

## A Study of clinical and radiological findings in chronic cor pulmonale

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### Abstract:

**Background:** Cor pulmonale is defined as an alteration in the structure and function of the right ventricle (RV) of the heart caused by a primary disorder of the respiratory system. Pulmonary hypertension is often the common link between lung dysfunction and the heart in cor pulmonale. Right-sided ventricular disease caused by a primary abnormality of the left side of the heart or congenital heart disease is not considered cor pulmonale, but cor pulmonale can develop secondary to a wide variety of cardiopulmonary disease processes.

**Materials and Methods:** Total 102 patients were included in the study with complaints of respiratory symptoms and relevant clinical signs with the aim of studying the commonest respiratory disease leading to cor pulmonale.

**Results:** Out of 102 patients, 85 were males and 17 females; smoking and agricultural pollutants were the common predisposing factors; and the most common disease leading to cor pulmonale was pulmonary tuberculosis with COPD of various etiologies.

**Conclusions:** Cor pulmonale is a state of cardiopulmonary dysfunction that may result from several different etiologies and pathophysiologic mechanisms. The prognosis for a particular patient with cor pulmonale is inextricably linked to that of the underlying pulmonary disease or disorder. Long-term treatment and follow-up is required for better survival and better quality of life.

**Keywords:** Cor pulmonale; Chronic obstructive pulmonary disease (COPD); Tuberculosis.

### Introduction:

Cor pulmonale is a complication of COPD and Sequelae of Tuberculosis & has high morbidity and mortality. The term cor pulmonale was introduced in 1931 by Dr. Paul. D. White [1]. The Latin word cor means the heart. The Latin word Pulmo means the lung. Cor pulmonale is thus literally lung heart [2]. By definition (W.H.O.-1963): Chronic cor pulmonale is defined as — Hyper trophy of the right ventricle resulting from diseases affecting the function and / or structure of the lung, except when these pulmonary alterations are the result of diseases that primarily affect the left side of the heart or congenital heart diseases [1]. Diseases predisposing to cor pulmonale are an enormous health problem throughout the world. The incidence of cor pulmonale varies from country to country, between urban & rural areas, & with exposure to air pollution [3]. In Delhi, India – where a large segment of the population lives under conditions of severe air pollution, the incidence of cor pulmonale has been estimated to be about 16 % [3]. In England, cor pulmonale was responsible for 30 -40 % of all clinical cases of heart failure [3]. In United States, 10-30% of hospital admissions for congestive heart failure are due to cor pulmonale [3]. In persons more than 50 years of age, cor pulmonale is the third common cardiac disorder (after coronary & hypertensive heart disease) [4]. The prognosis for a particular patient with cor pulmonale is inextricably linked to that of the underlying pulmonary disease or disorder. Hence cor pulmonale is treated by Pulmonologist rather than cardiologist [3].

### Aim of the Study:

Aim of this study was to know 1) the commonest respiratory diseases leading to cor pulmonale, 2) the most common clinical presentations in cor pulmonale, 3) the commonest clinical signs of cor pulmonale and 4) the chest x ray findings in cor pulmonale.

### Materials and Methods:

Patients admitted in pulmonary medicine ward of the Government General Hospital Kurnool, India who complained of shortness of breath, cough, wheeze, chest tightness or pain, fever, pedal edema, drowsiness, and early morning headache have been evaluated from January 2008 to December 2009. On the basis of patient's history, physical findings, radiological examination electrocardiographic changes the diagnosis of chronic cor pulmonale was made. Each case taken for the study was subjected to echocardiography. An ethical committee approval and consent from study subjects was obtained.

### Inclusion Criteria:

All patients with chronic cor pulmonale of both the genders were included in the study as cases. The diagnosis of chronic cor pulmonale was established by:

1. Clinical history with cough with sputum, paroxysmal cough, dyspnea, fluid retention with edema, recurrent chest infections, cyanosis, fatigue, chest pain, near syncope, palpitation.
2. General physical examination suggesting RVF such as raised jugular venous pressure, tender

hepato megal, epigastric pulsations, left parasternal heave, loud P2.

3. Radiological examination, electrocardiographic and echocardiographic changes associated with chronic cor pulmonale.

#### Exclusion Criteria:

1. Patients with primary involvement of left side of the heart.
2. Patients with valvular or myocardial disease.
3. Patients with arterial occlusive disease from emboli.
4. Patients with primary pulmonary hypertension.
5. Patients with congenital heart disease.
6. Patients with congenital heart diseases with reversal of shunt.

A special focus on clinical history of tuberculosis and occupational exposure to various kinds of harmful pulmonary stimulants were obtained. All relevant investigations were done accordingly.

#### Results:

Total number of cases included in the study (n) = 102, Number of male patients = 85(83.3%) and Number of female patients =17(16.67%).

In males 70.4% of cases occurred between the age group of 31-60 years. Peak age incidence of age group in males is 51-60 years at an average of 29.4% of the total males included in the study. Peak age incidence in females is between 31-50 years at a percentage of 70.5% of the total females included in the study.

**Table 1: Age Distribution of the patients**

Age in years	Male	Female
10-20 YEARS	1 (1.1%)	
21-30 YEARS	6 (7%)	3 (17.6%)
31-40 YEARS	13 (15.2%)	5 (29.4%)
41-50 YEARS	22(25.8 %)	7 (41.1%)
51-60 YEARS	25 (29.4 %)	2 (11.7%)
61-70 YEARS	10 (11.7%)	
71-80 YEARS	6 (7 %)	
81-90 YEARS	2 (2.3%)	
91-100 YEARS	0	

Among 102 patients, male smokers were 73 (85.5 %) and 12 males (14.5%) were non smokers: all 17 female patients were non-smokers. When type of smoking was taken into consideration 91.7 % were beedi smokers, 6.8 % were cigarette smokers and 1.3 % were bharg smokers.

Highest number of smokers had a smoking history of 31-40 years with a percentage of 35.6% of the total smokers.

Among males, most of the patients were agricultural laborers accounting for 48.8 % and most of the males were under low economic class (74.1%)

Among female patients agricultural laborers accounted for 52.9% of the cases and 82% were below poverty line. 36.2% of the patients have duration of illness between 2-5 years at the time of first admission. 19.6% each, of the patients have duration of illness between 6-8 years and 9-10 years at the time of first admission.

**Table 2: Diseases responsible for causing cor pulmonale**

Disease	Number	Percentage
Pulmonary Tuberculosis +COPD	42	41.1 %
Pulmonary Tuberculosis	29	28.4 %
COPD	17	16.6 %
Bronchial Asthma	1	0.9 %
Obstructive Sleep Apnoea Syndrome	1	0.9 %
Malignancy	1	0.9 %
Pulmonary Tuberculosis + Bronchial Asthma	2	1.9 %
Pulmonary Tuberculosis + Bronchiectasis	7	6.8 %
Pulmonary Tuberculosis+ COPD+ Asthma	2	1.9 %

In this study, Most common cause of cor pulmonale was pulmonary tuberculosis with COPD and next common being pulmonary tuberculosis individually.

**Table 3: Clinical Symptoms**

Symptom	Percentage
Breath less ness	100%
Cough	94%
Chest pain	48.8%
Pedal edema	72%
Oliguria	32.5%
Palpitation	48.8%
Abdominal fullness	54.6%
Wheeze	55.8%
Hemoptysis	18.6%
Drowsiness	20.9%
Day time sleepiness	16.2%
Syncopal attacks	9.3%
Fever	61.6%
Head ache	27.9%
Snoring	1.1%
Increased micturition	6.9%
Mental irritability	1.1%
Insomnia	6.9%
Exanthematous fevers in childhood	12.7 %

**Table 4: Clinical Signs**

Sign	Percentage
Raised jugular venous pressure	88.3%
Cyanosis	75.5%
Hepato jugular reflux	87.2%
Clubbing	51%
Apical impulse > 9.5 cm from mid sternal line	53.4%
Apical impulse not palpable	12.7%
Epigastric pulsations	60.4%
Pre cardiac bulging	22%
Para sternal heave	46.5%
Tender hepatomegaly	87.2%
Loud p2	68.6%
Palpable p2	13.9%
Murmur in tricuspid area	13.9%
Murmur in pulmonary area	3.4%
Flapping tremors	8.1%
Conjunctival chemosis	4.6%
Pursed lip breathing	39.5%
Ascites	3.4%
Polycythemia	1.1%
Scoliosis	11.6%
Kyphosis	2.3%
Kyphoscoliosis	1.1%
Pectus excavatum	9.3%
Pectus carinatum	1.1%
Lethargy	6.9%

In this study, most common symptom was breathlessness (Table 5) and most common sign was raised jugular venous pressure (Table 6).

**Table 5: Radiological findings**

X-ray findings	Number of Cases	Percentage
Cardiomegaly	54	52.3%
Copd changes	49	47.6%
Bronchiectasis	13	12.7%
Fibrosis	15	15.1%
Pleural thickening	05	4.6%
Cavity	06	5.8%
Fibro cavity	16	16.2%
Calcification	02	2.3%
Prominent pulmonary conus	05	4.6%
Collapse	01	1.1%
Pleural effusion	02	2.3%
Loculated pleural effusion	01	1.1%
Tuberculosis lesions	77	75.5%
Rda diameter >16 cm	54	53.4%
Lda diameter > 18 cm	17	17.4%
Retro Sternal Air	16	16.2 %
Space Between 1 and 3.5 cm < 1 cm >3.5 cm	14	13.9 %
	06	5.8 %

**Discussion:**

Cor pulmonale is a cardiac disease that occurs as a complication of chronic lung diseases like COPD and Sequelae of pulmonary tuberculosis is more often presented to a pulmonologist rather than a cardiologist. In persons more than 50 years of age, cor pulmonale is the third common cardiac disorder (after coronary & hypertensive heart disease) [4]. COPD was the cause of chronic cor pulmonale in more than 80% of all cases. It has been estimated that up to 14% of patients with COPD suffer from secondary pulmonary hypertension [5].

The prevalence rates of COPD in males varied from 2.12% to 9.4% in studies conducted in north India and from 1.4% to 4.08% in south India. The respective ranges for females were 1.33%–4.9% in north India and 2.55%– 2.7% in south India. The median values of these prevalence rates are 5% for males and 2.7% for females. Thus, COPD is more common among males than females. The male to female ratio varied from 1.32:1 to 2.6:1 with median ratio of 1.6:1.5 [6]. The prevalence of COPD is confined to adults 30 years of age and above.

The prevalence of chronic bronchitis among the rural population was 57 per 1000 population. The type of smoking influenced the magnitude of prevalence. The prevalence of chronic bronchitis in hookah smokers was 85/1000 population, in beedi smokers 31/1000, and in chillum smokers 17.5/1000. It was seen that 13.5% of beedi smokers had chronic bronchitis [7].

The present study is contemplated to study cor pulmonale in pulmonary diseases as a large number of pulmonary patients are admitting in our ward. In this study, of a total of 102 patients, male patients were 85(83.3%) and females 17 (16.67%) A study done by Vishwanathan in 1963-1966 showed cor pulmonale was more common in males compared to females [8]. According to Banerjee (1963) in his study out of 75 cases 60 were males and 15 were females [9] and this difference in sex distribution is mainly due to smoking in males in India. Wide variation in the incidence of cor pulmonale ranging from 5.5% to 47% (Samuelson, 1952; Viswanathan, 1968; Padmavathi and Mishra 1969; Chattarjee et al 1971) may be attributable to selective nature of the study subjects and differences in diagnostic criteria [10]. Padmavathi et al., reported the incidence is equally common in men and in women and accounts for 20% of all admissions for heart disorder in Delhi.

In our study of 102 patients, 9 patients (8.8%) had duration of illness of less than 2 years where as 37 patients (36.2%) have duration of illness between 2-5 years at the time of first presentation in our study. 40 patients (39.2%) have duration of illness between 6-10 years at the time of first admission. The average duration of illness before cor pulmonale set in was reported as over 10 years by Samuelson, 1952, below 5 years by Kapoor, 1959 and Padmavathi and Mishra,

1969 and average duration as 5 years by Agarwal et al., 1978 [10].

The total known duration of disease before the diagnosis of cor pulmonale show extremes of 6 months and 28 years in Kapoor et al., study study [17]. Among the 102 cases studied, most of the patients are from low socioeconomic back ground accounting for about 74.1%. In my study detailed enquiry is made regarding occupation of the patient. Most of the males of which 41 patients are agricultural laborers accounting for 48.8% of the study group. This suggests agriculture pollution is also playing role in causation of cor pulmonale. In our study, among females 52.9% of them are agricultural laborers and 82% of them are below poverty line. In our study 73 of male patients were smokers (85.8%) among which 62 patients are current smokers (84.9%) and 11 were ex-smokers (15%). Beedi is the most popular form of smoking among the patients in our study with 67 patients smoke beedis (91.7%) and only 5 patients in our study are cigarette smokers (6.8%). One patient is having history of smoking bhang. Only 14.2% of male patients in our study were non smokers. Of the female patients in our study group 100% are non smokers. Among the smokers in our study group highest number of smokers i.e. 55 patients (53.9%) had a smoking history of more than 20 years. Out of these 35.6% of smokers had a smoking history of 31-40 years. Among the smokers in our study group highest number of smokers i.e. 61 patients (59.8%) had a smoking history of more than 20 pack years of which 25 patients (24.5%) had a smoking history of 20-40 pack years and 36 patients (35.2%) had history of above 40 pack years. This is in accordance with COPD and correlates with BTS guidelines which suggest that most patients with COPD have at least a 20 pack - years of smoking history. A strong association exists between tobacco smoking and the occurrence of COPD. In our study of 102 patients with cor pulmonale, among female patients 58.8% of them had a history of indoor smoke with a maximum number of patients having exposure of 16-20 years. The occurrence of severe bronchitis among non-smokers was mainly due to their exposure to tobacco smoke either at home or at the workplace. A study conducted by Vishwanathan between 1963-1966 showed that 66 patients out of 130 were admitted after being exposed to smoke from fire places in which cow dung cake along with fire wood or coal were burnt [8]. Padmavathi et al concluded that the cause of chronic cor pulmonale in women in Delhi was damage to the lungs from exposure to smoky cooking fuels from girlhood onwards, followed by repeated chest infections [11].

**Table 6: Smoking as a etiological factor comparative percentage by various authors**

Authors	Percentage
Shankar et al., (1965)	80%
Padmavathi et al.,	70 %

Vishwanathan., (1965)	60 %
Banerjee., (1963)	17 %
Present study (2009)	71 %

In our study among all the causes of cor pulmonale, pulmonary tuberculosis and COPD combined or either independently is responsible for major causative diseases of cor pulmonale in our study accounting for 88 patients (86.1%) of the total cases. Bronchial asthma either singly or in combination with other respiratory diseases was responsible for development of cor pulmonale in about 2.94% of the cases. Malignancy and obstructive sleep apnea syndrome accounted for 0.9% each, as a causative disease for the development of cor pulmonale in our study. Bronchiectasis played a contributive role in the development of cor pulmonale in about 8.8% of cases. In Aderaye et al., east African study of chronic cor pulmonale bronchial asthma was responsible for 15% of the cases. Among other causes, pulmonary tuberculosis (13%), COPD (12%), interstitial lung disease (5%), Bronchiectasis (2%), obesity (2%) and kyphoscoliosis accounted for 1% [13]. In Swami et al., study the causative diseases of cor pulmonale were pulmonary tuberculosis in 75.90% of the cases. Among other causes, emphysema (chronic bronchitis, bronchial asthma) is responsible for cor pulmonale in [15]. 27% [10]. Our present study is very well correlated with this study with reference to COPD alone as the etiological factor in 16.6% and bronchial asthma in 0.9%.

Breathlessness (100%) was the most common symptom in this study which is in correlation with the studies of Padmavathi, Stuart and Kamat Series [14]. According to Padmavathi, Stuart and Kamat series, breathlessness, cough, abdominal pain/ distension and peripheral edema were the chief presenting complaints [14]. Whereas Vishwanathan's study showed cough and edema were the predominant symptoms [8].

In this study, raised jugular venous pressure (88.3%) was the commonest sign which is in correlation with the study of Swami et al study where clinical evidence of cor pulmonale was around 50% in his study of 49 cases. Kapoor et al., noted that Symptoms suggestive of heart involvement were absent in 21 of the patients, and suggestive clinical signs were present in 10 of them. The most constant physical sign leading to consideration of cor pulmonale in these patients were a loud pulmonary second sound [12].

During clinical examination in palpation and auscultation at the subxiphoid region where we can frequently find a heave and. an accentuated second heart sounds. When present, these can be regarded as diagnostic of CCP, as shown by Kapoor, Sharma and Rawat (1971) [15]. In the East African study of cor pulmonale by Aderaye et al., the following findings were noted: Cyanosis in 93% of patients, Clubbing in 45%, wheezing in 45%, Accentuated P<sub>2</sub> in (14%), right

sided gallop rhythm (S<sub>3</sub>) in (17%), congestive heart failure in (86%), secondary polycythemia in (80%) [13].

Radiological studies noted in this study were- RDA diameter >16 cm – 53.4%, Cardiomegaly – 52.3%, COPD changes – 47.6%, LDA diameter >18 cm – 17.4%, Retro sternal air space < 1 cm – 13.9%, Bronchiectasis – 12.7%. Chest x ray evidence of cor pulmonale was present in 67% of all cases of cor pulmonale in an East African study by Aderaye et al [13]. This correlates with our present study where radiological evidence of cor pulmonale was apparent in 52.8% of the cases.

### Treatment and follow-up

All the patients were treated based on the following guide lines- 1) Treatment of underlying condition 2) Antibiotics 3) Bronchodilators 4) Corticosteroids 5) Supplemental oxygen 6) Pulmonary vasodilators 7) Anticoagulation 8) Diuretics

Oxygen therapy was the main stay of our treatment; low flow oxygen of 1-2 litres/min was administered to our patients for 12-16 hours per day. Aminophylline was used for bronchodilator action, as theophyllines were useful in pulmonary hypertension treatment wherever required. Diuretics were used in patients with right heart failure and corticosteroids were used in COPD exacerbation patients. Sildenafil 20 mg TID was tried in some patients with limited response. In our study, of the total number of 102 cases, 7 patients expired during the follow up with in a span of 6 months to 2.5 years after the diagnosis of cor pulmonale was established of which 4 patients had tuberculosis associated with COPD at the time of presentation. The longest survival in our study after the diagnosis of cor pulmonale was established was a case who survived on long term home oxygen therapy for 17 years after diagnosis.

### Conclusion:

Cor pulmonale is a state of cardiopulmonary dysfunction that may result from several different etiologies and pathophysiologic mechanisms. Most of the conditions that cause cor pulmonale are chronic and slowly progressive, patients may also present with acute and life-threatening symptoms. The prognosis for a particular patient with cor pulmonale is inextricably linked to that of the underlying pulmonary disease or disorder. Long-term treatment and follow-up is required for better survival and better quality of life.

**Conflicts of Interest:** None declared

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