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Study of prevalence of cor pulmonale in patients with pulmonary tuberculosis with reference to ECG, echocardiographic changes and radiological extent of the disease

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Abstract
Background: Tuberculosis is an ancient disease which continues to be a major health problem in most developing countries. Bilateral and extensive tuberculosis can cause pulmonary hypertension due to extensive fibrosis which causes distortion of parenchyma. The basic underlying pathophysiology is increase in the pulmonary vascular resistance and pulmonary hypertension. Clinical diagnosis depends on right ventricular dysfunction, pulmonary hypertension and evidence of primary lung disease. Early treatment prevents this late complication of pulmonary tuberculosis.
Methods: This was a cross sectional study conducted among 100 cases of pulmonary tuberculosis patients attending outpatient/ inpatient, are subjected to spirometry, Chest X-Ray, ECG and Echocardiographic studies. Data obtained was noted. Statistically analysed to obtain the prevalence cor pulmonale in patient with PTB. Detailed clinical and radiological profile of those having cor pulmonale was studied. Diagnostic efficacy of echocardiography in cor pulmonale was studied.
Results: The prevalence of cor pulmonale in pulmonary tuberculosis cases in this study is 11%. ECG findings showed that 21% of the patients had p-pulmonale. Echocardiographic features showed 15% had RVH, 17% had RA dilated. 11% of the patients had RVSP >40mmHg and paradoxical movement of IVS. 10% of the patients had TAPSE < 16mm.
Conclusion: Echocardiographic features are consistent with clinical evidence of congestive cardiac failure.

Keywords: Cor pulmonale, pulmonary tuberculosis, ECG, Echocardiography

1. Introduction

Tuberculosis (TB), which is one of the oldest diseases known to affect humans and is likely to have existed in pre hominids, is a major cause of death worldwide. This disease is caused by bacteria of the *Mycobacterium tuberculosis* complex and usually affects the lungs, although other organs are involved in up to one-third of cases. If properly treated, TB caused by drug-susceptible strains is curable in virtually all cases. If untreated, the disease may be fatal within 5 years in 50–65% of cases. Cor pulmonale is right ventricular dysfunction (enlargement) due to pulmonary hypertension secondary to diseases of the lung, bony thorax, lung ventilation or pulmonary circulation [1]. Virchow in nineteenth century found changes like right ventricular hypertrophy in autopsies of patients who died of pulmonary tuberculosis [2]. Bilateral and extensive tuberculosis can cause pulmonary hypertension due to extensive fibrosis which causes distortion of parenchyma. The basic underlying pathophysiology is increase in the pulmonary vascular resistance and pulmonary hypertension. Clinical diagnosis depends on right ventricular dysfunction, pulmonary hypertension and evidence of primary lung disease. Early treatment prevents this late complication of pulmonary tuberculosis. Chronic cor-pulmonale is usually the end result of long standing pulmonary disease, which results from pulmonary hypertension and subsequently to right ventricular hypertrophy (RVH) and failure.

The right ventricle (RV) may get hypertrophied without producing right heart failure. Therefore, in chronic cor-pulmonale the mechanism which leads to RVH ultimately results in right heart failure. Chronic cor-pulmonale as a cause of congestive cardiac failure (CCF) is being recognized in recent years [3]. Therefore recognition of chronic cor-pulmonale is of great importance to physicians, pulmonologists and cardiologists. Analysis of cardiovascular epidemiology in India also reflected that chronic cor pulmonale forms a significant proportion of cardiovascular cases. The mechanism of development of PHT in treated PTB patients is thought to result from residual pulmonary structural damage and pulmonary function abnormalities leading to gas exchange abnormalities and chronic hypoxia [4]. It has also been suggested that repeated secondary respiratory tract infections, caused by residual chest x-ray abnormalities, play an important role in the pathogenesis of PHT in treated PTB patients [5]. PTB Patients attending outpatient /inpatient are subjected to Chest X-ray, ECG and Echocardiographic studies. Patients having cor pulmonale features are subjected to detailed clinical history and examination.

2. Methodology

100 Patients attending the RNTCP DOTS center and those who were admitted in the medicine wards formed the study subjects. The data was collected from the patients by the detailed clinical history, clinical examination of the patients and relevant investigation in a specially designed proforma.

1. Patients were assigned a case number, and their name, age, sex, occupation socio-economic status will be noted.
2. Total duration of pulmonary tuberculosis and treatment.
3. History of smoking, or tobacco in any other form was specifically noted in the personal history.

4. Family history of pulmonary tuberculosis was specifically noted.
5. Patients having clinical evidence of cor pulmonale were subjected to spirometry study to rule out COPD.

Chest x-ray findings

The chest x-rays were analyzed by measuring the Cardiothoracic (CT) ratio, along with the widest diameter of the right descending pulmonary artery. Evidence of pulmonary hypertension was taken if right descending pulmonary artery width was >16mm. And also extent of parenchymal involvement of pulmonary TB is noted in the form lesions like lobar Collapse, fibrosis, cavitory lesion, bronchiectasis etc.

ECG findings

ECG was used to detect and exclude patients with Ischemic Heart Diseases (IHD). A 12 lead ECG was recorded in all the patients. The following ECG signs reflecting chronic cor-pulmonale were recorded: 1) P wave axis of +90 or more- right axis deviation, 2) P pulmonale, 3) right bundle branch block (RBBB), 4)RVH defined by one of following pattern, a) Q/R ratio in aVR >3, b) R/S ratio in V1>1.

Inclusion Criteria

All cases of pulmonary tuberculosis, irrespective of duration and type of treatment received will be included in the study.

Exclusion Criteria

1. Primary lung pathologies
2. All primary cardiac diseases
3. Occupational lung diseases
4. Malignant lung diseases
5. Less than 18yrs

3. Results

Table 1: Age wise distribution of study subjects

Age group	Frequency	Percent
18 - 25 yrs	3	3.0
26 - 45 yrs	59	59.0
46 - 65 yrs	36	36.0
> 65 yrs	2	2.0
Total	100	100.0
Mean ± SD	42.96 ± 11.08	

The age group ranged between from 18 to 72 years in the study group. Maximum number of patients was between the age group of 26-45 years. The mean of age distribution in the study group is 42.96 years

Radiological features have been classified in to fibrosis, fibrocavitary, fibro thorax and others. Distribution of cases is as depicted in figure no.7. 16% of patients had shown cardiomegaly, 10% had fibro thorax and 42% of the patients had fibrocavitary lesion

Table 2: Electrocardiographic profile of the patients

ECG findings	Frequency	Percent
P pulmonale		
Absent	79	79.0
Present	21	21.0
Total	100	100.0
RBBB		
Absent	85	85.0
Present	15	15.0
Low voltage		
Absent	85	85.0
Present	15	15.0

Table 3: Echocardiographic profile of the patients

Echocardiography	Frequency	Percent
RVH		
Absent	85	85.0
Present	15	15.0
RA/RV		
Dilated	17	17.0
Normal	83	83.0
RVSP group		
≤ 40 mmHg	89	89.0
> 40 mmHg	11	11.0
IVS motion		
Normal	89	89.0
Paradoxical Movt	11	11.0
TAPSE		
< 16mm	10	10.0
>16mm	90	90.0

Among 100 patients 15% of patients had right ventricular hypertrophy, 17% had RA/RV dilated. 11% of the patients had RVSP >40mmHg and also had paradoxical movement of IVS. 10% of the patients had TAPSE < 16mm which signifies RV dysfunction.

Table 4: Proportion of Cor pulmonale based on different criteria

Criteria	Frequency	Percentage
Presence of p pulmonale	21	21.0
Presence of Rt ventricular hypertrophy	15	15.0
Presence of RA/RV dilatation	17	17.0
RVSP > 40 mmHg	11	11.0
Paradoxical IVS motion	11	11.0
TAPSE <16 mm	10	10.0

4. Discussion

The present study concludes that prevalence of cor pulmonale in patients with pulmonary tuberculosis is 11%. Patients with cor pulmonale may present with RVH, asymptomatic RV dysfunction or RV failure. Evidence of congestive heart failure was seen in majority of the cases as evident by raised jugular venous pressure, enlarged tender liver and lower limb oedema. Majority of patients had pulmonary hypertension as evidenced

by epigastric pulsation (92%), loud P (70%) and palpable P (52%) [6].

Minority of them had evidence of right ventricular hypertrophy with a parastrernal heave (40%). Hence clinical diagnosis is usually possible only when patients develop right ventricular failure.

In the present study out of 100 cases of pulmonary tuberculosis 10 cases (10%) had clinical evidence of cor pulmonale in the form of right heart involvement as compared to a study by P K Jain et al where out of 125 cases, 11 cases (8.8%) had a clinical evidence of cor pulmonale [7].

Generally the peak incidence of cor pulmonale occur in 4^{th},5^{th},6^{th} decade of life according to Shanker et al and K Vishwanathan [8, 9] studies, but another study showed incidence of cor pulmonale in less than 40 years old patients with pulmonary tuberculosis [10]. In the present study also out of 11 cases, 5 patients (45%) had less than 40 years old. A study had reported a series of 60 cases of Cor Pulmonale in which the majority had tuberculosis as the primary pathology [11]. In a study, reporting an autopsy series, considered tuberculosis as the most important cause of Cor Pulmonale, having contributed no less than 60% of their cases [12]. Their material, of course, was biassed in that tuberculous individuals formed a disproportionately large number of their autopsies, but significance must be attached to the incidence of 51 % Cor Pulmonale in tuberculous patients autopsied by them.

5. Conclusion

According to the present study prevalence of cor pulmonale in PTB cases is 11%

6. References

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