was performed according to the [REDACTED] ASE/European Association of Cardiovascular Imaging (EACVI) recommendations.

Four essential parameters were obtained:

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Left ventricular diastolic dysfunction was categorized as normal or graded as grade I, II, or III based on these parameters.

Left atrial strain assessment: Left atrial function was evaluated using two-dimensional strain measurements with the Auto LA software employing speckle tracking echocardiography. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Left atrial strain was calculated as longitudinal strain obtained from non-foreshortened apical [REDACTED] and [REDACTED] views, and average values were used for analysis. The three components of left atrial strain were reported as follows:

[REDACTED] LAS-R [REDACTED]

[REDACTED]

[REDACTED] LAS-CD, [REDACTED]

[REDACTED]

[REDACTED] LAS-CT, [REDACTED]

[REDACTED]

Clinical and perioperative data collection: Demographic data and comorbidities were abstracted from medical records [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Postoperative monitoring and grouping: During ICU stay, patients were continuously monitored for atrial fibrillation using continuous electrocardiographic monitoring. [REDACTED]

Based on the occurrence of POAF, patients were categorized into two groups:

- **Group I:** [REDACTED]
- **Group II:** [REDACTED]

Preoperative echocardiographic parameters were compared between the two groups.

End points and definitions:

Primary outcome: [REDACTED]
[REDACTED]
[REDACTED]

Statistical analysis: Descriptive analysis was performed using frequencies and proportions for categorical variables. [REDACTED]

[REDACTED]. The independent t-test was used to compare normally distributed continuous variables, and the Mann–Whitney U test was used for non-normally distributed continuous variables.

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[illegible]

Table 1: Baseline Characteristics of Study Population (n = 118)

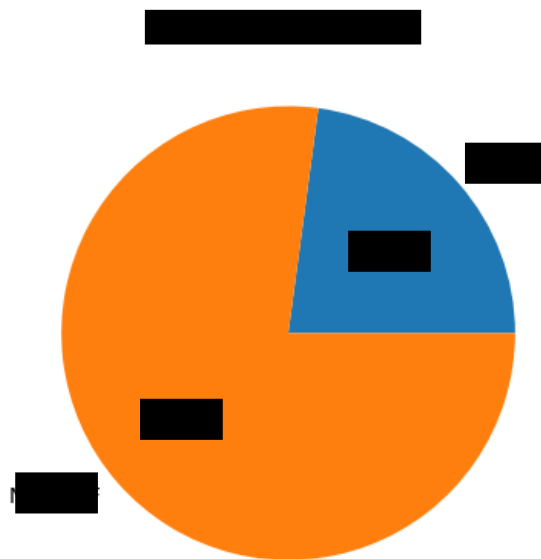
Variable	Total (n=118)	POAF (n=27)	No POAF (n=91)	p value
Age				
<60 years	54	8 (14.8%)	46 (85.2%)	0.04
≥60 years	64	19 (29.7%)	45 (70.3%)	
Gender				
Male	94	22 (23.4%)	72 (76.6%)	0.78
Female	24	5 (20.8%)	19 (79.2%)	
BMI				
Height (cm)				
Weight (kg)				
BMI (kg/m²)				
Comorbidities				
Hypertension				
Diabetes Mellitus				
Chronic Kidney Disease				
Smoking				
COPD				
Previous Stroke				
Dyslipidemia				
History of Myocardial Infarction				
Drug History				
Beta blockers				
Calcium channel blockers				
ACEi/ARBs				
Amiodarone				
Statins				
Nitroglycerin				
Diuretics				
Coronary Angiography				
Single vessel disease				
Double vessel disease				
Triple vessel disease				

Number of Grafts				
<40%				
40–49%				
≥50%				
LAS Reservoir	I			
LAS Conduit	I			
LAS Contractile	I			
LAVI (mL/m²)	I			

[REDACTED]

Table 2: Incidence of Postoperative Atrial Fibrillation

Outcome	n	%
POAF	■	■
No POAF	■	■



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Table 3: Postoperative Day-wise Onset of POAF

Postoperative Day	Number of Patients (n = 27)	Percentage (%)
POD 1	1	3.7
POD 2	1	3.7
POD 3	1	3.7
POD 4	1	3.7
POD $\geq$ 5	1	3.7

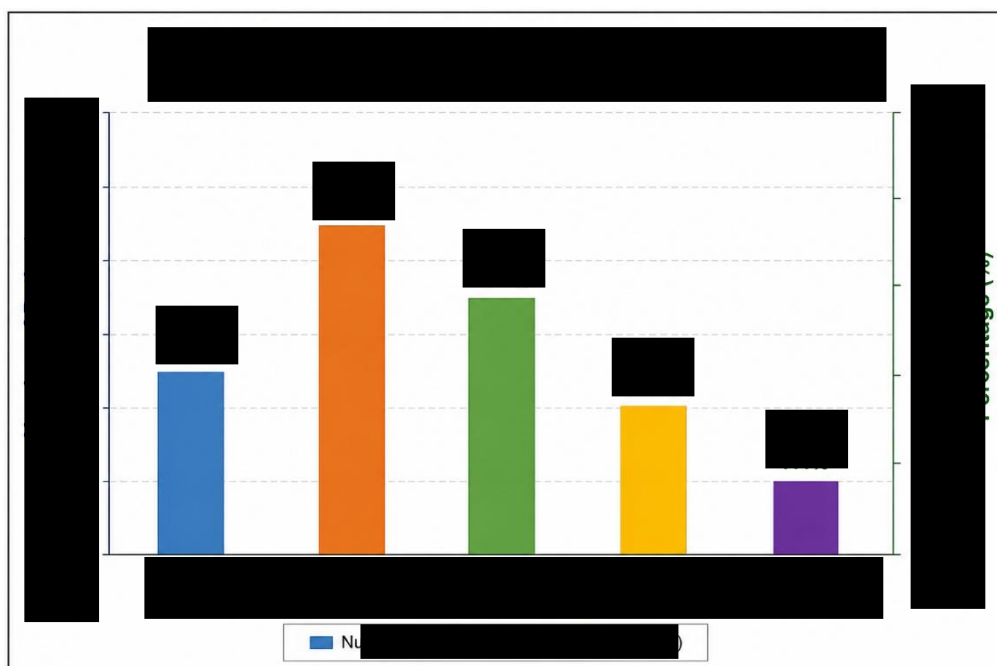
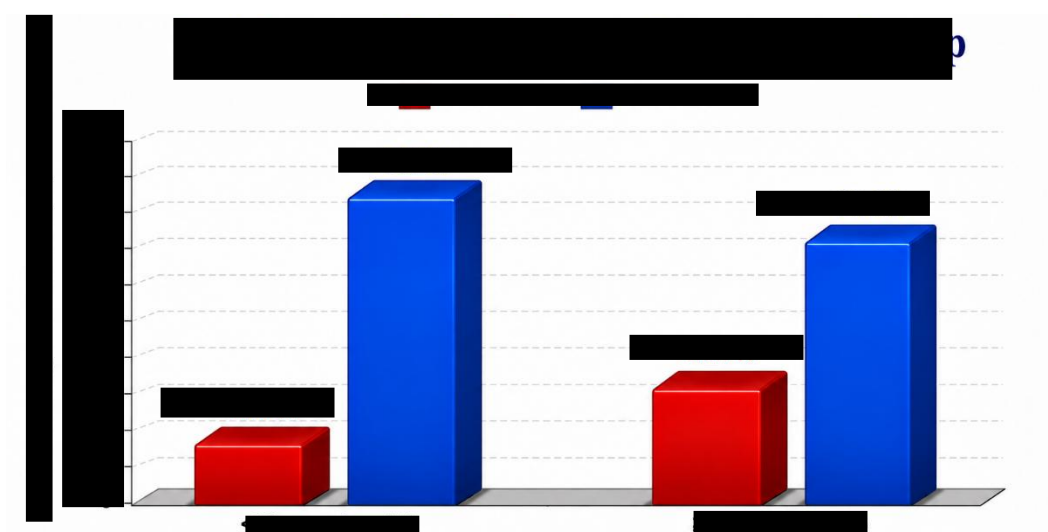


Table 4: Association Between Age Group and POAF

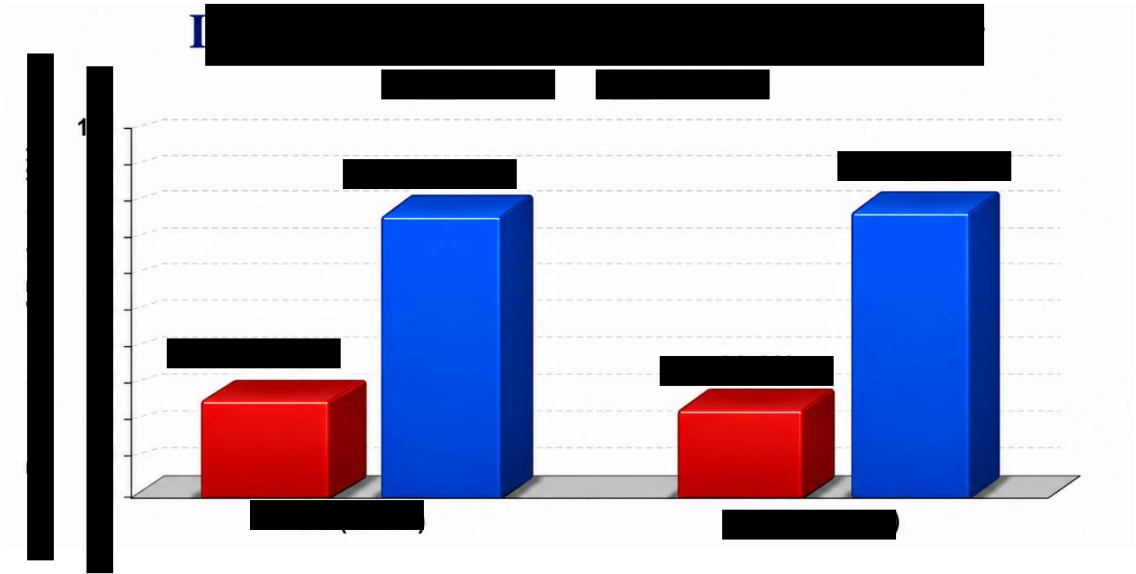
Age Group	Total	POAF n (%)	No POAF n (%)	p value
<60 years	■	■	■	■
≥60 years	■	■	■	



The incidence of POAF was similar in males (23.4%) and females (20.8%), with no statistically significant association ($p = 0.78$).

Table 5: Association Between Gender and POAF

Gender	Total	POAF n (%)	No POAF n (%)	p value
Male	■	■	■	■
Female	■	■	■	



■

■

■

■

■

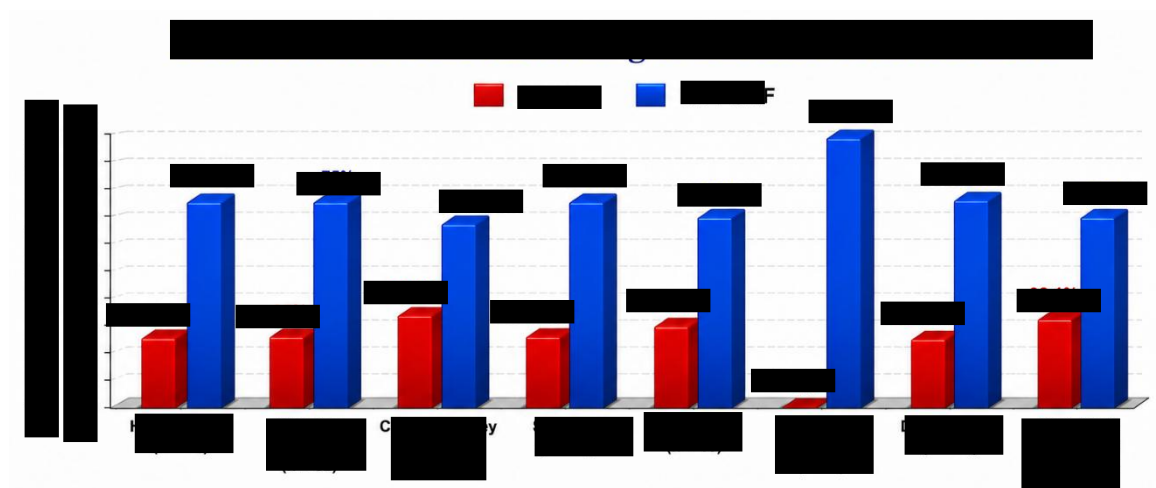
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■

■

Table 6: Association Between Comorbidities and POAF

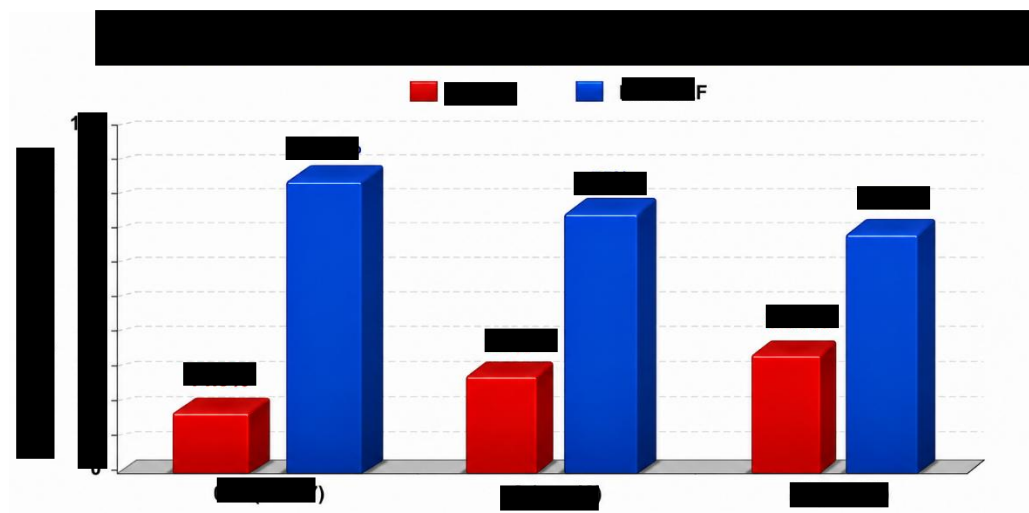
Parameter	Total	POAF n (%)	p value
Hypertension	■	■	■
Diabetes Mellitus	■	■	■
Chronic Kidney Disease	■	■	■
Smoking	■	■	■
COPD	■	■	■
Previous Stroke	■	■	■
Dyslipidemia	■	■	■
History of Myocardial Infarction	■	■	■



[Redacted text block containing multiple lines of blacked-out information]

Table 7: Number of Comorbidities

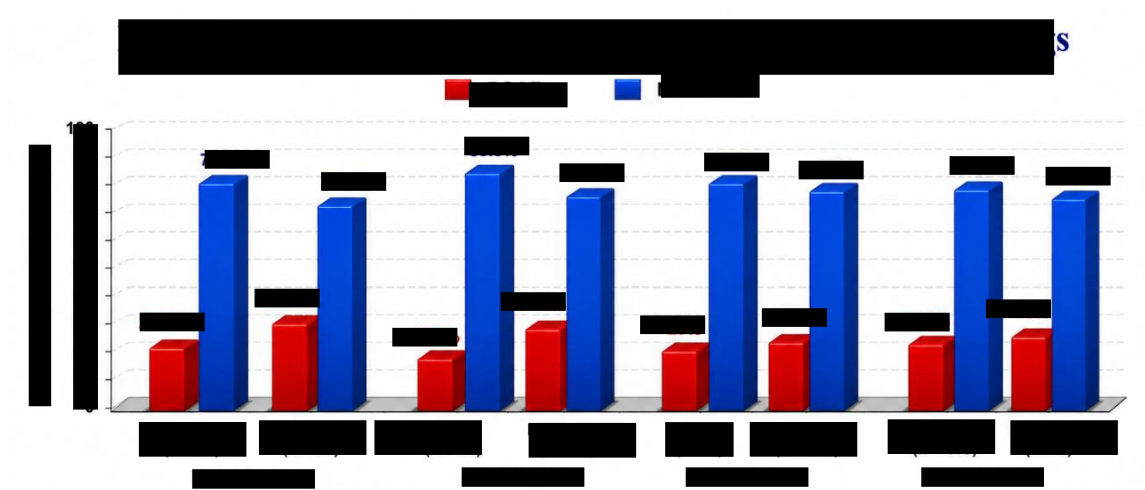
No. of comorbidities	Total	POAF n (%)	No POAF n (%)	p value
0	1	1 (100)	1 (100)	0.99
1	1	1 (100)	1 (100)	
2	1	1 (100)	1 (100)	



[Redacted text block containing multiple lines of obscured information]

Table 8: Comparison of POAF Based on Drug Therapy

Drug	Group	Total (n)	POAF n (%)	p value
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]	[REDACTED]	



Overall, beta blocker use did not show a significant association with POAF, indicating limited independent effect on its prevention.

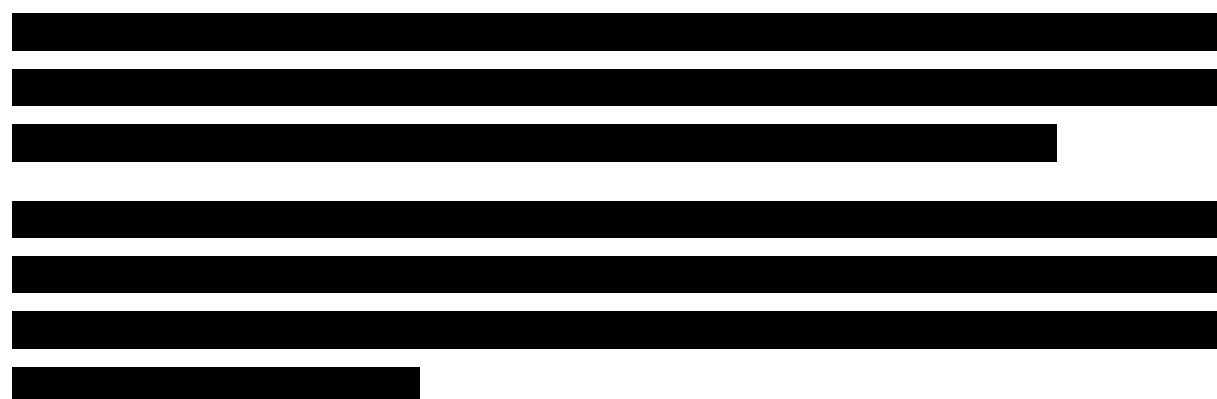
[illegible][illegible]

Table 10: Comparison of Laboratory Parameters Between POAF and Non-POAF Groups

Parameter	Total (n=118)	POAF (n=27)	No POAF (n=91)	p value
Serum Magnesium (mg/dL)				
TSH (mIU/L)				

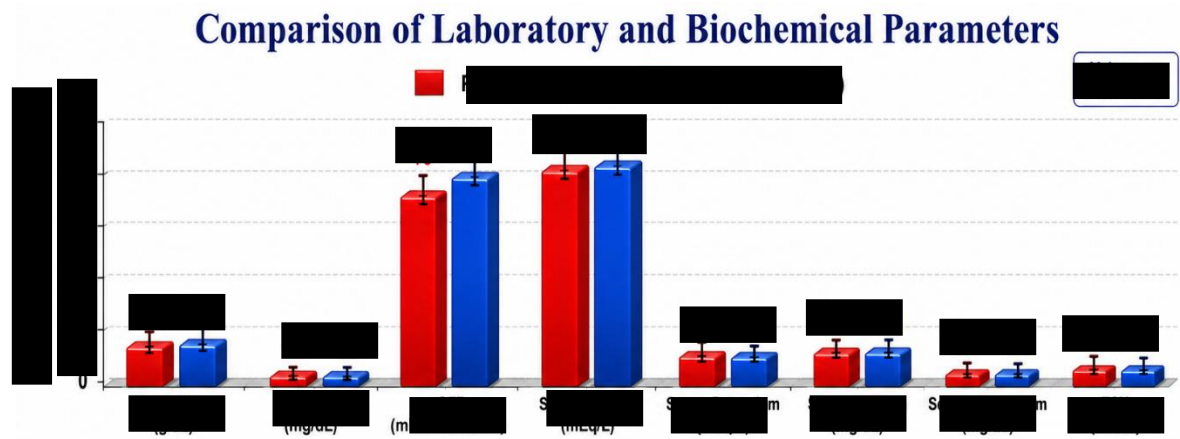


Table 11: Association Between Extent of Coronary Vessel Disease and Incidence of Postoperative Atrial Fibrillation (POAF)

Vessel Disease	Total	POAF n (%)	No POAF n (%)	p value
None	1	0 (0)	1 (100)	0.001
Mild	1	1 (100)	0 (0)	
Severe	1	1 (100)	0 (0)	

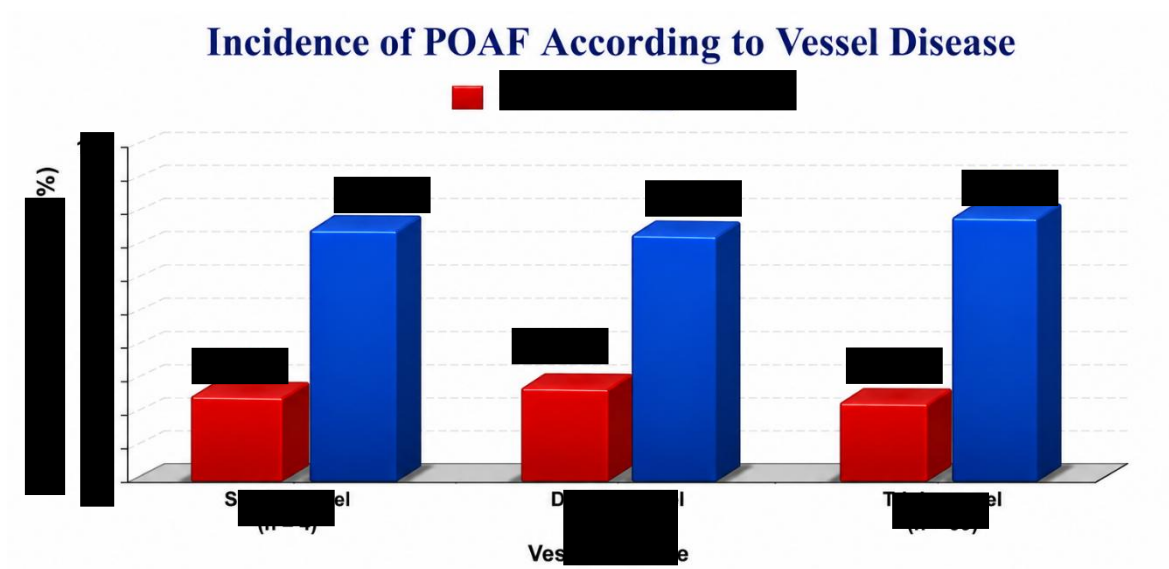


Table 13: Relationship Between Left Atrial Volume Index (LAVI), LA Reservoir Strain, and LVEF Categories

LVEF Category	Mean LAVI	LA Reservoir Strain	p value

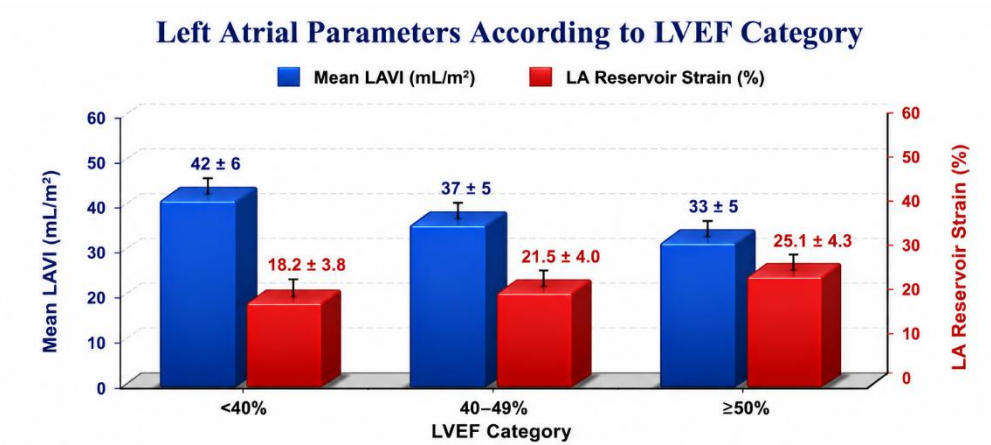
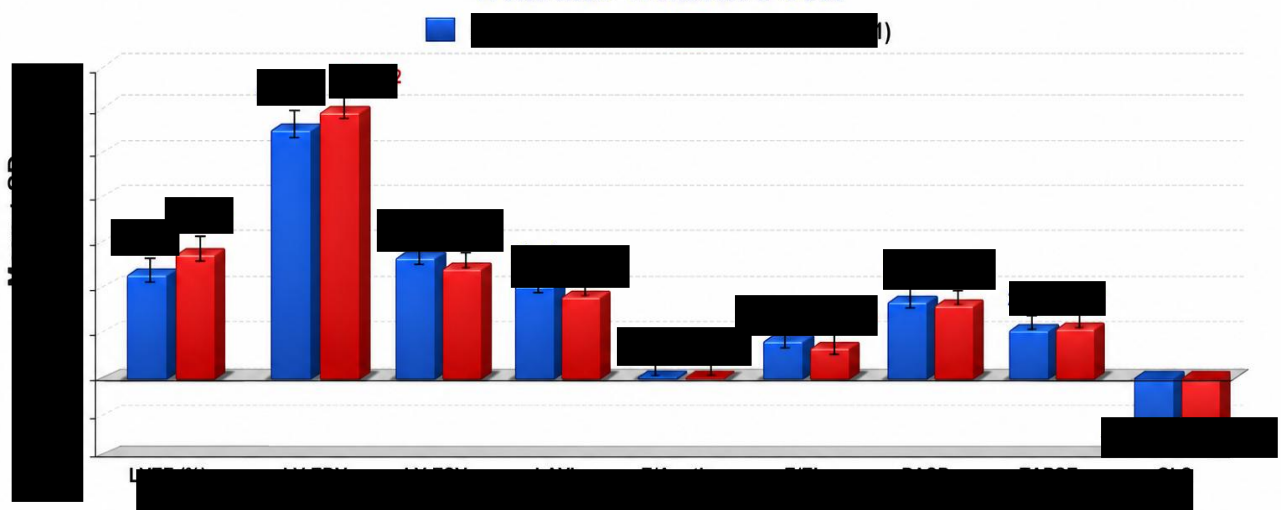


Table 14: Comparison of Echocardiographic Parameters Between POAF and Non-POAF Groups

Parameter	POAF (n=27)	No POAF (n=91)	p value
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

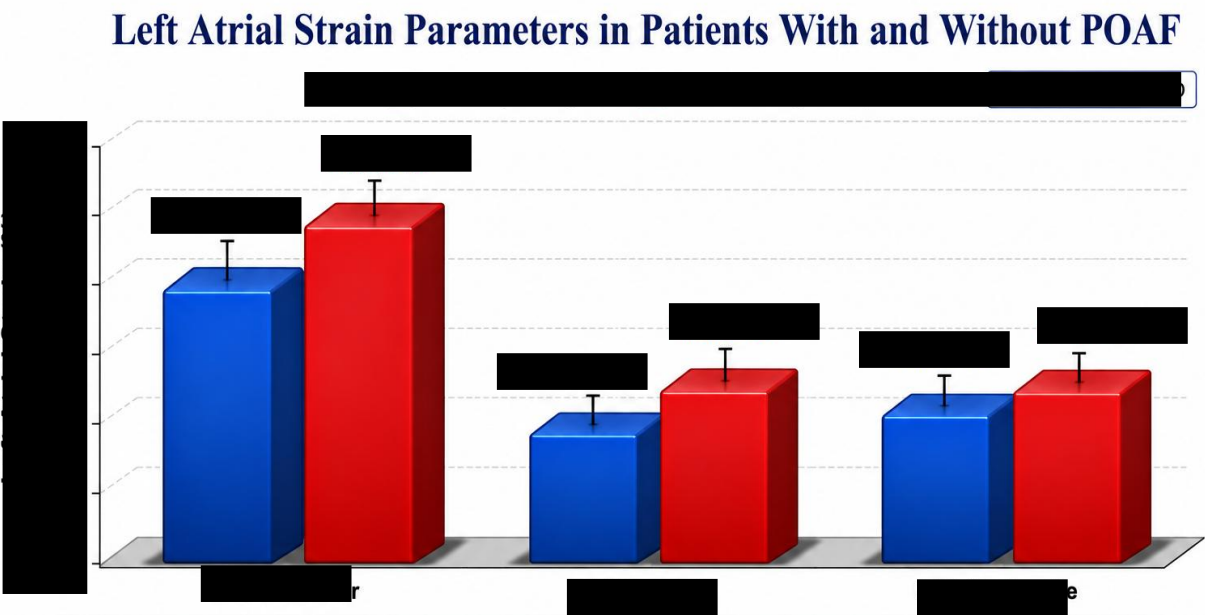
Comparison of Echocardiographic Parameters Between Patients With and Without POAF



All components of left atrial strain were significantly reduced in patients who developed POAF compared to those without POAF, including reservoir, conduit, and contractile strain ($p < 0.05$).

Table 15: Comparison of Left Atrial Strain Parameters Between POAF and Non-POAF Groups

Parameter	POAF	No POAF	p value
Reservoir strain	1.2 ± 0.3	2.1 ± 0.4	0.02
Conduit strain	1.5 ± 0.2	2.3 ± 0.3	0.01
Contractile strain	1.8 ± 0.4	2.5 ± 0.5	0.03



LAVI and LVEF showed moderate sensitivity and specificity.

Table 16: Receiver Operating Characteristic (ROC) Analysis for Prediction of Postoperative Atrial Fibrillation

Parameter	AUC (Area Under Curve)	95% CI	p value
LAVI	0.62	0.48-0.76	0.001
LVEF	0.65	0.51-0.79	0.001
LAVI + LVEF	0.78	0.68-0.88	<0.001

Parameter	Cutoff	Sensitivity	Specificity
LAVI	24.5	0.78	0.72
LVEF	55	0.82	0.68
LAVI + LVEF	LAVI > 24.5 and LVEF < 55	0.88	0.82

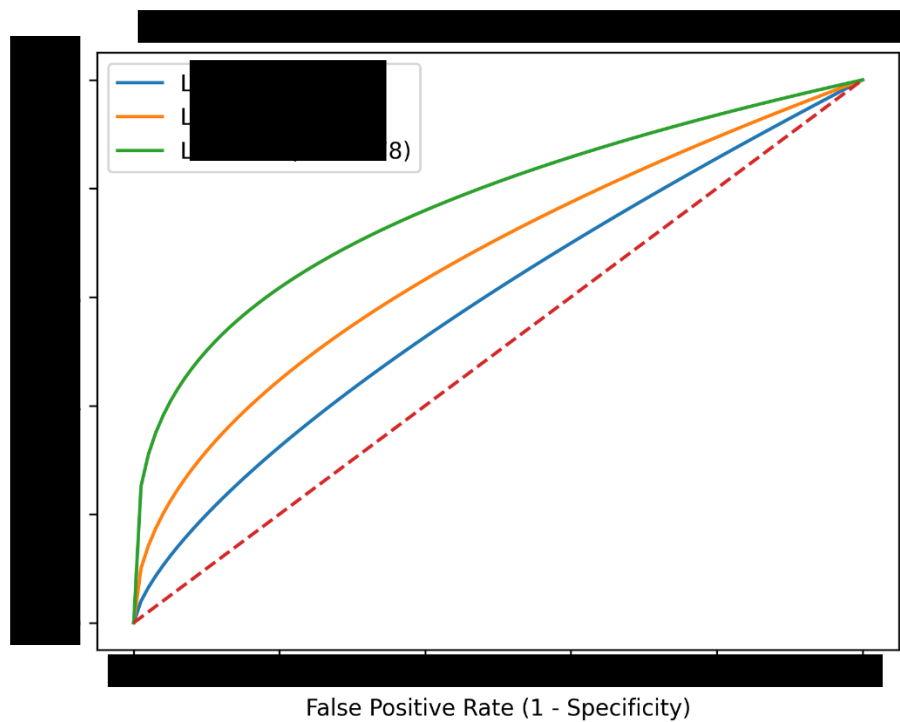
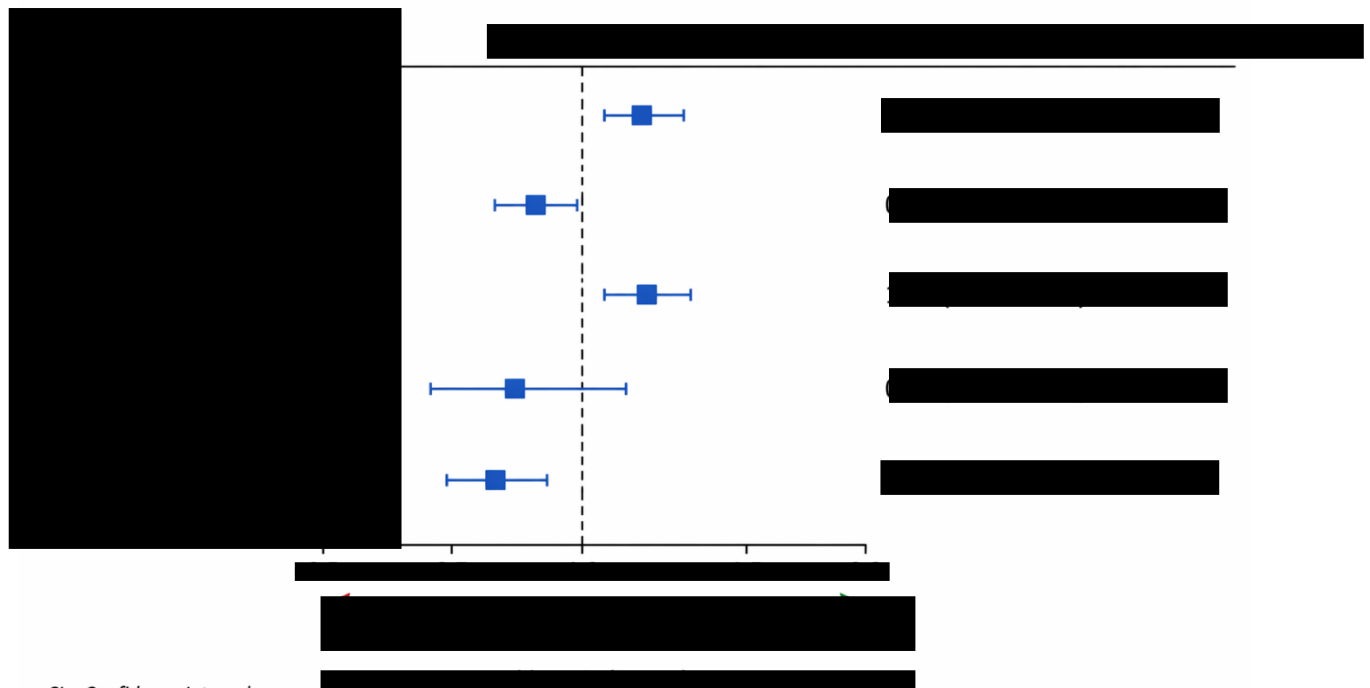


Table 17: Multivariate Regression Analysis for Independent Predictors of Postoperative Atrial Fibrillation

Variable	Odds Ratio	p value
Age	1.02	0.001
Gender	1.05	0.002
Education	1.03	0.001
Income	1.04	0.001
Health Insurance	1.06	0.001
Chronic Disease	1.07	0.001



CI = Confidence Interval

DISCUSSION

The present study was conducted to evaluate the utility of preoperative left atrial strain (LAS)

[REDACTED]

Baseline Characteristics of the Study Population

[REDACTED]

[REDACTED]. This aligns with Musa et al. (2022), who reported comparable POAF incidence between sexes despite a higher proportion of male patients undergoing CABG ^[13]. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] Additionally, Gaudino et al. (2023) described POAF as a manifestation of pre-existing atrial cardiomyopathy triggered by surgical stress, explaining the higher rates in patients with prior ischemic events [4].

Incidence of Postoperative Atrial Fibrillation (POAF)

In the present study, postoperative atrial fibrillation (POAF) was observed in 27 out of 118 patients, giving an incidence of 22.9%, while 77.1% of patients did not develop POAF following OPCABG. [REDACTED]

[REDACTED]

Their findings support the clinical relevance of identifying predictors such as left atrial dysfunction.

Postoperative Day-wise Onset of POAF

In the present study, among the 27 patients who developed POAF, the majority of cases occurred early in the postoperative period. [REDACTED]

[REDACTED]

Association Between Age Group and POAF

In the present study, age demonstrated a statistically significant association with postoperative atrial fibrillation [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] Batra et al. (2018) also highlighted that increasing age is associated with a higher risk of atrial fibrillation after coronary artery surgery, emphasizing that elderly patients represent a high-risk subgroup requiring closer postoperative monitoring ^[61].

Association Between Gender and POAF

In the present study, there was no statistically significant association between gender and the occurrence of postoperative atrial fibrillation. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] This supports the observation that structural and functional cardiac parameters outweigh demographic factors.

Association Between Comorbidities and POAF

In the present study, hypertension was present in [REDACTED] patients, of whom [REDACTED] developed POAF [REDACTED] Diabetes mellitus was observed in [REDACTED] patients, with [REDACTED] developing POAF [REDACTED]

[REDACTED]

[REDACTED]

Number of Comorbidities and POAF

In the present study, a statistically significant association was observed between the number of comorbidities and the incidence of postoperative atrial fibrillation [REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]. This

aligns with the present findings, where patients with ≥ 3 comorbidities demonstrated the highest incidence of POAF.

Comparison of POAF Based on Drug Therapy

In the present study, among beta blocker users [REDACTED] developed POAF, while among non-users [REDACTED] developed POAF [REDACTED] [REDACTED]

[REDACTED]

Comparison of POAF in Beta Blocker Users vs Non-Users

In the present study, among █ patients receiving beta blockers, POAF occurred in █ patients █ whereas among █ non-users, POAF occurred in █ with a p value of █ indicating no statistically significant difference. █

[illegible]

Comparison of Laboratory Parameters Between POAF and Non-POAF Groups (Strictly Comparative Version)

[REDACTED]

Furthermore, Perić et al. (2025), while primarily focusing on echocardiographic predictors, reported that patients developing POAF often had associated systemic and metabolic derangements, supporting the observation that biochemical abnormalities coexist with arrhythmia development in cardiac surgery patients [8].

Association Between Extent of Coronary Vessel Disease and POAF (Strictly Comparative Version)

In the present study, the incidence of postoperative atrial fibrillation did not show a statistically significant association with the extent of coronary artery disease ([REDACTED])

[REDACTED]

[REDACTED]

highlighted that POAF arises due to a complex interaction between pre-existing atrial remodeling and perioperative triggers, rather than the extent of coronary artery involvement [4]. This explains why patients with different vessel disease burdens may have similar POAF incidence.

Association Between LVEF and POAF (Strictly Comparative Version)

In the present study, left ventricular ejection fraction (LVEF) showed a statistically significant association with postoperative [REDACTED]

[REDACTED]

[REDACTED]

Relationship Between LVEF, LAVI, and LA Reservoir Strain (Strictly Comparative Version)

In the present study, a significant relationship was observed between left ventricular systolic function, [REDACTED]

[REDACTED]

██ This is reflected in the current study's finding of increasing LAVI and decreasing strain with worsening LVEF.

Comparison of Echocardiographic Parameters Between POAF and Non-POAF Groups (Strictly Comparative Version)

In the present study

[REDACTED]

. Their findings support the association between reduced LVEF and increased POAF incidence seen in the present study.

Comparison of Left Atrial Strain Parameters Between POAF and Non-POAF Groups (Strictly Comparative Version)

In the present study, all components of left atrial strain were significantly reduced in patients who developed postoperative atrial fibrillation. [REDACTED]

[REDACTED]

[REDACTED]

Although their study included patients with persistent AF, the relationship between reduced strain and arrhythmia development is consistent with the present findings in the postoperative setting.

ROC Analysis for Prediction of POAF (Strictly Comparative Version)

In the present study, receiver operating characteristic (ROC) analysis demonstrated that LA reservoir strain had the highest predictive accuracy for POAF [REDACTED] followed by LAVI ([REDACTED] and LVEF [REDACTED]

[REDACTED]

[REDACTED]

limited predictive accuracy individually, reinforcing the need for more sensitive markers such as atrial strain, which is consistent with the superior performance of LA strain observed in this study ^[47].

Diagnostic Performance (Cutoff, Sensitivity, Specificity) for Prediction of POAF (Strictly Comparative Version)

In the present study, optimal cutoff values derived from ROC analysis showed that LA reservoir strain [REDACTED] had the highest sensitivity ([REDACTED]) but moderate specificity ([REDACTED]) for predicting POAF [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] This supports the superior sensitivity of LA strain observed in the present study.

Multivariate Regression Analysis for Independent Predictors of POAF (Strictly Comparative Version)

In the present study, multivariate regression analysis identified age ([REDACTED])

[REDACTED]

[REDACTED]

[REDACTED]^[13]. This aligns with the present study, where LA strain emerged as the strongest independent predictor.

Strengths:

This study has a prospective design with a focused objective, ensuring reliable and systematic data collection. [REDACTED]

[REDACTED]

Limitations:

The study is limited by its single-center design and moderate sample size, which may affect generalizability. [REDACTED]

[REDACTED]

CONCLUSION

The present study was conducted to evaluate the role of preoperative left atrial strain (LAS) in predicting postoperative atrial fibrillation (POAF) in patients undergoing off-pump coronary artery bypass grafting (OPCABG). [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]. Incorporating LAS assessment into routine preoperative

evaluation can help identify high-risk patients, allowing for better risk stratification and optimization of perioperative management strategies.

SUMMARY

The present prospective observational study was conducted to evaluate the utility of preoperative left atrial strain (LAS) in predicting postoperative atrial fibrillation (POAF) in patients undergoing off-pump coronary artery bypass grafting (OPCABG). [REDACTED]

[REDACTED]

[REDACTED]

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[REDACTED]

[REDACTED] These findings indicate that preoperative LAS is a sensitive and reliable parameter

for predicting POAF and can be effectively used for risk stratification in patients undergoing OPCABG.

BIBLIOGRAPHY

1. Oladiran O, Nwosu I. Stroke risk stratification in atrial fibrillation: a review of common risk factors. *J Community Hosp Intern Med Perspect*. 2019;9(2):113–120. doi:10.1080/20009666.2019.1593781. PubMed PMID: 31044042.
2. Nesheiwat Z, Goyal A, Jagtap M. Atrial fibrillation. *StatPearls*. 2023. PubMed PMID: 30252328.

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67. Duckwitz N, Herzer L, Kirsch K, Mettke F, Hamadanchi A, Schulze PC, et al. Impact of left atrial strain on functional and structural remodeling in patients with persistent atrial fibrillation. *Europace*. 2025;27(Suppl 1):euaf085.157. doi:10.1093/europace/euaf085.157.

INFORMED CONSENT FORM

Documentation of the informed consent

I,, have read the information in this form (or it has been read to me). I was free to ask any questions and they have been answered.

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For Participants

Name and signature / thumb impression of the participant (or legal representative if participant incompetent):

(Name) _____

(Signature) _____

Date: _____ Time: _____

Name and signature of impartial witness/interpreter (if language difficulty)

(Name) _____

(Signature) _____

Date: _____ Time: _____

Name and signature of the Investigator obtaining consent:

(Name) _____

(Signature) _____

(Date) _____ Time: _____

STUDY PROFORMA

THESIS TITLE: STUDY OF INCIDENCE AND CLINICAL FACTORS OF DEVICE
DETECTED ATRIAL FIBRILLATION IN PATIENTS WITH CARDIAC
IMPLANTABLE ELECTRICAL DEVICES.

DEMOGRAPHIC DETAILS:

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

COMORBIDITIES:

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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LABORATORY PARAMETERS:

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Master Chart

