Chronic cor-pulmonale in adults: An experience from a tertiary teaching hospital in Dharwad

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ABSTRACT

Background: Cor-pulmonale develops in response to acute or chronic changes in the pulmonary vasculature and/or the lung parenchyma that are sufficient to cause pulmonary hypertension. The true prevalence of cor-pulmonale is difficult to ascertain. However, recent advances in two dimensional echocardiography/Doppler imaging and biomarkers make it easier to screen and detect cor-pulmonale.

Aim: To study the etiology of cor-pulmonale, and to correlate it with the clinical, chest x-ray (CXR), electrocardiography (ECG) and echocardiography (ECHO) findings.

Methods: Fifty consecutive patients admitted with confirmed diagnosis of cor-pulmonale were included into the study. Detailed history, clinical examination, ECG, CXR and ECHO were carried out in all the cases.

Results: Out of the 50 patients, 32 were males and 18 were females. Maximum incidence was seen in 50-69 age group comprising 60% of the cases with mean age being 55.2 years. Majority (56%) of patients had the history of symptoms of more than 10 years duration. Chronic bronchitis was the underlying cause in the largest number (54%) of patients. Majority of patients had evidence of pulmonary hypertension. Q/R ratio in a VR >3 was observed in 60% of cases. On ECHO, right atrial enlargement was evident in 46% of patients and RVH was evident in 94% of cases.

Conclusions: In patients with clinical diagnosis of chronic cor-pulmonale, chest x-ray is a poor tool for detection of pulmonary hypertension, but gives information about its etiology. ECG provides information about RVH and right atrial enlargement. Echocardiography is helpful in detecting all cases of cor-pulmonale and to exclude pulmonary hypertension produced by left sided heart disease.

Keywords: cor-pulmonale, pulmonary hypertension, echocardiography

INTRODUCTION

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.[1] The right ventricle (RV) may get hypertrophied without producing right heart failure. Therefore, in chronic cor-pulmonale the mechanisms which leads to RVH ultimately results in right heart failure.[2] Chronic cor-pulmonale as a cause of congestive cardiac failure (CCF) is being recognized in recent years. 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.[3] The high incidence of chronic cor-pulmonale in Dharwad, Karnataka which consists mostly of rural population base prompted this study with a view to elucidate its etiology and also to correlate clinical, x-ray, electrocardiography(ECG) and echocardiography (ECHO) findings in such patients.

MATERIAL AND METHODS

Fifty consecutive patients admitted to a tertiary care hospital in Dharwad, Karnataka with confirmed diagnosis of cor-pulmonale were included into the study. Detailed history, clinical examination, electrocardiography (ECG), chest X–ray (CXR) and echocardiography (ECHO) were carried out in all the cases. The results were analyzed and descriptive statistics was used.

Exclusion criteria: Congenital heart diseases, right heart failure secondary to dysfunction of the left side of the heart, ischemic heart disease and rheumatic heart disease cases were excluded from this study.

Data was collected by using proforma meeting the objectives of the study. Purpose of the study was carefully explained to the patients and informed consent was obtained.

Investigations: Complete haemogram, blood urea, serum creatinine, serum electrolytes like sodium, potassium and chloride, routine urine examination, chest x-ray, ECG and ECHO was done in all these patients.

Socioeconomic status of study population was assessed based on modified Kuppuswami's scale. Class I taken as high class, class II and class III taken as middle class, and class IV and class V taken as low class.

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. This was assessed independently by radiologists who were unaware of clinical and laboratory information.

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 $+90^0$ 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.

ECHO findings: 2-D echocardiography was used to measure right ventricular dimensions and the right ventricular wall thickness to assess the presence of right ventricular hypertrophy and/or dilatation. Evidence of right atrial enlargement is confirmed if right atrial size >55mm and RVH if free wall thickness >5mm.

Statistical methods: The results were analyzed by calculating percentages, the mean values and standard deviation (SD).

RESULTS

Out of 50 patients of chronic cor-pulmonale studied, 32 were males and 18 were females, male: female ratio being 1.8: 1. The age of patients varied from 28 – 78 years. Maximum incidence was seen in 50-69 age group comprising 60% of the cases, with mean age being 55.20 years. Majority of the patients were illiterates (65%), belonging to low class, and all of them were from rural/semirural areas.

Duration of underlying respiratory disease: Before the onset of cardiac failure, patients furnished a history of symptoms referable to the underlying lung condition for a variable period of time. Symptoms of duration of more than 10 years were given by 56% of cases. The shortest duration in this study was 4 months and the longest was 30 years.

Physical findings: All the cases presented primarily as gross CCF, with dyspnea, oedema, liver enlargement, raised venous pressure and ascites, but no significant cardiac signs (Table-1). On the basis of absence of signs of other heart disease and presence of gross pulmonary disease, the diagnosis of chronic cor-pulmonale was made.

Table1: Distribution of signs and symptoms manifested (n=50).

Symptoms and signs	No. of patients	Percentage (%)
Dyspnea	50	100
Cough	50	100
Orthopnea	32	64
Raised venous pressure	41	82
Lower limb oedema	36	72
Enlarged liver	34	68
Ascites	17	34
Cyanosis	30	60
Mental confusion	16	32
Epigastric pulsation	46	92
Loud P2	35	70
Palpable P2	26	52
Left parastrernal heave	20	40

Pulmonary conditions: Chronic bronchitis was the underlying cause in the largest number of patients accounting for 54% of caes(Table-2). Pulmonary tuberculosis formed a low figure despite its high incidence in this part of Karnataka.

Table-2: Underlying pulmonary diseases (n=50).

Disease	No of patient	Percentage (%)
Chronic bronchitis	28	54
Emphysema	10	20
Bronchiectasis	06	12
Bronchial asthma	02	04
Pulmonary tuberculosis	03	06
Chest deformity	01	02
Primary pulmonary hypertension	00	00
Total	50	100

Laboratory findings: Majority (64%) of cases were anaemic. Table 3 shows the CXR, ECG and Echo findings of the study population.

Table-3: CXR, ECG and Echo findings suggesting RVH and pulmonary hypertension (n=50).

Variables	No of patients	Percentage (%)
X ray changes	24	48
Right descending pulmonary artery width >16mm		
Cardiomegaly (CT ratio >50%)	31	62
ECG changes	36	72
Right axis deviation		
Q/R >3 in aVR	21	42
R/S >1 in V1	30	60
Echo findings	23	46
Right atrial size >55mm		
Free wall thickness >5mm	47	94

DISCUSSION

The important aspect of this study was the high incidence of cor-pulmonale in an entirely nonindustrial population. Of the 50 patients, maximum numbers of cases (60%) were seen in the age group of 50-69 years. This correlates well with a similar study wherein the incidence was 65% in the corresponding age group.[4] Males outnumbered females which is comparable to another study where the ratio was 1.2:1.[5] Chronic bronchitis was found to be commonest etiological factor for the causation of cor-pulmonale. Majority of the males were smokers who smoked >10 beedies/day for more than 20 years. Platts et al., in their study has established the definite role of smoking in the causation of cor-pulmonale.[6]

All patients suffering from chronic cor-pulmonale were admitted to hospital with varying degree of dyspnea and cough with expectoration. Patients with cor pulmonale may present with RVH, asymptomatic RV dysfunction or RV failure.[7] 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_2 (70%) and palpable P_2 (52%). 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. While comparing the clinical signs for pulmonary hypertension and RVH in patients with and without chronic obstructive pulmonary disease (COPD), it was found that these clinical signs were seen only in a minority of cases with COPD, which is probably due to hyperinflation of the chest. Thus, majority of them presented with evidence of cardiac failure, since most of the patients sought medical aid only when they got disabled to a great extent by their symptoms. A similar study showed pulmonary hypertension as a common complication of chronic obstructive pulmonary disease (COPD).[8] The increase in pulmonary artery pressures is often mild to moderate. However, 5–10% of patients with advanced COPD may suffer from severe pulmonary hypertension and present with a progressively downhill clinical course because of right heart failure added to ventilatory handicap.[8]

In our study, 48% of the patients had the changes suggestive of pulmonary hypertension on chest x-ray. Cardiomegaly was seen in 62% and pleural effusion in 40%, both of which were seen in patients with gross failure. Chest x-ray is very helpful in patients presenting with cor-pulmonale due to causes other than COPD like bronchiectasis and extensive fibrosis. It is also very helpful to detect the cause of acute exacerbations. The use of non-invasive imaging techniques to assess the anatomy and function of the pulmonary vessels and heart has taken on added importance with the recent advent of novel therapies. Imaging findings not only constitute a diagnostic tool but have also proven to be essential for prognosis and treatment follow-up.[9]

A 12 lead ECG was recorded in all patients. 60% had sinus tachycardia because many patients presented with infective exacerbation, and many patients were on beta agonists. Right axis deviation was present in 72% of cases. Mittal SR et al., [10] reported in their study, Q/R ratio in aVR >3, was diagnostic of RVH in chronic cor-pulmonale and it had a specificity of 94%. In our study the specificity using Q/R in aVR was only 60%. Right atrial enlargement by measuring height of p wave in lead II was detected in 44%. Right ventricular

enlargement by taking ratio of R/S in lead VI was present in 60%. The reported incidence of RVH in such patients varies from 28% to 75%.[11]

By using 2D echocardiography, right atrial enlargement was seen in 46% of patients (right atrial size ≥55mm). Right ventricular hypertrophy (RVH) was seen in 94% (free wall thickness ≥5mm), and pericardial effusion was seen in 20% of patients. A study comparing ECG, vector cardiography (VCG) and ECHO data in 78 patients with chronic bronchitis, allowed the distinction of 4 grades of RVH. Apparent ECG signs of RVH in chronic bronchitis develop much later, usually after the development of secondary pulmonary hypertension.[12]

CONCLUSION

The high incidence of cor-pulmonale in a study population consisting mostly from rural background is the result of chronic bronchitis and emphysema secondary to untreated chronic respiratory infections. Contributing factors include low social class and ill ventilated and overcrowded living conditions. In patients with chronic cor-pulmonale, chest x-ray is a poor tool for detection of pulmonary hypertension, but gives information about the etiology. ECG gives information about RVH and right atrial enlargement, in addition to arrhythmias produced by disease *per se* or drugs used to treat it. Echocardiography is helpful in detecting all cases of cor-pulmonale and to exclude pulmonary hypertension produced by left sided heart disease.

AUTHOR NOTE

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