



PRE AND POST BRONCHOSCOPIC EVALUATION OF CARDIAC RHYTHM AND FUNCTIONAL CHANGES OF THE HEART ON ECG AND ECHOCARDIOGRAPHY.

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Received: 05-05-2026

Revised: 22-05-2026

Accepted: 11-06-2026

Published: 25-06-2026

Abstract

Background: Serious complications following bronchoscopy is around 1.1% and mortality is about 0.02%. Cardiovascular complications are well known to occur as a result of premedications, topical anaesthetics, hypoxemia⁵ and release of catecholamines in response to anxiety state during the bronchoscopy procedure. **Objective:** To evaluate the cardiac rhythm changes and functional changes of the heart before and after diagnostic fibreoptic bronchoscopy. **Methods:** This descriptive study involved 180 patients and was conducted in the Department of Pulmonary Medicine at Bangalore Medical College and Research Institute over an 18-month period. Patients who underwent fiberoptic bronchoscopy and met the inclusion and exclusion criteria were included in the study. **Result:** Of the 180 patients who underwent flexible fibreoptic bronchoscopy, the majority had a normal sinus rhythm, with 166 patients (92.2%) showing this rhythm prior to the procedure. After the bronchoscopy, sinus tachycardia was the most prevalent rhythm, seen in 93 patients (51.7%), followed by normal sinus rhythm in 44.4% of patients and sinus bradycardia in 3.9%. Five patients (2.8%) had ventricular premature contractions (VPCs) and one patient (0.6%) experienced atrial bigeminy before the bronchoscopy, both of which resolved after the procedure. Additionally, two patients (1.1%) developed VPCs following bronchoscopy; however, these were considered to be non-significant. Two (1.1%) patients out of 180 were intubated following FOB and no deaths were reported among them. **Conclusion:** Fiberoptic bronchoscopy is regarded as one of the safest procedures. The most frequently observed minor arrhythmia after the procedure is sinus tachycardia, with no major arrhythmias reported. Furthermore, changes in the 2D echocardiogram, such as variations in heart contraction, pulmonary artery systolic pressure (PASP), or left ventricular ejection fraction (LVEF), showed no significant alterations after the procedure, underscoring its appropriateness for outpatient settings.

Keywords: Fiberoptic bronchoscopy, ECG, 2DECHO.



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INTRODUCTION

Fiberoptic bronchoscopy usually performed via oral or nasal route¹. Serious complication following bronchoscopy is around 1.1% and mortality is about 0.02%. During bronchoscopy ECG changes are associated with 15 % (ST-T change in 4%, transient right bundle branch block in 3%)²

Careful evaluation of the patients cardiovascular status should be performed prior to bronchoscopic examination³. ECG provides a quick, portable, and non-invasive way to assess cardiac rhythm and strain. along with 2D echo it can identify early cardiac functional changes of the heart giving time for early interventions.

Cardiovascular complications are widely recognized as potential outcomes of premedications, topical anaesthetics, hypoxemia⁴ and release of catecholamines in response to anxiety state during the bronchoscopy procedure. Among the various complications, occurrence of hypoxemia and cardiac arrhythmias during the procedure is well known and can endanger the life of the patients if not detected early and properly treated⁵. Educating physicians and bronchoscopists about these complications can help prevent or reduce the likelihood of such adverse effects.

In the limited review of literature study of cardiac rhythm and functional changes of the heart after bronchoscopy, could not be found. Hence the present study intends to evaluate the cardiac rhythm and functional changes of the heart in the patients who undergo bronchoscopic procedure which may help us to detect cardiac abnormalities early and can be managed in time and risk of such complications be reduced.

MATERIALS AND METHODS

This descriptive study was conducted on a population of 180 patients of age group between 18-80 years, undergoing diagnostic Flexible fiberoptic bronchoscopy attending as outpatients/inpatients to the hospital attached to Bangalore Medical College & Research Institute, Bangalore, during the study period from August 2022 to January 2024

SAMPLE SIZE:

Based on previous study conducted by Ahmed S et al 6by assuming equal proportion at variants and considering proportion of minor arrhythmia during the control period which is around 69%

Sample size is calculated as

$$N = 4pq/d^2$$

$$N = 4 \times 69 \times 31 / 100$$

$$= 8556 / 100$$

$$= 86 \text{ approximately } 90 \quad N = 90$$

Sample size calculated is 90 using above formula. In total we have included 180 patients in the study

INCLUSION CRITERIA:

1. Age of the patients > 18 years of either sex
2. Patient willing to give informed consent.
3. Patient undergoing fibreoptic bronchoscopy

EXCLUSION CRITERIA:

1. Age below 18 years.
2. Patient not willing to give informed consent.
3. Patient with the recent history of Myocardial Infarction (within 3 months).
4. Contraindications to bronchoscopy like bleeding diathesis, unstable angina, uraemia and uncooperative patients.
5. Patients who are on arrhythmogenic and anti-arrhythmogenic medication.
6. Patients with known cardiac disorders, Valvular heart disease and congenital heart disease.

METHODOLOGY:

After obtaining approval and clearance from the institutional ethics committee, the patients fulfilling the inclusion criteria will be enrolled for the study after obtaining informed consent. A detailed history of respiratory and cardiovascular symptoms will be elicited by interviewing the patients. The socio-demographic and details as per the proposed proforma (Annexure-2) will be obtained and entered and then the patients will be clinically examined thoroughly. Patients are then subjected to ECG and 2D echocardiography 12 hours before fibreoptic bronchoscopy and between 10-12 hours of the procedure to look for changes in the cardiac rhythm and functional changes of the heart. Cardiologist opinion was taken for the pre bronchoscopy and post bronchoscopy ECG and 2 DECO changes.

ECG: All the patients were subjected to 12 lead ECG in the department of Respiratory medicine of BMCRI 12 hours before the bronchoscopy and 10-12 hours after bronchoscopy and looked for the changes in the heart rate and cardiac rhythm. Cardiac rhythms were classified as major and minor arrhythmias according to Shrader and Lakshminarayan. Major arrhythmias were defined as those that could potentially lead to hemodynamic compromise, including sinus bradycardia (<40bpm), supraventricular tachycardia (>120bpm), PVCs (<50 per hour) and any other ventricular arrhythmias, all other arrhythmias were considered minor. Bronchoscopy: All the patient were subjected to flexible fibreoptic bronchoscopy. Pre-bronchoscopy workup including coagulation profile, 2Dechocardiography electrocardiography, sputum AFB and infection serology is done. Xylocaine test dose and tetanus toxoid is given on the day before bronchoscopy and the patient is maintained nil per orally for 4 -6 hours prior to the procedure. Nebulisation to be done with four percent xylocaine via ultrasonic nebulizer prior to the procedure. Bronchoscopy will be performed with Olympus BF IT150 bronchoscope series under topical anaesthesia. Routine vital parameters will be monitored.

2D-echocardiography: All patients were subjected to two-dimension transthoracic Doppler echocardiography 12 hours before the procedure and around 10-12 hours of the procedure and compare the changes in the cardiac contractility and ejection fraction. The machine used will be VIVID E95 model of GE health care system with a multifrequency probe with a range of 2–4.3 MHz, with both 2D and M-Mode studies.

Changes of the ECG and 2D-echocardiography 12 hours before and around 10-12 hours of bronchoscopy are noted and the data collected will be documented and used further in statistical analysis.

ASSESSMENT TOOLS:

Electrocardiography:

D echocardiography:

Flexible fibreoptic Bronchoscopy: All the patient were subjected to flexible fibreoptic bronchoscopy. Pre-bronchoscopy workup including coagulation profile,

OUTCOME MEASURES:

- Heart rate
- Cardiac rhythm
- Right and left ventricular contractility
- Ejection fraction
- PASP

STATISTICAL ANALYSIS:

Data collected will be entered in Microsoft excel and analysed using descriptive statistics namely Mean, Standard deviation, percentage wherever applicable. Appropriate parametric and non- parametric tests will be conducted such as chi-square test for categorical valuables and Pearson's correlation for continuous variable using SSPS version 20.0.

RESULTS

Age distribution were <20 years is 2.2%, 21-30 years is 12.2%, 31-40 years is 17.8%, 41-50 years is 15.6%, 51-60 years is 18.9%, 61-70 years is 23.3%, 71-80 years is 8.3%, >80 years is 1.7%. Descriptive Statistics of Age were the minimum age recorded is 18, the maximum age is 92, and the mean age $\pm$ standard deviation is 50.3 ± 16.5 years. Gender distribution were Female is 31.1%, Male is 68.9%. Non smokers were 65.0%, smokers were 35.0%. Comorbidity distribution- T2DM absent in 80.0%, present in 20.0%. HTN-absent in 88.9%, present in 11.1%. CKD-absent is 94.4%, present in 5.6%, Hypothyroidism-absent is 97.8%, present in 2.2%.

Table 1: Pre and Post Bronchoscopy Heart rate(HR) distribution

	Pre		Post	
	Frequency	Percent	Frequency	Percent
NSR	166	92.2	80	44.4
Sinus Tachycardia	13	7.2	93	51.7
Sinus Bradycardia	1	0.6	7	3.9
Total	180	100	180	100

The above table shows pre and post bronchoscopy heart rate distribution - normal sinus rhythm accounts for 92.2% in pre bronchoscopy and 44.4% in post bronchoscopy, Sinus Tachycardia present in 7.2% pre bronchoscopy and 51.7% in post bronchoscopy similarly Sinus Bradycardia accounts for 0.6% in pre bronchoscopy and 3.9 % in post bronchoscopy respectively.

Table 2: Pre bronchoscopy ECG ST changes distribution

Pre bronchoscopy ECG ST changes		
	Frequency	Percent
Nil	173	96.1
non specific ST elevation	1	.6
T inv v1 to V3	1	.6
T wave inversion in v1-v2	1	.6
t wave inversion in v3-v6	1	.6
T wave inversion in v5-v6	1	.6
T wave inversion v1-v4	1	.6
t wave inversion V2	1	.6
Total	180	100.0

The above table shows Pre bronchoscopy ECG ST changes distribution where nil has highest percentage (96.1%), all other variable has lowest percentage (0.6%).

Table 3: Post bronchoscopy ECG ST changes distribution

Post bronchoscopy ECG ST changes		
	Frequency	Percent
Nil	173	96.1
ST elevation V1-V3	1	.6
ST elevation in I,II	1	.6
t wave inversion in v1,v3	1	.6
t wave inversion in v3,v4	1	.6
t wave inversion v3-V6	1	.6
T wave inversion V5-V6	1	.6
T wave inversion in v1-v4	1	.6
Total	180	100.0

Table 4: Pre-Bronchoscopy Arrhythmia distribution

Pre-Bronchoscopy Arrhythmia		
	Frequency	Percent
Nil	174	96.7
Atrial bigeminy	1	0.6
VPCs (non-significant)	5	2.8
Total	180	100.0

The above table shows Pre bronchoscopy arrhythmia distribution where nil VPCs has highest percentage (97.2%), atrial bigeminy (0.6%) and VPC (non-significant) is (2.8%).

Post arrhythmia distribution -nil VPCs has percentage (98.9%) and VPCs(non-significant) has (1.1%).

Pre & Post bronchoscopy HR changes by Paired sample t-test were t-value=13.431, p-value=0.0005<0.01 which shows highly statistical significance difference at $p < 0.01$ level.

(Pre bronchoscopy most of the patient had Normal sinus rhythm, post bronchoscopy most of them had sinus tachycardia)

Table 5: Comparison of Pre & Post bronchoscopy LVEF changes by Paired sample t- test

Table 3: Comparison of Pre & Post bronchoscopy LVEF changes by paired sample t-test						
Variable	Groups	Mean	N	SD	t-value	p-value
LVEF	Pre bronchoscopy	0.59	180	0.03	1.065	0.288 #
	Post bronchoscopy	0.59	180	0.03		
# No Statistical Significance at p > 0.05 level						

Pre & Post bronchoscopy LVEF changes by Paired sample t-test were t-value=1.065, p-value=0.288>0.05 which shows no statistical significance difference at $p > 0.05$ level.

Table 6: Comparison of Pre & Post bronchoscopy PASP changes by Paired sample t- test

Table 6: Comparison of Pre- & Post-bronchoscopy PASP changes by Paired sample t-test						
Variable	Groups	Mean	N	SD	t-value	p-value
PASP	Pre bronchoscopy	31.98	180	6.90	1.418	0.158 #
	Post bronchoscopy	32.02	180	6.90		
# No Statistical Significance at p > 0.05 level						

Pre & Post bronchoscopy PASP changes by Paired sample t-test were t-value=1.418, p-value=0.158>0.05 which shows no statistical significance difference at $p > 0.05$ level.

Table 7: Inference 2d echo distribution (comparison pre to post bronchoscopy)

Inference 2d echo		
Pre bronchoscopy to Post bronchoscopy changes	Frequency	Percent
EF -61to 55%,PASP 30 to 33mmhg	1	.6
EF-60 to 58%	1	.6
PASP-30-33mmhg,EF-61-58%	1	.6
PASP-30-33mmhg	1	.6
PASP33-36mmhg	1	.6
No changes	175	97.2
Total	180	100.0

The above table shows Inference 2d echo distribution (comparing pre and post bronchoscopy ECHO changes) -No changes has highest percentage (97.2%), all other variable has lowest percentage (0.6%).

DISCUSSION

Fibreoptic bronchoscopy is generally a safer procedure which carries some risks, such as bleeding, infection, respiratory and cardiac complications. These risks are minimized by careful patient selection and monitoring of the patients during and after the procedure and skilled performance by trained medical professionals. The reported rate of complications following Fibreoptic bronchoscopy, including cardiac arrhythmias, is low.7-8. Hypoxemia and cardiac arrhythmias are recognized complications during fibreoptic bronchoscopy that can pose serious risks to patients if not promptly identified and managed.5 Our study aimed to evaluate cardiac rhythm and functional changes of the heart using ECG and echocardiography before and after bronchoscopy. It included a total of 180 patients who underwent fibreoptic bronchoscopy for various reasons, with the most common indication being to rule out pulmonary tuberculosis. Among the 180 patients, the majority belonged to the age group of 61-70 years, accounting for 23.3% of the total, and the cohort was predominantly male (68.9%). Of the patients, 110 had no comorbidities, while 70 had comorbid conditions. The most common comorbidity was type 2 diabetes mellitus, followed by systemic hypertension, chronic kidney disease (CKD), and hypothyroidism.

Most patients had a normal sinus rhythm, with 166 (92.2%) exhibiting this rhythm pre-bronchoscopy. Post-bronchoscopy, the most common rhythm was sinustachycardia, observed in 93 patients (51.7%), followed by normal sinus rhythm in 44.4% and sinus bradycardia in 3.9%. ST elevation was considered significant in males if there was more than 2.5 mm elevation in those under 40 years and more than 2 mm elevation in those over 40 years. In females, a significant elevation was defined as greater than 1.5 mm.9 In our study, the ST and T wave changes observed before and after bronchoscopy were not significant. Ventricular premature contractions (VPCs) are considered significant if there is a high VPC burden, the presence of polymorphic VPCs, a family history of sudden cardiac death, R-on-T phenomena, or consecutive VPCs.9 In our study, a total of 5 patients (2.8%) had VPCs, and 1 patient (0.6%) experienced atrial bigeminy before the bronchoscopy, which resolved after the procedure. Additionally, 2 patients (1.1%) developed VPCs following bronchoscopy, but these were deemed non-significant.

Arrhythmias were classified as major or minor based on the criteria established by Shrader and Lakshminarayan. Major arrhythmias were defined as those that cause hemodynamic instability and included sinus bradycardia (less than 40 bpm), supraventricular tachycardia (greater than 120 bpm), VPCs (more than 50 per hour), and any other ventricular arrhythmias.5 Credle et al. conducted a retrospective survey of 22,521 fibreoptic bronchoscopy (FOB) procedures, reporting eight minor arrhythmias, two major arrhythmias, and one death due to cardiac arrest. They concluded that sinus tachycardia occurred more commonly, sinus bradycardia was not observed, and VPCs were rare. In our study, we also found that sinus tachycardia (51.7%) was the most common finding, while sinus bradycardia was observed in 7 patients (3.9%) following FOB. A prospective study conducted by Ahmed S. Elguindi et al.11 reported that the occurrence of total arrhythmias, including sinus tachycardia, was 69%, with minor arrhythmias at 69% and major arrhythmias at 8%. During fibreoptic bronchoscopy (FOB), the occurrence of total and minor arrhythmias increased to 77% and 73%, respectively. In our study, nearly all patients experienced minor arrhythmias, primarily sinus tachycardia (51.7%), and there was an increase in minor arrhythmias from 7.1% to 51.7% following the procedure. Importantly, none of the patients experienced hemodynamic compromise that would have led to major arrhythmias. There is limited literature on the occurrence of Takotsubo cardiomyopathy following fibreoptic bronchoscopy (FOB), a condition often thought to arise from stress-induced catecholamine release, leading to decreased heart contraction. In our study, none of them developed this condition.

Changes observed in the 2D echocardiogram, specifically in contraction, left ventricular ejection fraction (LVEF), and pulmonary artery systolic pressure (PASP), were compared pre and post-bronchoscopy among the 180 patients. Only 5 patients exhibited changes in LVEF and PASP, which were not deemed significant.

Credle et al⁸ reported four deaths occurring in 24,521 procedures and Paul M. Suratt et al reported 10 deaths following bronchoscopy³. Our study showed one death among the 180 patients following fibreoptic bronchoscopy. The indication for the procedure was to evaluate an upper lobe mass and to rule out malignant etiology. In our study, 2 patients (1.1%) out of 180 required intubations following fibreoptic bronchoscopy, but no deaths were reported among them. It was believed that the need for intubation was due to an overdose of anesthesia used during the procedure.

CONCLUSION

Flexible Fibreoptic bronchoscopy is generally regarded as a safe procedure, clinicians should stay alert for possible cardiac complications, such as malignant Ventricular premature contractions, ventricular and atrial tachycardia, particularly in high-risk patients. Early recognition, effective management, and preventive strategies are essential for minimizing adverse outcomes.

In our study the occurrence of Sinus tachycardia is more commonly observed following the procedure accounting to 51.7%. The incidence of major arrhythmias was very low, 5 patients (2.8%) had VPCs (nonsignificant) and 1 patient (0.6%) experienced atrial bigeminy before the fiberoptic bronchoscopy, which resolved following the procedure. Lignocaine anaesthesia mostly provide protective effect against the development of major arrhythmia. 0.5 % mortality noted and 2 patients (1.1%) required intubation following procedure, but no mortality reported among them. No significant Echocardiographic changes were noted following the procedure, from the above study it can be inferred that flexible fibreoptic bronchoscopy is a safe procedure that can be performed on an outpatient basis.

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