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**Dr. Chandulal**  
Associate Professor,  
Department of General  
Medicine, MNR Medical  
College and Hospital,  
Sangareddy, Telangana, India

**Dr. R. Venkat Naik**  
Professor, Department of  
General Medicine,  
Maheshwara Medical College  
and Hospital, Sangareddy,  
Telangana, India

**Corresponding Author:**  
**Dr. Chandulal**  
Associate Professor,  
Department of General  
Medicine, MNR Medical  
College and Hospital,  
Sangareddy, Telangana, India

## Electrocardiographic variations in cases with pulmonary tuberculosis related to anti-tuberculosis therapy

**Dr. Chandulal and Dr. R. Venkat Naik**

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### Abstract

Tuberculosis is the major public health concern globally. Cardiovascular involvement was observed in 1-2% of cases with pulmonary tuberculosis. The present study was designed to assess the ECG changes in pulmonary tuberculosis before and after anti-tuberculosis therapy. A total of 90 clinically diagnosed with sputum positive pulmonary tuberculosis cases above 21 years of age were included. Cases with abnormal findings on ECG were advised to echocardiography to detect the exact abnormality / cardiac complication due to pulmonary tuberculosis. Collected data were analysed to compare the ECG changes in pulmonary tuberculosis at the initial diagnosis and follow up for six months. In 60% of cases, the duration of symptoms was less than 6 months and in 40% cases, it was more than 6 months. ECG abnormalities were observed in 65.5% pulmonary tuberculosis cases before commencing anti-tuberculosis therapy, whereas ECG abnormalities were noted in 34.4% of cases after completion of anti-tuberculosis therapy. Sinus tachycardia was observed in pulmonary tuberculosis cases before anti tuberculosis therapy was 42.2% and after 6 months follow up with ATT it was reduced to 11.1%. Sinus tachycardia, QRS axia+90<sup>0</sup>, p wave axis +90<sup>0</sup>, Right side axis deviation and p-pulmonale was the main abnormalities noticed in ECG before the commencement of anti-tuberculosis therapy. The values were reverted back to normal after anti tuberculosis therapy. PT cases with atypical features should be a monitor with echocardiography for early detection of cardiac complications.

**Keywords:** pulmonary tuberculosis (PT), electrocardiography, anti tuberculosis therapy (ATT)

### Introduction

India comprises one-fourth of the global tuberculosis burden. According to WHO estimated incidence of tuberculosis was 211 in 1 lakh people and the associated mortality is 32 in 1 lakh people [1, 2]. In postnatal life, the lung is the commonest site for tuberculosis infection which is transmitted by aerosol [3]. Lungs and heart are functionally works in such a harmony that complications in one influence the function of others. Cardiovascular involvement occurs in 1-2% of the cases with pulmonary tuberculosis and usually affects the pericardium and myocardium rarely valves are involved [4].

Studies suggested that tuberculosis increases the risk of the acute myocardial infarction, chronic heart diseases and unstable angina about 40% compared to the non-tuberculosis group [5, 7]. There is a literature gap on the determination of cardiac manifestations in pulmonary tuberculosis. The present study was designed to assess the ECG changes in pulmonary tuberculosis before and after anti-tuberculosis therapy.

### Materials and Methods

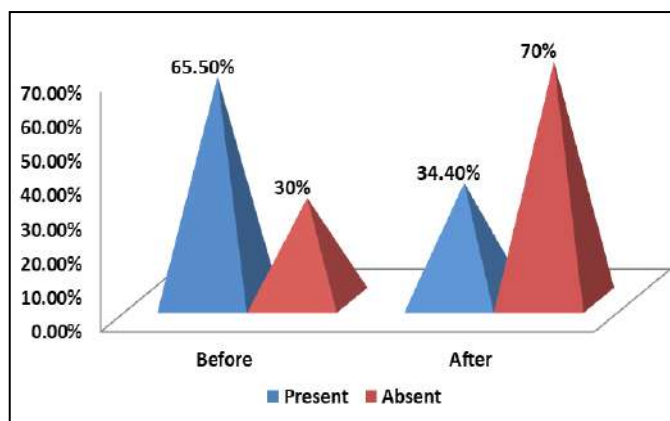
The present cross-sectional study was conducted in the Department of General Medicine at MNR Medical College and Hospital, Sangareddy from June 2019 to June 2020. A total of 90 clinically diagnosed with sputum positive pulmonary tuberculosis cases above 21 years of age were recruited. The written informed consent was obtained from all the study participants and the study protocol was approved by the institutional ethics committee. Cases with acid fast bacilli positive, freshly diagnosed with <2 weeks of ATT were included. Cases with systemic complications, heart disease, COPD, Diabetes mellitus, Hypertension, COPD, pulmonary hypertension and corpulmonale were excluded.

The detail history was collected and all the study participants were subjected to detailed clinical examination. Cases with abnormal findings on ECG were advised to echocardiography to detect the exact abnormality / cardiac complication due to pulmonary tuberculosis. ECG was taken at the time of initial diagnosis <2 weeks of commencing anti-tuberculosis therapy and after completing the course of anti-tuberculosis therapy. Collected data was extracted in to Microsoft Excel sheet. Data were analysed to compare the ECG changes in pulmonary tuberculosis at the initial diagnosis and follow up for six months. The SPSS version 23 software was used to carry out statistical analysis relevant to the study. The frequency and percentage (%) were calculated for cardiac manifestations in patients with pulmonary tuberculosis. The chi-square test was used to compare the variables and p-value of < 0.05 was considered statistically significant.

**Results**

**Table 1:** Demographic details of the study participants.

Parameter	Number	Percentage
<b>Age (In years)</b>		
21-30	18	20%
31-40	23	25.5%
41-50	29	32.2%
>50	20	22.2%
<b>Gender</b>		
Male	48	53.3%
Female	42	46.6%
<b>Weight (In Kg)</b>		
Above 50	74	82.2%
Below 50	16	17.8%
<b>Socioeconomic status</b>		
Upper	03	3.33%
Middle	31	34.4%
Lower	56	62.2%
<b>Status of smoking</b>		
Smokers	59	65.6%
Non smokers	31	34.4%
<b>Duration of symptoms</b>		
< 6 months	54	60%
> 6 months	36	40%

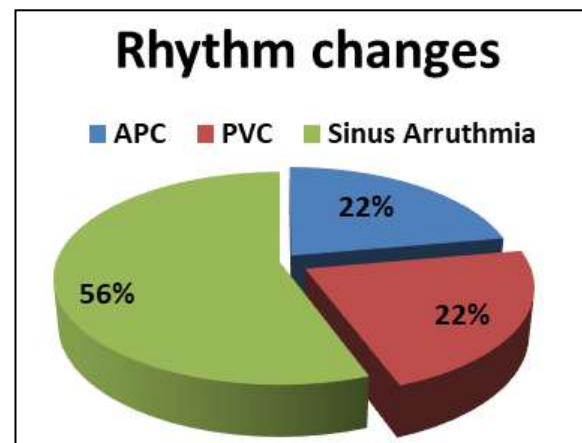


**Graph 1:** ECG changes before and after Anti tuberculosis therapy

The duration 'P' wave was normal in all the study participants before and after anti tuberculosis therapy. The duration of QRS was normal in all the study participants before and after anti tuberculosis therapy.

**Table 2:** Details of abnormal findings of ECG in the pulmonary tuberculosis cases.

ECG parameters	Before	After	P value
<b>P wave Axis</b>			
Normal	80 (88.9%)	84 (93.3%)	0.418
N+ 90°	10 (11.1%)	06 (6.7%)	
<b>QRS axis</b>			
Normal	78 (86.7%)	84 (93.3%)	0.186
N+90°	12 (13.3%)	06 (6.7%)	
<b>PR Interval</b>			
Normal	85 (94.4%)	88 (97.8%)	0.245
Prolonged	05 (5.6%)	02 (2.2%)	
<b>QR amplitude</b>			
Normal	79 (87.8%)	86 (95.6%)	0.152
Low	11 (12.2%)	04 (4.4%)	
<b>QT interval</b>			
Normal	90 (100%)	90 (100%)	-
Abnormal	-	-	
<b>ST segment</b>			
Normal	90 (100%)	90 (100%)	-
Abnormal	-	-	
<b>T wave</b>			
Normal	83 (92.2%)	90 (100%)	0.238
Inverted	07 (7.8%)	-	
<b>Heart rate</b>			
Bradycardia	03 (3.3%)	01 (1.1%)	0.005
Tachycardia	38 (42.2%)	10 (11.1%)	
<b>Axis deviation</b>			
Normal	78 (86.7%)	86 (95.6%)	0.512
Right axis deviation	09 (10%)	03 (3.3%)	
Left axis deviation	03 (3.3%)	01 (1.1%)	



**Graph 2:** Various rhythm changes in the study participants.

**Discussion**

Tuberculosis is global health concern and one of the leading causes of mortality globally. According to the American lung association, over 9.6 million people have an active form of tuberculosis. This study was designed to assess the ECG changes in pulmonary tuberculosis before and after anti-tuberculosis therapy. A total of 90 clinically diagnosed with sputum positive pulmonary tuberculosis cases above 21 years of age were recruited. Majority cases were belonged to age group 41-50 (32.2%), 31-40 (25.5%) and above 50 years (22.2%) age group. Males (53.3%) are more when compared to female cases (46.6%). A study by Dasti MA *et al.* noted mean age of pulmonary tuberculosis cases was 45.21 years [8]. In a study by Aslam Chouri *et al.* recruited 50 cases with pulmonary tuberculosis, majority cases were in between age group 46-60 years (48%) with male

predominance (84%) than females (10%) [9]. Majority cases were belonged to lower economic status (62.2%) followed by middle (34.4%) and upper economic status (3.33%). In this study, 65.6% cases were tobacco smokers and 34.4% cases were non-smokers. A study by Aslam Chouri *et al.* noted that majority cases were belonged to lower economic class (86%) followed by middle economic class (14%) and none of the cases belonged to upper economic class. Smoking habits was observed in 68% cases [8]. In 60% of cases the duration of symptoms was less than 6 months and

in 40% cases it was more than 6 months. In a study by Aslam Chouri *et al.* noted that duration of disease is <1 month in 94% cases and >1 month in 6 cases [8].

Electro cardiographic abnormalities was observed in 65.5% pulmonary tuberculosis cases before commencing anti-tuberculosis therapy, whereas ECG abnormalities was noted in 34.4% of cases after completion of anti-tuberculosis therapy for 6 months follow up. Studies by Dasti MA *et al.* and Gaur SN *et al.* showed ECG abnormalities in 72% cases and 46.4% cases respectively [8, 9].

**Table 3:** Comparison of ECG finding of present study with other studies.

ECG changes	Dasti MA <i>et al.</i> (2015)	Aslam Chouri <i>et al.</i> (2017)	Gaur SN <i>et al.</i> (2017)	Present study
Sinus tachycardia	30.55%	58%	47	42.2%
Sinus bradycardia	4.15%	-	01	3.3%
P wave axis +90°	-	-	14	11.1%
QRS axis +90°	5%	-	10	13.3%
P-pulmonale	12.5%	24%	07	8.8%
Right axis deviation	6.94%	20%	-	10%
Left axis deviation	8.33%	22%	-	3.3%
Prolonged PR interval	9.72%	-	-	5.6%
Prolonged QT interval	4.16%	-	-	0

In the present study, sinus tachycardia was observed in PT cases before ATT was 42.2% and after 6 months follow up with ATT it was reduced to 11.1%. Before ATT, sinus Bradycardia was 3.3% and was reduced to 1.1% after ATT the difference was statistically significant ( $p < 0.005$ ). In a study Dasti MA *et al.* observed sinus tachycardia in 30.55% cases and sinus Bradycardia in 4.15% cases [8]. A study by Aslam Chouri *et al.* observed sinus tachycardia in 58% cases [9]. A study by Gaur *et al.* noticed sinus tachycardia in 47 cases and sinus Bradycardia in 1 case [10].

ECG findings before ATT noticed right side axis deviation was observed in 10% cases and left side deviation in 3.3%. Whereas after ATT, right side axis deviation was seen in 3.3% cases and left side deviation was seen in 1.1% cases. A study Dasti MA *et al.* noticed high side axis deviation in 9.64% cases and left side axis deviation in 8.33% cases. A study by Aslam Chouri *et al.* noticed right side deviation in 20% cases and left deviation in 22% cases [9]. Prolonged PR interval was seen in 9.72% cases and prolonged QT interval was seen in 4.16% cases [8]. In this study prolonged PR interval was observed in 5.6% cases. In this study p wave axis +90° was observed in 11.1% cases and QRS axis +90° in 13.3% cases. A study by Gaur SN *et al.* noted that p wave axis +90° was observed in 14 cases and QRS axis +90° in 10 cases [10]. In this study cor pulmonale was seen in 8.8% cases. In a study by Dasti MA *et al.*, Aslam Chouri *et al.* and Gaur SN *et al.* noticed cor pulmonale in 12.5%, 24% and 07 cases respectively [8, 10]. A study by Agarwal BV *et al.* observed cor pulmonale in 19 cases out of 125 PT cases, whereas Padmavathi A *et al.* noticed 32 out of 454 cases of cor pulmonale due to pulmonary tuberculosis [11, 12].

### Conclusion

In the present study, Sinus tachycardia, QRS axia+90°, p wave axis +90°, Right side axis deviation and p-pulmonale was the main abnormalities noticed in ECG before commencement of anti-tuberculosis therapy. The values were reverted back to normal after anti tuberculosis therapy. Therefore, it is must to provide care to the pulmonary tuberculosis cases who have atypical features like breathing difficulties, chest pain, abnormal ECG changes and such

cases should be monitored with echocardiography for early detection of cardiac complications

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