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"A Study of Clinical Profile, Electrocardiographic and Echocardiographic Changes in Chronic Cor Pulmonale; A Prospective Observational Study"

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Introduction

Cor pulmonale, commonly referred to as pulmonary heart disease, is broadly defined by altered Right Ventricular(RV) anatomy and/or function in the setting of chronic lung illness and is induced by the presence of pulmonary hypertension. Although RV dysfunction is a major sequel of HFpEF and HFrEF, this is not recognised as cor pulmonale(1). Pulmonary arterial hypertension (PAH), however, is usually the underlying pathogenic reason for right ventricular hypertrophy in cor pulmonale (2) and is the common connection between lung dysfunction and the heart in cor pulmonale. Cor pulmonale probably represents 15 percent to 20 percent of all instances of heart failure(3). Cor pulmonale is responsible for 5-10 percent of all heart problems, 20-30 percent of all hospitalizations for heart failure. The development of PAH has substantial prognostic consequences, since it considerably raises the chance of hospitalisation and is linked with shorter survival(4).

Also, more than 50 percent of the cases of chronic cor pulmonale are attributable to chronic bronchitis, asthma or emphysema. COPD is by far the most frequent

cause of chronic cor pulmonale in the industrialised world(5). Chronic cor pulmonale develops more prevalent in male smokers, between the ages of 50 to 60 years of age (6).

The real incidence of cor pulmonale is difficult to estimate for two reasons. First, not all patients with chronic lung illness will develop cor pulmonale, and second, our capacity to identify pulmonary hypertension and cor pulmonale by standard physical examination and laboratory tests is rather insensitive (7). Chronic cor pulmonale has lasted so long undetected is due to a number of factors. For many years diagnosis was not made. The problem was disguised in the associated pulmonary signs on one hand, and was recognised on the other hand as some other sort of heart disease. Physiologists are just now in the process of reducing these concepts and techniques of diagnosis so that doctors can add them to this clinical analysis (8).

Chronic cor pulmonale is known as a significantly lengthy, eventually deadly human experience consuming typically a major part of the patient's life. Thus it poses a severe concern in public health and preventive medicine (9).

So far as hospital admissions are concerned, high rates for the incidence of cor pulmonale among hospital admission for heart failure ranging from 16 percent to 38 percent have been recorded from areas such as Belgrade, Delhi, Prague and Sheffield. In most documented series more than 50 percent of patients are attributable to chronic bronchitis, asthma or emphysema, which represent a poorly defined group of illnesses and unknown aetiology(10).

Chronic cor pulmonale, however, is linked with more slowly emerging and increasing pulmonary hypertension that leads to first mild right ventricular hypertrophy and right ventricular dilatation.

There are scarcely any such sort of studies done in the northeast area of India in the past. With the availability of echocardiography, it became feasible to measure the amount of right ventricular hypertrophy and pulmonary hypertension noninvasively. Therefore, this hospital based observational research was aimed to evaluate clinical profile,

electrocardiographic, radiographic alterations and echocardiography in patients with chronic cor pulmonale.

Material and Methods

The current cross-sectional study was conducted at Inlaks And Budhrani Hospital, Koregaon Park, Pune, a multi-specialty tertiary care hospital with 364 beds that draws patients from various socioeconomic strata. The study comprised patients who met the inclusion and exclusion criteria and were

admitted to the hospital's pulmonology department. Data were gathered prospectively with a sample size of 40, which was established using the effect size from a prior study by Shankar Rao et al.(11) taking into account prevalence of 56 percent. From December 2017 to August 2019, the study was carried out. ECG, Chest radiograph, clinical examination, and laboratory investigation were used for screening. After that, an echocardiogram was performed on the patient to confirm the diagnosis.

The trial included all chronic cor pulmonale patients above the age of 18 who gave their consent to participate. Criteria were used to make the diagnosis of chronic cor pulmonale (Clinical history of symptoms suggestive of chronic respiratory system disease such as cough with sputum, paroxysmal cough, dyspnoea, fluid retention with edema and sometimes ascites, recurrent chest infections, cyanosis, fatigue, chest pain, near syncope, palpitation ; General physical examination suggesting Right Ventricular Failure, tender hepatomegaly, pedal edema, clubbing; Radiological examination, electrocardiographic and echocardiographic changes associated with chronic cor pulmonale). Patients who have electrocardiographic and radiographic abnormalities of chronic cor pulmonale as well as echocardiographic changes related to the condition.

Patients under the age of 18 who have mostly affected the left side of the heart The study excluded participants with acute cor pulmonale, valvular or cardiac illness, acute pulmonary arterial occlusive disease brought on by emboli, primary pulmonary hypertension, and congenital heart disease.

The patients who were included received extensive examinations, detailed history taking concerning symptoms and related comorbidities, as well as an in- depth physical examination and recording of findings in a predesigned and pretested proforma. All of the information was gathered and organised using a Microsoft Excel spreadsheet, and it was then evaluated using tables and graphs. Utilizing SPSS (Statistical Package for the Social Science) Version 17 for Windows, data was analysed.

Results

Following inclusion and exclusion criteria, a total of 40 patients from the departments of medicine at the Budhrani Hospital in Pune and the Sadhu Vaswani Mission's Medical Complex in Inlaks were included. Ages of the patients varied from 30 to 79. The average age was 53. 70% of patients are between the ages of 40 and 59, making up the majority of the patient population. In our study, there were more men than women (Table 1). 50 percent of the cases included workers in the labour force, and 35 percent involved farmers or agriculturists. The symptoms ranged in length from two years to twenty-two years, with a mean of

seven years. (Table 1)

Table 1: Distribution of the cases

		Male(%)	Female(%)	Total(%)
Age group (years)	30-39	6 (16.67)	0 (0)	6 (15)
	40-49	7 (19.44)	1 (25.0)	8 (20)
	50-59	18 (50.0)	2 (50.0)	20 (50)
	60-69	3 (8.33)	1 (25.0)	4 (10)
	70-79	2 (5.56)	0 (0)	2(5)
Occupation	labourer	20 (55.56)	0 (0)	20 (50)
	Agriculturist	14 (39.0)	0 (0)	14 (35)
	Housewife	0 (0.0)	4 (100)	4 (10)
	Others	2 (5.5)	0 (0)	2(5)
Duration of Symptoms (Years)	2-5	19 (52.7)	1 (25.0)	20(50)
	6 - 10	11 (30.5)	3 (75.0)	13(32.5)
	11 - 20	4 (11.1)	0 (0)	4(10)
	> 20	2 (5.5)	0 (0)	2(5)

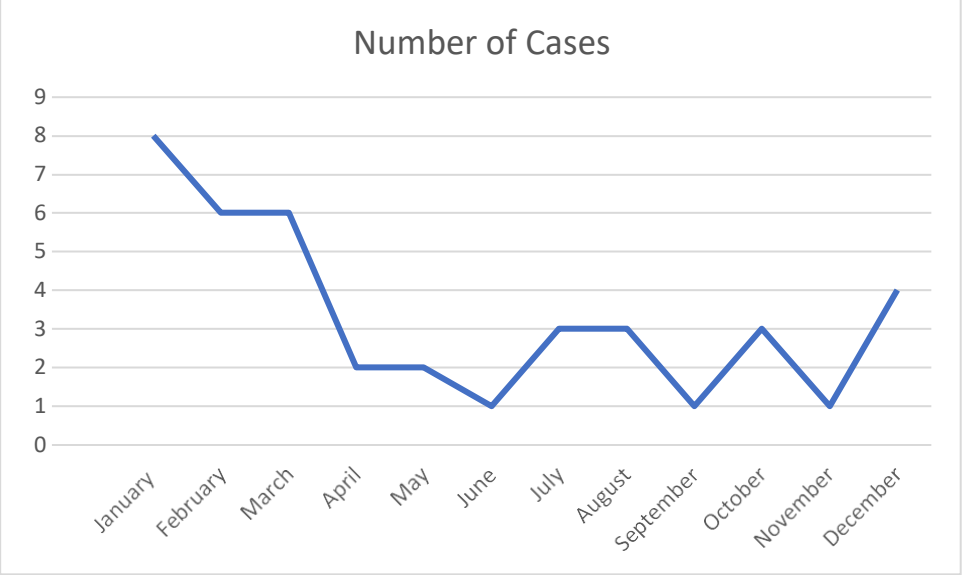

Figure 1: Seasonal prevalence of chronic cor pulmonale

Figure 1 shows that the incidence of chronic cor pulmonale is higher in the months of January, February, and March. Thus, the winter months saw the highest frequency.

Patients experienced between two and twenty-two years of symptoms. Breathlessness and coughing with expectation were present in all cases. Ninety-five percent of the patients had limb swelling, and 80 percent of them also had appetite loss. 70%, 40%, and 25% of patients, respectively, reported experiencing abdominal pain, fever, and hemoptysis. Cyanosis, clubbing, and pedal edoma were evident in 70%, 20%, and 55% of patients, respectively, in terms of physical signs. All of the patients' respiratory system abnormalities included tachypnea, ronchi, and crepitation. In 80% of the patients, a barrel- shaped chest and

diminished breath sounds were noticed.

Table 2: Symptomatology

		Total(%)
Symptoms	Cough with expectoration	40(100)
	Breathlessness	40(100)
	Swelling of limbs	38(95)
	Loss of appetite	32(80)
	Pain abdomen	28(70)
	Fever	16(40)
	Haemoptysis	1025()
	Palpitations	8(20)
	Chest pain	6(15)
General physical sign	Pallor	10(25)
	Tachycardia	40(100)
	Cyanosis	28(70)
	Clubbing	8(20)
	Pedal Edema	22(55)
Respiratory system findings	Tachypnoea	40(100)
	Barrel Shaped Chest	32(80)
	Decreased Chest expansion	40(100)
	Decreased Breath Sounds	32(80)
	Ronchi	40(100)
	Crepitation	50(100)
Clinical Signs	Raised JVP	28(70)
	Left Parasternal Heave	30(75)
	Dullness in Left 2nd ICS	24(60)
	Loud P2	36(90)

Tachycardia was evident in all patients in terms of clinical symptoms, and increased JVP was reported in 70% of patients. 75 percent of patients had left parasternal heave, 60 percent had dullness in their left second ICS, and 90 percent had loud P2.

According to radiographic findings, 60% of the patients had chronic bronchitis, emphysema, and an enlarged TD heart/cardiomegaly. RDPA > 16 mm and prominent pulmonary conus were seen in 30% and 55% of patients, respectively. was noticed in 40% of the patients.

Out of 40 patients, 70% had p pulmonale (a tall peak p wave of less than 2.5 mm). Right axis deviation was the second most frequent finding in 60% of patients, followed by arrhythmias in 55% of patients. Table 3 provides an overview of all ECG results.

Table 3 : Investigation Findings

		Total(%)
Radiological Features	Chronic Bronchitis with emphysema	24(60)

	Enlarged TD Cardia	16(40)
	Prominent Pulmonary Conus	10(30)
	RDPA > 16 mm	22(55)
	Bronchiectasis	4(10)
	Old Pulmonary TB	4(10)
	Kyphoscoliosis	2(5)
	Interstitial Lung Disease	2(5)
ECG Findings	P pulmonale.	28(70)
	Right axis deviation.	24(60)
	Right ventricular hypertrophy	18(45)
	RBBB	10(25)
	Low voltage complex	20(50)
	Arrythmias	22(55)
Pulmonary Function Test	Obstructive	36(90)
	Restrictive	4(10)
ECHO Findings RVIDED (m)	2.9-3.3	6(14)
	3.4-3.8	20(50)
	>3.8	14(35)

On spirometry, the obstructive type of ventilatory abnormality was found in 36 (90%) instances, whereas the restrictive type was seen in just 4 (10%) cases (Pulmonary Function Test).

Every patient had a 2D-Echo. 50 percent of patients had RVDED between 3.4 and 3.8, and 35 percent had RVDED >3.8, as shown in Table 3.

Discussion

In tertiary care hospitals, chronic cor pulmonale is a prevalent reason for medical admission. Although there are no precise statistics for this region of India. Some studies have been carried out throughout India, including in Gujarat in the extreme west (12) and Guwahati in the north-east (13) and other parts of the North-east(14).

On 40 patients who had been hospitalized with cor pulmonale, the current investigation was carried out in the south-western region of India. The peak incidence in the current study was discovered to occur in the fourth, fifth, and sixth decades of life, and the age distribution is quite close to that of cases analysed. Between the ages of 40 and 49, Padmavathi and Misra observed the highest incidence(15). 50.2 years was the reported mean age by Gupta et al (16). Similar findings were achieved in a research by Thakker et al(12) Out of 60 patients, the majority were between the ages of 50 and 70. This result is well associated with the research by Vakil et al (17) in which 65% of the participants were in the same age group, demonstrating an increase in the risk of cor

pulmonale with advancing age. In the current study, we also discovered that the prevalence of cor pulmonale in people under the age of 40 was rising. This finding can be ascribed to environmental pollution as well as early-life smoking habits.

According to the current study, out of 40 cases, 36 were men and 4 were women. Studies have indicated that chronic cor pulmonale affects men more frequently than women.(12,13,16,18–20) The main cause of this disparity in sex distribution between men and women is smoking, but it may also be attributed to the greater proportion of men who visit hospitals, as well as the fact that men who work outdoors or in other industries are more likely to be exposed to irritants like dust, fumes, and irritating fog.

In our study, the majority of instances were from the lowest socioeconomic level. Most of the patients were labourers and farmers, then housewives. According to a research by Goswami et al the majority of instances (27.5 percent) included workers who also smoked. The condition is also more common in those from lower socioeconomic classes, according to Thakker RM et al(12). Housewives may have been impacted by smoking as well as breathing in smoke from burning cowdung cakes for cooking in chullhas. Similar results were reported by burning coal and firewood, according to Vishwanathan K et al(21) The primary contributing factors to the onset of chronic cor pulmonale, which was strongly associated with the patient's work, were bronchial asthma and chronic bronchitis. In the current study, the bulk of the patients were 50% labourers and 35% farmers. A research done by R. Vishwanathan(21) between 1963 and 1966 revealed that 66 of the 130 patients. were hospitalized after being exposed to smoke from fires where fire wood or coal and cow dung cake were burned. Smoke is unquestionably a potential source of air pollution that may cause bronchial discomfort in those who are vulnerable. It's important to take indoor air pollution into account as a potential cause of COPD.(13)

The majority of the research group's patients made their first appearances in the winter. Wintertime exacerbations, particularly of chronic bronchitis, can lead to the development of chronic cor pulmonale, which can lead to heart failure.(22)

The majority of the patients in the current study experienced symptoms for only 2 to 5 years (50 percent). Padmavathi and Pathak et al.(18) and Goswami et al. Assam's research both came to the same conclusions. The majority of the patients in our research smoked, which was also the case in Assam's study. 90 percent of smokers in the majority who smoked according to Goswami et al. were heavy smokers (37.5 percent). It has been demonstrated in research by Platts et al. (23), Thakker RM et al(12), Pandey et al(24), S. Gupta et al(16) and Sunil Babu M et al(20) that smoking is the most prevalent cause of the development of chronic cor pulmonale.

The majority of individuals were admitted to the hospital with advanced cardiac involvement. In the current investigation, all of the patients had coughing and shortness of breath. Many had abdominal discomfort (80%), lack of appetite (80%), and peripheral edoema (95%) and pain in abdomen(70%). Thakker et al(12) and Goswami et al(13) reported that all patients were admitted in the hospital with moderate to severe dysponea and distressing cough with excitation. Similar findings were reported by Gupta et al(16), Pandey M.R. et al(24), and Padmavathi et al.(18). Gupta et al.[1989] noticed cyanosis in 50% of cases(16). Patients with cor-pulmonale may present with RVH, asymptomatic RV dysfunction.(25)

25% patient presented with pallor which is comparatively high when compared to the study by Goswami et al(13) where they reported 5% patients having pallor, this may be due to 80% patients in present study were having loss of appetite and being majority of cases from low socio- economic class, diet may have played a role. 70% patients were having cyanosis in present study which was somewhat lesser than that seen in Goswami et al (95%) this may be due to severe congestive hepatomegaly in Study by Goswami et al. Gupta et al [1989] noticed cyanosis in 50% of cases.(16) while clubbing was 20% same present study and Goswami et al study. Padmavathi et al.(18)reported dyspnoea in 100%, pedal edema in 90.4% and cyanosis in 83.2% of the group.

Tachypnoea, ronchi, and crepitation were respiratory system results in the current investigation in all patients. In 80% of the patients, a barrel-shaped chest and diminished breath sounds were recorded. A similar finding was made in a research by Goswami et al. Wheezing (91.25 percent) and diminished breath sounds (96.25 percent) were the two main respiratory findings on chest auscultation. Crepitations, which can be caused by respiratory tract infections, were present in 78.75 percent of patients. In 96.25 percent of instances, chest expansion was reduced (5 cm), and in 3.75 percent of cases, it was normal. Thakker RM et al(12) and Sindhur JC et al(19) observed similar findings.

In the current study, higher parasternal heave was detected in 75% of patients, and raised JVP was seen in 70% of patients, which was consistent with the findings of previous studies. According to Goswami et al. (13) left parasternal heave was seen in 96.25 percent of cases and JVP was elevated in all patients. In 96 percent of patients, Thakker RM et al(12) discovered significant neck veins, and in 93 percent of cases, they discovered epigastric pulsation. In the study by Sunil Babu M et al., parasternal heave was present in 70% of patients (20) . This may be because the symptoms are persistent, as opposed to the present research's 90 percent prevalence of loud second heart sounds (P2 component), which was 60 percent in Goswami et al(13) study. Both Padmavathi and Pathak(18) and Sindhur JC et al(19) identified loud P2 in 70% and 65% of patients, respectively.

Chest X-ray findings in the current investigation were consistent with the clinical characteristics. The majority of the chest x-rays showed emphysema (60%) and cardiomegaly, along with chronic bronchitis (40 percent). Similar results were seen in a research by Goswami et al.(13), where a chest X-ray in 75% of subjects suggested chronic bronchitis with emphysema. Gireesh et al.(10) and Corazza et al.(26) found it to be in 58 percent and 95.2% of instances, respectively. Similar to the findings of Goswami et al., this investigation demonstrated prominent pulmonary conus in 30% of patients and cardiomegaly in 40% of cases(13)

40% of the patients had cardiomegaly, according to Guptha and Mathur(16), and 34% had significant conus. In 56.25 percent of the patients in Matthay(27), RDPA (Right descending pulmonary artery diameter) >16mm was observed. Similar to the findings of Goswami et al. (13) and Gireesh et al(10), bronchitis, old pulmonary tuberculosis/fibrosis, and kyphoscoliosis, were detected in 10%, 10%, and 5% of patients, respectively. According to the current study, pulmonary fibrosis with other etiological variables is a cause of chronic cor pulmonale in 5% of patients with pulmonary TB and emphysema.

As well as smoking-related emphysema and workplace dangers, pulmonary tuberculosis itself may not be the only factor contributing to chronic cor pulmonale.(15) In a research by Agrawal et al.(28) , it was shown that 11 instances (8.8%) out of 125 patients with pulmonary tuberculosis had congestive heart failure as the clinical manifestation of cor pulmonale. In the current study, 28% of participants exhibited gross thoracic deformity. Due to recurrent respiratory infections and poor lung compliance from the deformity, these individuals were more susceptible to developing chronic cor pulmonale.

In ECG 28 of the 40 patients that were investigated had P pulmonale, which had a clear association with the severity of chronic cor pulmonale and was more common in instances with longer disease duration. In the current investigation, 10 instances (or 25%) had an ECG that showed RBBB. Compared to studies conducted by other authors, the current study demonstrates that, despite its limitations, ECG can still be helpful in the diagnosis of chronic cor pumonale. ECG can also be used to identify COPD patients who are at risk for a lower survival time. The current study demonstrates that ECG, despite its limitations, can still be helpful in the diagnosis of chronic cor pulmonale, in contrast to studies conducted by other authors.

In the current study, on spirometry, only 4 (10%) cases of a restrictive ventilatory defect and 36 (90%) cases of an obstructive kind of defect were found. In a research conducted in rural Nepalese communities by Pandey et al.(24) , 63.5 percent of the participants had an obstructive pattern of respiratory illness, 2% had a restrictive pattern, and the other participants had a mixed type. According to S. Gupta et al. (16), just 3.4 percent of patients had a restrictive pattern, whereas

96.6 percent had an obstructive pattern. According to a study by David E. Dines and Thomas W. Parkin, 28 out of 52 patients (or 54% of them) had obstructive pulmonary disease(29).

The research found that the mean RVIDED (Right Ventricular Internal Diameter at End Diastole) was 3.52 cm, but Gupta et alstudy .'s from 1989 found that the RVIDED was 3.45cm and 2.97 cm, respectively. The mean RVIDED measured in the research by Gnan Abhinesh and Chandrasekhar was 3.7 cm(30) . According to Alok Agrawal's study, the average RVIDED was 4.02 0.56 cm (31) According to Debabrata Goswami et al(13) study's the average RVIDED was 3.7$\pm$0.52 cm. As a result, it was discovered that echocardiography was a trustworthy, noninvasive way to evaluate right ventricular function. It is more sensitive than an ECG in detecting chronic cor pulmonale.

Conclusion

Cor-pulmonale is a serious cardiovascular morbidity widespread in the community. The present study shows that chronic obstructive airway disease is a prevalent cause of chronic cor pulmonale in this part of the nation as well. The high frequency of cor- pulmonale was identified in the old age group and especially in males. Tobacco smoking was discovered in urban and industrial regions due to chronic bronchitis. In patients of chronic cor- pulmonale, X-ray chest is a poor technique for identification of pulmonary hypertension, but offers information on the pathogenesis. ECG and 2D echocardiography are important studies for identification of cor-pulmonale as well as its severity and treatment prognosis. Combination of the chest X-ray, ECG and 2D-echocardiography examinations is an essential aspect of care of patients of cor- pulmonale.

Echocardiography is effective in identifying all instances of cor- pulmonale and to eliminate pulmonary hypertension generated by left sided heart disease. Echocardiography has been demonstrated to be more sensitive than other non-invasive modalities of diagnostic approaches. It is possible to measure the morphologic alterations of the right side of the heart in patients with COPD and chronic cor pulmonale and can be of practical value in the evaluation of pulmonary artery pressure utilising Doppler Echocardiography.

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