Original Research Paper

Volume-9 | Issue-3 | March-2019 | PRINT ISSN - 2249-555X

General Medicine

STUDY OF NON INVASIVE INVESTIGATIONS IN EARLY DETECTION OF COR PULMONALE DUE TO CHRONIC OBSTRUCTIVE LUNG DISEASE

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ABSTRACT

Objective : Cor pulmonale is an important complication and cause of mortality in patients with Chronic Obstructive Pulmonary Disease. Its detection by various clinical methods is often delayed until overt right heart failure develops, because of pulmonary hyperinflation. This study was conducted to estimate the value of Non-Invasive investigations in early detection of cor pulmonale and to compare its sensitivity with physical, radiological and electrocardiographic examination

Methods: 50 cases of COPD were taken for the study. All the patients were subjected to ECG, Chest X-ray in addition to routine investigations. All patients were evaluated by echocardiography for evidence of right ventricular dilatation, hypertrophy and pulmonary hypertension.

Results: Out of 50 patients of COPD, cor pulmonale was detected in 48 patients by Echocardiography. Mean age was 59.9 ± 12.45 yrs. All male patients had a history of smoking for ≥ 5 yrs. By physical examination, cor pulmonale was detected in 19 out of 50 patients (38%). By chest X-ray, cor pulmonale was found in 14 out of 50 patients (28%). 20 out of 50 patients (40%) had evidence of cor pulmonale on ECG, pulmonale were: ECG – 42%, Physical examination –40%, Chest radiography – 29%, By all clinical methods – 65%. Overall cor pulmonale was detected in 62% of patients by all clinical methods and in 96%.

Interpretation: In the light of findings of the present study we opine that echocardiography is a useful diagnostic method for early detection of cor pulmonale in patients with COPD and better management of cases

KEYWORDS :

INTRODUCTION

Chronic cor pulmonale is a serious, protracted, ultimately fatal human experience, There are large differences in its reported prevalence. So far as hospital admissions are concerned, high figures for the incidence of cor pulmonale among hospital admissions for heart failure ranging from16% to 38% have been reported from places such as Belgrade, Delhi, Prague and Sheffield. In most reported series more than 50% of the cases are attributed to chronic bronchitis, asthma or emphysema.3

Chronic Obstructive Pulmonary Disease (COPD) is the term that is widely used as synonymous for the chronic bronchitis and emphysema.4 Chronic cor pulmonale is usually the end result of long standing pulmonary disease, which results from pulmonary hypertension and subsequently right ventricular hypertrophy and failure.5 The importance of chronic cor pulmonale as a cause of congestive cardiac failure is being recognized in recent years. Therefore, the recognition of chronic cor pulmonale is of great importance to all medical practitioners.

Pulmonary arterial hypertension and right heart overload are among the most important complications of COPD and cor pulmonale is well recognized consequence of it.5

This study was done to determine the usefulness of various non-invasive investigations in the early detection of cor pulmonale due to COPD

MATERIALS AND METHODS

Aim :

To study COPD patients admitted for 18 Months starting from January 2016 to June 2017. Total of 50 cases of COPD admitted to Department of Medicine, Government General Hospital, Kurnool, during the study period, were taken after considering the inclusion and exclusion criteria.

Sample Size - 50 patients

INCLUSION CRITERIA:

a) Patients with chronic obstructive pulmonary disease (COPD) diagnosed by suggestive symptoms and confirmed by physical, radiographic and pulmonary function tests (PFT).
b) Patients with COPD with clinically detectable evidence of cor pulmonale

Exclusion Criteria:

1) Primary diagnosis of bronchial asthma.
2) Interstitial lung disease.
3) Known left ventricular systolic dysfunction (Ex., Ischemic heart disease).
4) Poorly controlled hypertension.
5) Significant valvular heart disease.
6) Congenital heart disease.
7) Very poor echogenic subjects in whom meaningful echocardio graphic examination could not be performed.

RADIOLOGICAL CRITERIA: 32, 42, 44, 47

Emphysema – One or more of the following:

A lung height of ≥ 29.9 cm, measured from the dome of the right diaphragm to the tubercle of the first rib, Flattening of diaphragm - on a PA radiograph, if the highest level of the dome of the right hemi diaphragm is < 1.5 cm above and perpendicular to a line drawn between the costophrenic and vertebrophrenic angles, Increase in the retrosternal air space, measured 3 cm below the manubrial sternal junction (>4.4 cm) The presence of bullae Cardiomegaly – cardio thoracic ratio > 50 %.

ECG CRITERIA: WHO 3 criteria for RVH was considered for our study - qR pattern with intrinsicoid deflection > 0.03sec in V1
R amplitude < S amplitude in V5 R or Rl amplitude < S amplitude in lead I Incomplete RBBB with QRS duration < 0.12 sec.

P amplitude ≥ 0.25 mm in lead II Right axis deviation ≥ 110 degree
T-inversion in leads V1 to V4 or in leads II and III An ECG is considered diagnostic of RVH if criterion 1 or two or more of criteria 2-4 are met. Criteria 5-7 reinforce the diagnosis

OBSERVATIONS AND RESULTS

The following were the observation made from the study of 50 cases of COPD admitted to medical wards of Government General Hospital, Kurnool.

Sex	No. of cases	Percentage
Male	36	72 %
Female	14	28 %

AGE DISTRIBUTION OF CASES:

Age interval (years)	Male	Female	Total	Percentage
31 – 40	2	3	5	10 %
41 – 50	6	2	8	16 %
51 – 60	9	3	12	24 %
61 – 70	10	3	13	26 %
71 – 80	9	3	12	24 %
Total	36	14	50	

Table2. Showing Age Distribution:

ANTHROPOMETRIC PARAMETERS:

Table 5

	Range		Mean ± SD
Height (in mts)	1.42	- 1.76	1.59 ± 0.08
Weight (in kgs)	35	- 75	52.12 ± 9.58

Table 4. Occupation

Occupation	No. of cases	Percentage
Farmer	22	44 %
House wife	11	22 %
Coolie	9	18 %
Driver	2	4 %
Factory worker	2	4 %
Clerk	1	2 %
Tailor	1	2 %
Teacher	1	2 %
Shop keeper	1	2 %

Agriculture was the occupation of majority of patients (44%). Among 14female patients, 11 were housewives

Table 10 Signs at presentation

Signs	No. of cases	Percentage
Pallor	21	42%
Cyanosis	11	22%
Pedal Edema	16	32%
Raised JVP	17	34%
Fever	7	14%
Tachypnea (>20/min)	49	98%
Increased activity of accessory muscles of respiration	37	74%
Emphysematous chest	39	78%
Decreased chest expansion	50	100%
Hyperresonant note on percussion	9	18%
Liver and cardiac dullness obliteration	22	44%
Cardiomegaly	11	22%
Rhonchi	39	78%
Crepitations	45	90%
Parasternal heave	11	22%
Epigastric pulsations	9	18%
Palpable P_2	16	32%
PSM at Tricuspid area	10	20%
Tender liver	9	18%
Ascites	5	10%

DURATION OF SMOKING:

Table 8.

Duration of smoking (in pack yrs)	No. of cases (n = 36)	Percentage
< 6	1	2.78%
6 - 15	14	38.89%
16 - 25	13	36.11%
> 25	8	22.22%

Favoured mode of smoking was Beedi. 34 out of 36 patients smoked Beedi,only 2 were smoking cigarettes.In all 14 female patients, the indulgence of inhalation of smoke was in theform of smoke from dung-mould burnt in chulha in ill-ventilated kitchen.Tobacco chewing habit was seen in 10 patients – 4 female and 6 male

DISCUSSION

The present study was designed in an endeavor to access the value of Noninvasive investigations in the diagnosis of cor pulmonale in patients with chronic obstructive pulmonary disease.

The patients admitted to Governement General Hospital, Kurnool came from Kurnool town and neighbouring villages. The patients therefore represented urban as well as rural population.

The aim of present work was to find out the respective value of physical examination, chest X-ray, ECG and echocardiography in the diagnosis of cor pulmonale patients with COPD.

Age:

The highest incidence in the present study was in the age group of 61-70 years (26%). 74% of patients belonged to age more than 50 years. Similar predilection for elderly age group was found in other studies also.

In Vakil's 73 series 65% were in the 41-70 age group, JC Banerjea 74 observed maximum incidence in 51-70 age group (58%), while in PS Shankar's 34 series it was in age group of 41-60 years (68%) and in Padmavati's 33 study it was 30-59 years (78%).

Sex:

Out of the 50 cases studied, 72% were males and 28% females, i.e. a ratio of 2.57:1. Other studies from various parts of the country showed preponderance in males – 5.2:1(Vakil), 4:1 (Banerjea JC), 1.2:1 (Padmavati), 2.3:1 (Mathur) and 5.4:1 (Shankar PS). COPD was mainly found in males, thus placing them at a higher incidence of having chronic cor pulmonale than in females.

OCCUPATION:

In this study most of the patients were farmers (44%) followed by manual labourers (18%). In these patients, probably the occupation was not of any significance in the causation of the disease.

In a study conducted by Kedarnath et al 73 in Kanpur, they found that 75.6% of the cases of cor pulmonale were manual labourers. Berry et al in their analysis of 106 patients of chronic cor pulmonale reported that 60.3% of their patients were manual workers. In both the series the disease had the highest incidence in manual labourers and those exposed to dust and smoke.3

All the female patients were housewives. They had to cook and perform other household duties in their poorly ventilated smoky kitchens. Those coming from rural areas were part-time farm workers or manual labourers.

SMOKING:

In this study all male patients (100% of 36 males) were smokers. Most of them smoked >1 pack of beedies/day. The majority had the habit of smoking for more than 6 years (92%). All females did their routine household work in poorly ventilated kitchens, using firewood for cooking.

In this study, chronic bronchitis was found to be the commonest etiological factor for the causation of cor pulmonale. The hospital study of congestive heart failure by Stuart Harris et al showed that heavy smoking was the major cause of pulmonary heart failure.

Favoured mode of smoking was Beedi. 34 out of 36 patients smoked Beedi, only 2 were smoking cigarettes.

In all 14 female patients, the indulgence of inhalation of smoke was in the form of smoke from dung-mould burnt in chulha in ill-ventilated kitchen.

Tobacco chewing habit was seen in 10 patients – 4 female and 6 male

MODE OF SMOKING:

Table 9

Mode of smoking	No. of cases (n = 50)	Percentage
Beedi	34	68%
Cigarettes	2	4%
Others	0	0%
Inhalation of smoking from chulha	14	28%

DURATION OF ILLNESS:

Table 7 Duration of symptoms

Duration of illness	No. of cases	Percentage
< 5 yrs	5	10%
5 - 10 yrs	32	64%
> 10 yrs	13	26%

RADIOLOGICAL FINDINGS:

Evidence of chronic bronchitis and/or emphysema was seen in 42 of patients.

Emphysema features were seen in 22 patients and chronic bronchitis features in 20 patients

Table 15 Radiolgical findings

Chest X-ray	No. of cases	Percentage
Cardiomegaly	21	42 %
Pulmonary Artery dilatation > 16 mm	14	28 %
Normal	36	72 %

ELECTROCARDIOGM:

Table 16 ECG Findings

ECG	No. of cases	Percentage
Evidence of RVH	20	40%
Incomplete RBBB	8	16%
P pulmonale	30	60%
Right axis deviation ≥ 110°	17	34%
Right ventricular strain pattern	3	6%

ECHOCARDIOGRAPHIC FINDINGS:

Table 17

Echocardiography	No. of cases	Percentage
RV Hypertrophy	44	88%
RV Dilatation	46	92%
Pulmonary Hypertension	47	94%
Evidence of cor pulmonale	48	96%

Pulmonary hypertension was the most common finding on echocardiography (94%), closely followed by RV Dilatation and RVH in 92% and 88% respectively

Table 14 Severity of COPD

Severity of COPD	FEV1 % Predicted	No. of cases	Percentage
Mild	≥ 80	0	0%
Moderate	50 – 79	8	16%
Severe	30 – 49	26	52%
Very severe	< 30	17	34%

RECOMMENDATION OF AREAS FOR FURTHER STUDY

Tans esophageal echocardiography (TEE) :

Transesophageal echocardiography (TEE) uses high frequency sound waved (ultrasound) to make detailed pictures of heart and the arteries that lead to and from it. Unlike a standard echocardiogram, the echo transducer that produces the sound waves for TEE is attached to a thin tube that passes through your mouth, down your throat and into your esophagus. Because the esophagus is so close to the upper chambers of the heart, very clear images of those heart structures and valves can be obtained.

ADVANTAGES:

The advantage of TEE over TTE is usually clearer image, especially of structures that are difficult to view transthoracically (through the chest wall). The explanation for this is that the heart rests directly upon the esophagus leaving only millimeters that the ultrasound beam has to travel. This reduces the attenuation (weakening) of the ultrasound signal, generation a stronger return signal, ultimately enhancing image and Doppler quality.

Emphysematous chest and rotation of heart leads to poor echo window in TTE in COPD patients and this is where comes the role of TEE in indirectly assessing the severity of COPD via measurement of PAH and degree which the right sided heart is involved.

Emerging role of transesophageal echocardiography in severe COPD

*In Songara A et al*82 Total 100 patients of COPD were evaluated for PH via TTE and TEE was performed in all those 33 patients whose TTE were non-confirmatory due to poor echo window.

*Songara A et al*82 concluded that TEE can be advised in grade 3 and grade 4 patient, if ECG and ECHO findings are normal or absent and the patient is symptomatic and clinically there is evidence of PAH. This will help in diagnosing PAH in early phase of the disease and thereby improving the survival rate and longevity of patient.

Plasma N-terminal Pro-brain Natriuretic Peptide:

Secondary pulmonary hypertension and cor pulmonale are important causes of death and poor prognosis in COPD patients, BNP has been shown to be useful for the diagnosing patients suspected of having heart failure. It is also well known that plasma BNP levels are elevated in patients with secondary pulmonary hypertension and chronic lung disease with right ventricular overload.

Plasma N-t Pro-BNP: A Prognostic marker in patients with COPD.

In Jaebongaro, Dongku, Kwangju,et al83 study Plasma NT-pro BNP levels were measured in 61 patients with stable COPD. PLASMA NT-pro BNP levels, pulmonary function, PaO2, AND PaCO2 levels and systolic pulmonary artery pressure were compared according to COPD severity and the main stimulus responsible for increasing BNP and NT-pro BNP synthesis and secretion is myocardial wall stress.

Plasma NT-proBNP levels increased significantly with disease severity, progression of chronic respiratory failure, and secondary pulmonary hypertension in patients with stable COPD. These results suggest that plasma NT-proBNP can be a useful prognostic marker to monitor COPD progression and identify cases of secondary pulmonary hypertension in patients with stable COP

CONCLUSION

Detection of cor pulmonale in early stages is important for therapeutic and prognostic implications.

Diagnosis of cor pulmonale by conventional clinical methods is often delayed, until overt right sided failure, due to hyper inflation of lungs. Echocardiography alone is found to be extremely useful and better than other modes of examination (physical examination, chest radiography, ECG), provided that echo-window is adequate, in diagnosing cor pulmonale in patients of COPD.

Thus echocardiography is a useful addition in diagnostic method for early detection of cor pulmonale and better management of cases.

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