



Original Research Article

A study on clinical manifestations, radiological features, electrocardiographic and echocardiographic changes in various lung diseases associated with cor-pulmonale in patients attending Government General Hospital, Kakinada

Malle Divya¹, Kiran Mathangi^{1,*}, K Chakravarthi¹, M Mohana Pradeepika¹, K Rajendra Kumar¹

¹Dept. of Pulmonary Medicine, Rangaraya Medical College, Kakinada, Andhra Pradesh, India



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ABSTRACT

Introduction: Cor-pulmonale is an alteration in the structure and function of right ventricle secondary to many broncho-pulmonary vascular diseases and from different chest wall abnormalities. The development of PAH has an important prognostic role, as it significantly increases the risk of hospitalization and is associated with reduced survival.

Materials and Methods: 100 patients of cor-pulmonale confirmed by clinical, radiological and electrocardiographic manifestations from outpatient and inpatients in Pulmonology Department, Government General Hospital, RMC, Kakinada, over a period of November 2018–November 2019 were included in the study.

Results: Out of 100 study cases, most affected age group is 51–60 years, males were more affected than females maybe because of the fact number of smokers were male. Out of 100, seventy patients were smoker, of which 63 were male and 7 were female. Almost every patient of cor-pulmonale presented with dyspnea and cough and had features suggestive of RHF. On ECG, p-pulmonale was the most common finding followed by right axis deviation for cor-pulmonale. On ECHO, RVSP > 60 mmHg is found in 56% cases. Radiologically, 48% cases of cor-pulmonale were secondary to chronic bronchitis and emphysema.

Conclusions: Echocardiographic screening of all patients with chronic lung disease especially the middle age males and the smokers will benefit in early detection of disease and initiation of treatment, thus improving their prognosis. A combined clinical, radiological, ECG and echocardiographic findings can give clue about progression of PAH and cor-pulmonale.

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1. Introduction

Cor-pulmonale can be defined as an alteration in structure (e.g., hypertrophy or dilatation) and function (i.e failure) of the right ventricle secondary to primary disorder of the respiratory system resulting in pulmonary hypertension. Cor-pulmonale occurs secondary to many broncho-pulmonary vascular diseases and from different chest wall abnormalities. Cor pulmonale can be a fatal disease and it accounts for high incidence among hospital admission for heart failure. The development of PAH

has important prognostic role, as it significantly increases the risk of hospitalization and is associated with reduced survival.

In most reported series, more than 50% of cases are due to chronic bronchitis, emphysema^{1–3}.

It is difficult to estimate prevalence of cor-pulmonale because, all patients with chronic lung disease will not land in cor-pulmonale, and our ability to diagnose PAH and cor-pulmonale by physical examination and lab investigations alone is relatively insensitive. Therefore, it is apparent that cor-pulmonale can be diagnosed collectively clinically, radiologically, electrocardiographically and echocardiographically.

* Corresponding author.

E-mail address: kirandr2014@gmail.com (K. Mathangi).

This study was conducted to know the clinical manifestations, radiological features, electrocardiographic and echocardiographic changes in various lung diseases landing in cor-pulmonale.

2. Materials and Methods

A Prospective observational study during one year period from November 2018 to November 2019. 100 patients of cor-pulmonale confirmed by clinical manifestations, radiological features (chest X-ray), and electrocardiographic changes from outpatient and inpatient in pulmonology department, Government General Hospital, RMC, Kakinada. An ethical committee approval was taken.

2.1. Inclusion criteria

All patients of both genders with clinical features like dyspnea, recurrent chest infections, fluid retention and general physical examination suggestive of right ventricular failure like raised JVP, hepatomegaly and bilateral pedal edema with right ventricular hypertrophy or dilation in ECHO.

2.2. Exclusion criteria

Patients with following conditions are excluded as they themselves can lead to right ventricular failure and might affect the investigational changes:

Primary involvement of left heart (valvular or myocardial disease, arterial occlusive disease, primary pulmonary hypertension, congenital heart disease, gross anemia with heart failure) or Chronic liver disease or Chronic kidney disease.

1. After taking consent, detailed recording of history is taken
2. Complete physical examination
3. Following investigations are done: Complete haemogram, renal and liver function tests, ultrasound abdomen, chest X-Ray, PFT, ECG, 2-Dimensional Echocardiography.

3. Results

The following observations were made in 100 study cases of cor-pulmonale.

Table 1: Age distribution among study group: The age group ranged between 24 to 85 years in the study group.

Age in years	No. of cases	Percentage
<40	09	9%
40-50	16	16%
51-60	40	40%
>60	35	35%

Table 2: Sex Distribution among Study Group:

Sex	No. of cases	Percentage
Male	72	72%
Female	28	28%

Table 3: Smoking association among study group: Most of the patients were chronic smokers.

Smoking history	No of Male cases	No. of female cases	Percentage
Present	63	7	70%
Absent	9	21	30%

Table 4: Association with smoking duration among smokers:

No. of Pack years	No. of cases	Percentage
<10	25	35.71%
11-20	10	14.28%
21-29	22	31.42%
>29	13	18.57%

Table 5: Association with Past History of Tuberculosis:

Past H/O tuberculosis	No. of cases	Percentage
Present	29	29%
Absent	71	71%

Table 6: Symptomatology among study Group:

Symptom	No. of cases	Percentage
SOB	100	100%
Cough with expectoration	100	100%
Peripheral edema	100	100%
Chest pain	31	31%
Abdominal distention	39	39%
Palpitations	22	22%
Loss of appetite	30	30%
Hemoptysis	4	4%
Fever	30	30%
Pain abdomen	28	28%

Table 7: Distribution of physical findings among study group:

Physical finding	No. of cases	Percentage
Tachypnea	100	100%
Tachycardia	48	48%
Accessory muscle usage	100	100%
Clubbing	26	26%
Cyanosis	39	39%
Chest AP diameter equal or greater than transverse diameter	21	21%
Pedal edema	100	100%
Raised JVP	75	75%
Decreased chest expansion	100	100%
Decreased breath sounds	80	80%
Loud P2	90	90%
Crepitation and rhonchi	100	100%
Ascites	40	40%

Table 8: Association of Cor-pulmonale among study group:

Diseases	No. of cases	Percentage
Chronic bronchitis and emphysema	48	48%
Bronchial asthma	10	10%
Bronchiectasis	9	9%
Sequel of pulmonary tuberculosis	19	19%
Kyphoscoliosis with thoracic deformity	6	6%
Interstitial lung disease	7	7%
Obstructive sleep apnea	1	1%

Table 9: Distribution of radiological features among study:

Radiological findings	No. of cases	Percentage
Increased Broncho vascular markings with or without over inflated lung fields suggestive of Emphysema	46	46%
Cardiomegaly with or without signs of PAH	22	22%
Gross fibrosis with or with out compensatory emphysema	19	19%
Basal bronchiectasis (bilateral or left or right)	4	4%
Kyphoscoliosis	6	6%
Bilateral basal reticular opacities	3	3%
Normal	10	10%

Table 10: Distribution of ECG Findings among study group:

ECG changes	No. of cases	Percentage
P pulmonale	89	89%
Right axis deviation	66	66%
Low voltage complexes	31	31%
RBBB	28	28%
Right ventricular hypertrophy	22	22%
Arrhythmias	35	35%

Table 11: Distribution of Echocardiography changes:

Severity of PAH based on RVSP in mm of Hg (normal <35)	No. of Cases	Percentage
Mild (35-45)	18	18%
Moderate (46-60)	26	26%
Severe (>60)	56	56%

All patients showed enlarged right atrium and right ventricle with pulmonary artery hypertension either associated with trivial or moderate tricuspid regurgitation. 8 patients who were known cases of COPD with hypertension showed global hypokinesia. Associated left ventricular dysfunction was found in 23 cases.

RVID-ED more than 26mm indicates dilatation of right ventricle. Thus echocardiographic evaluation is found to be a reliable noninvasive method of assessing right ventricular

Table 12: Distribution of RVID-ED (Right Ventricular Internal Diameter At End Diastole) among Study Group:

RVID-ED (mm)	No. of Cases	Percentage
27-28 mm	9	9%
29-33 mm	12	12%
34-38mm	31	31%
>38mm	48	48%

function.

4. Discussion

In the present study the peak incidence was found to be in the 5th and 6th decades of life as most of the patients started smoking in third decade cumulative damage to the lung took over decades and this is well comparable with that of cases studied in Babu et al., (2013)¹ study where most cases are between 50-59 years. The incidence of cor-pulmonale below the age of 40 was also high which can be attributed to environmental pollution, as well as smoking habit started earlier in life.

Males (72%) are predominant gender in present study than females (28%) which is similar to Senthil kumar et al.² study group. The prevalence of cor-pulmonale among females in present study might be due to increasing prevalence of more tobacco smoking (owing to urbanization and westernization of society), biomass fuel (used to cook meals) exposure, indoor air pollution.

In present study 70% were smokers which closely resembles to Padmavathi et al., study⁴ (70%), Kumar et al., study⁵ (71%), Rao et al., study⁶ (76%). Out of 70% smokers, 63% were males and 7% were females. This can also be the reason of more prevalence in males. Many patients smoked cigars and beedis, which do not contain tobacco filter and have high tobacco content. 38% of study group had pack years >10. In Kumar et al., study², majority 96 (54%) were smokers and out of which majority 70 (72.92%) are smoking for more than 10 years. This strong association between smoking and cor pulmonale can be attributed to the development of COPD, progressing to cor-pulmonale over years. This finding is also consistent with many studies where smokers are more prone to COPD which exacerbates into COPD and then to heart failure.

In the present study 100% of the patients presented with shortness of breath, cough and peripheral edema. 39% has distension of the abdomen. According to Babu et al.¹, (2019), Kumar et al.⁵, (2009), Thakker et al.³, (2014), Rao et al.⁶, breathlessness and cough were present in 100% cases. In present study fever accounts for 30%, which is comparable to Rao et al. study⁶, (24%) which is attributed to infective process secondary to viral or bacterial etiology in a previously damaged lung parenchyma. In present study, loss of appetite is present in 66% of cases which indicates that the disease is a chronic process. This is nearer to

Rao et al study⁶, and Kumar et al., study². 4% cases had hemoptysis suggesting underlying bronchiectasis.

In present study tachypnea, accessory muscle usage, pedal edema, either rhonchi or crepitations or both and decreased chest expansion and signs of right heart failure are present in 100% cases, clinically suggesting the presence of cor-pulmonale. According to Kumar et al., study², tachypnea, rhonchi and crepitations were present in all the cases.

JVP is raised in 75% of cases in present study which correlated with previous studies. In Kumar et al., study⁵, raised JVP (88.3%) was the commonest sign Kapoor et al.,[32] noted that the most constant physical sign leading to consideration of cor pulmonale in patients with absent symptoms and clinical signs was the presence of a loud P2. According to Thakker et al., study³, Raised JVP, enlarged liver and pedal edema were present in majority of patients suggestive of congestive cardiac failure. Loud P2 is seen in 90% patients in present study which correlates well with Kumar et al².study.

Barrel shaped chest present in 21% cases in present study. Some patients showed signs of loss of lung volume which can be attributed to various underlying causes for cor pulmonale like fibrosis, post tuberculosis sequel, thoracic cage deformities.

the present study showed 60% patients had chronic bronchitis with or without emphysema which was leading cause for cor pulmonale similar to findings of Babu et al¹., Kumar et al²., and Thakker et al³..

In present study tuberculosis is the 2nd leading cause for development of cor-pulmonale accounting for 19% patients. Post tubercular sequeale in the form of fibrosis with destruction of vascular bed due to parenchymal abnormalities, vasculitis, endarteritis, reduced cross sectional area of pulmonary vasculature and distortion of architecture of pulmonary artery, vascular remodeling leads to development of pulmonary hypertension and cor-pulmonale subsequently.

In Kumar et al., study⁵, among all the causes of cor pulmonale, pulmonary tuberculosis and COPD combined or either independently is responsible for major causative diseases of cor-pulmonale accounting for 88 patients (86.1%) of the total cases.

In present study most frequently found radiological finding is increased broncho vascular markings with or without hyper inflated lung fields (46%) which suggest a differential diagnosis of chronic bronchitis, emphysema and bronchial asthma. Our study shows similar results with various studies conducted previously.

Comparison of ECG changes in various studies

p-pulmonale had definite correlation with severity of chronic cor-pulmonale and was found in majority of cases who had longer duration of illness. In present study RBBB present in 28% cases which is similar to Babu et al., study¹

Table 13: Comparison of Radiological Findings with Various Studies:

Study	Most common radiological abnormality	Percentage
Babu et al., 2013, Adichunagiri, Karnataka ¹	Chronic bronchitis with emphysema	60%
Kumar et al., 2019, Kancheepuram ²	Chronic bronchitis with emphysema	60%
Thakker et al., 2014, Gujarat ³	Emphysema	60%
Rao et al., 2019, Eluru ⁶	Increased bronchovascular markings with or without hyper inflated lung fields	54%
Present study	Increased bronchovascular marking with or without hyperinflated lung fields	48%

Table 14: Comparative percentage of p pulmonale in different studies

Study	Percentage
Thakker et al., ³	58%
Rao et al., ⁶	28%
Kumar et al. ²	71%
Present study	89%

(26%) and Kumar et al.,²(32%).

Though ECG has its limitations, it can still be useful in diagnosing cor pulmonale. ECG can also be used as a negative prognostic sign in targeting COPD patients at risk of shorter survival.

Various studies demonstrate that level of pulmonary hypertension is a prognostic indicator in cor-pulmonale. In present study PAH present in 100 % cases. Mild in 18%, moderate in 26% and severe in 56% cases. Echocardiography showed an enlarged right atrium, right ventricle and right ventricular hypertrophy with pulmonary artery hypertension either associated with trivial or moderate tricuspid regurgitation in every patient. Left ventricular dysfunction is present in 23% of cases.

Table 15: Comparing PAH in different studies

Study	Percentage
Thakker et al., ³	96.67%
Babu et al., ¹	100%
Kumar et al., ²	100%
Present study	100%

Based on pulmonary hypertension categorization and proper treatment initiation at right time, we can prevent the progression of disease. By keeping the patients on follow-ups and based on 2D ECHO findings, we can prevent the disease progression. As 2-D Echo is less invasive and repeatable, it acts as better prognostic tool.

Table 16: Comparing RVID-ED in Studies

Study	Mean RVID-ED in mm
Babu et al.,(2013) ¹	35.2 mm
Goswami et al.,(2017) ⁷	37.07mm
Agarwal et al.,(2017) ⁸	36.4mm
Present study	37.27mm

In present study mean RVID-ED is 37.27 mm, which is very well comparable to various previous studies. In present study right ventricular diameter in severely abnormal range in 48% cases. In Goswami et al., (2017) study⁷ RVID-ED is 37.07±5.21. In the study by Agarwal et al.,⁸ mean RVID-ED of 40.2 ± 5.6 mm, which is in the moderately abnormal range of RVID-ED.

Echocardiography is found to be a reliable method to assess right ventricular function. Doppler echocardiography is most useful with specificity and sensitivity of about 80%. Advances in echocardiography make this a useful test where cor pulmonale is suspected.

5. Conclusions

1. We would thus suggest that echocardiographic screening of all patients with chronic lung disease would help in early detection of disease and earlier initiation of treatment, thus improving their prognosis.
2. Instead of going for invasive cardiac catheterization, a combined clinical, radiological, ECG and echocardiographic findings can give clue about progression of PAH and cor-pulmonale.

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None.

8. Conflict of Interest

None.

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Author biography

Malle Divya Post Graduate

Kiran Mathangi Assistant Professor

K Chakravarthi Assistant Professor

M Mohana Pradeepika Post Graduate

K Rajendra Kumar Professor and HOD

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