

Clinical And Radiological Profile Of Various Lung Diseases Associated With Cor Pulmonale In Patients Attending Tertiary Care Centre

Dr Ruttala Akhila
Dr D Shravani Md
Dr. K Venkata Ramana Md
Dr.K Vijaya Kumari Md
Dr K Kanakalakshmi Md

Department Of Pulmonary Medicine, Andhra Medical College, Visakhapatnam, Andhra Pradesh, India.

Abstract:

Background :cor pulmonale is defined as modification in the rv region of heart's anatomy (such as hypertrophy or dilatation) and function brought on by a main respiratory system illness that causes pulmonary hypertension (1).

In clinical practise, this pathological definition is actually only marginally useful. According to certain suggestions, the term "alteration in the structure and function of the right ventricle" should be used in place of "hypertrophy."

Clinically, cor pulmonale has been divided into three groups: acute, subacute, and chronic, depending on when the disease first manifests itself (2). An acute cor pulmonale is distinguished from a chronic type of the condition based on how long the elevated rv afterload has been present. Acute pulmonary embolism (ape) is the most frequent cause of the acute form, but chronic obstructive lung illness typically results in the cp (copd)(3)but rare in disease like asthma(3)chronic thrombo embolism(4).

Materials and methods:

A prospective and observational study conducted on patients attending government hospital for chest and communicable diseases, visakhapatnam, andhrapradesh.

A total of 50 patients were selected based on inclusion and exclusion criteria.

Results:

Out of 50 patients, most common age group belongs to 50-59yrs age group followed by 40-49yrs age group and the least percentage was found in <40yrs age group. The mean age group of the patients was 55.56±11.47yrs. Sex distribution in the present study showed males around 34(68%) patients and females were 16(32%) patients. Male predominance is seen.

Most of patients occupation in the present study was agricultural labourers 18 (36%) and coolie 10 (20%). Followed by homemakers 8 (16%) which was equal to half of the women patients in the present study.

74% of patients in the present study were smokers and 4% of our patients use biomass fuel for cooking purposes.

Among 37 cases of smokers 33 (89%)cases were males and 4 (10.8%)cases were females.

Among 74% (37)of smokers, 40%(15) cases had <10 pack years,18.9%(7) cases had 11-20 pack years 29.7%(11) cases had 21 -29 pack years(10.8%) 4 cases > 29 pack years.

Almost all patients i.e 90% of the patients in the present study belongs to lower socioeconomic status. Only 8% belongs to upper class including upper lower and upper middle.

Among 50 patients majority of cases were copd 28(56%) , followed by post tb sequelae 9(18%),most common spirometry pattern was obstructive type in 38(76%) patients.

Among the physical findings of the patients shortness of breath(sob), increased respiratory rate, lower limb oedema were present in all patients, followed by loud p2 in 86%. Cough with expectoration(78%) and presence of parasternal heave(72%) were next common findings. Dry cough(22%) and chest pain(22%) were the least complaints raised by patients.

Mean duration of symptoms was found to be 5.60±3.27yrs.

Most common finding on chest x ray observation was cardiomegaly which is 56% next was emphysema(40%) followed by bronchiectasis(32%), main pulmonary artery enlargement was seen in 52% of cases, increased broncho vascular markings noted in 50% and reticulonodular pattern only in 8%.

Most of the patients i.e 36 patients on ecg investigation showed p- pulmonale (72%), followed by right axis deviation 58% and rbbb(24%) and other minor changes(10%).

On 2d echo right ventricular dilatation was present in all patients. And tricuspid regurgitation was found to be severe in 18(36%), moderate in 8 (16%) and mild in 24(48%) of patients.

Pulmonary artery hypertension was found in 27(54%) of patients followed by moderate in 13(26%) , mild in 10 (20%) of patients

Right ventricular dysfunction was found to be present severely in 20(40%), moderately in 10(20%) and mild in 20 (40%) of patients.

Conclusion:

Different clinical presentations and investigative findings from our study are almost comparable to those from earlier work by other researchers.

Clinical characteristics can be used to suspect cor pulmonale.

When compared to ecg, echocardiogram was determined to be a more effective diagnostic tool.

The major cause of chronic cor pulmonale in our study was found to be chronic obstructive pulmonary disease followed by bronchiectasis . Smoking formed the major and most important causal association in the present study.

Keyword : copd,pulmonary artery hypertension,right ventricular dilatation

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I. Introduction

Pulmonary heart" is what the Latin word cor pulmonale signifies.

Since Paul Dudley White first introduced the phrase cor pulmonale almost 100 years ago, it has frequently been used to refer to right ventricular failure.

The condition now known as cor puomonale has been referred to by a variety of names, including pulmonary failure by Fulton in 1953, Heart condition that causes pulmonary hypertension and arterial desaturation by Hecht in 1956, lungs heart failure by Stuart Harries & Henley in 1957cardiovascular secondary pulmonary hypertension disease by Meltingly in 1962, and persistent pulmonary hypertension disease by Calland in 1963.

Cor pulmonale is defined as modification in the RV region of heart's anatomy (such as hypertrophy or dilatation) and function brought on by a main respiratory system illness that causes pulmonary hypertension (1).

In clinical practise, this pathological definition is actually only marginally useful. According to certain suggestions, the term "alteration in the structure and function of the right ventricle" should be used in place of "hypertrophy."

Cor pulmonale results from many different defects of chest wall and bronchopulmonary vascular disorders, however this pathological description is actually of limited use in the practice.

Currently, cor pulmonale is described as "change of the right ventricle's structure and function brought on by illnesses that impact the lung's vasculature or its structure and function(1). This explicitly omits the changes brought on by illnesses of the congenital cardiac disease or the left ventricle. A cor pulmonale's frequency has been calculated to be around 16% in India, where a significant portion of the population lives in areas with severe air pollution.

Clinically, cor pulmonale has been divided into three groups: acute, subacute, and chronic, depending on when the disease first manifests itself (2). An acute cor pulmonale is distinguished from a chronic type of the condition based on how long the elevated RV afterload has been present. Acute pulmonary embolism (APE) is the most frequent cause of the acute form, but chronic obstructive lung illness typically results in the CP (COPD)(3)but rare in disease like asthma(3)chronic thrombo embolism(4). However, PAH is the ubiquitous link between the lung failure and heart in the cor pulmonale and is always the underlying pathogenic cause for the right ventricular enlargement. As not all chronic pulmonary disease in all individuals will lead to cor-pulmonale, and as our capacity to detect PAH & CP by examination and investigations alone is very insensitive, it is challenging to quantify the likelihood of cor pulmonale .

Due to its non-invasiveness and widespread accessibility, echocardiography is essential in diagnosis and therapeutic evaluation of these individuals. It is of most beneficial in an emergency situation .Additionally, it serves as a useful tool for monitoring right ventricular function in patients with cor pulmonale and determining if it has stabilised, declined, or improved over time. In reality, it not only gives predictive characteristics, but it may also be used to evaluate the effectiveness of treatment. Echocardiography can be helpful in diagnosis although limited in patients with parenchymal lung disease and hyperinflation (emphysematous changes) .Thelink between right heart catheterization and echocardiography is imperfect, but sensitivity is typically superior to specificity(5), suggesting normal echocardiogram outcomes which helps to

exclude significant cor pulmonale. Catheterization of right heart is the gold standard for diagnosis(6). The severity of pulmonary hypertension appears to correlate with magnitude of hypoxemia, hypercapnia and air flow obstruction.

What causes hypoxemia at its root must be treated as the first line of defence against cor pulmonale. All patients should receive treatment for any primary associated illnesses, such as COPD, OSA, and ILD. In hypoxic patients, long-term oxygen therapy reduces clinical RHF and improves pulmonary hemodynamics. This is due to the fact that oxygen decreases pulmonary vascular remodelling, RV afterload, and/or hypoxic vasoconstriction. Depending on the underlying pathophysiology, there are various outcomes for cor pulmonale. It typically portends a worse prognosis when cor pulmonale arises from a primary pulmonary illness.

As PAP and PVR rise in individuals with chronic lung disease, RV afterload typically rises gradually, causing progressive RV hypertrophy and reducing wall stress. The RV ultimately enlarges, changing from its initial crescent shape to a more spherical one that is better equipped to produce an increased stroke work. In combination with elevated heart rate, RV dilation and wall thinning contribute to increased RV wall stress, which in turn causes increase in myocardial oxygen consumption, decreased myocardial perfusion and RV ischemia. Severe tricuspid regurgitation may develop when the RV enlarges.

II. Aims And Objectives

1. To observe the clinical manifestations of cor pulmonale.
2. To observe the echocardiographic, electrocardiographic, and radiological alterations in various lung diseases landing in cor pulmonale.

III. Materials And Methods

Study design: hospital based prospective and observational study

Source of patients: patients attending government hospital for chest and communicable diseases, visakhapatnam, andhrapradesh

Study setting: government hospital for chest and communicable diseases visakhapatnam, andhra pradesh.

Sample size: a total of 50 patients were selected based on inclusion and exclusion criteria

Study period: january 2021 to july 2022

Inclusion criteria:

Age >18 years

Informed consent

All patients of both the genders with clinical features like dyspnoea, recurrent chest infections with general physical examination suggestive of right ventricular heart failure like raised jugular venous pulse , hepatomegaly and bilateral pedal edema

Patients who come with 2d echo report showing right ventricular/right atrial dilation or hypertrophy.

Exclusion criteria:

Patients with following conditions: valvular or myocardial disease, congenital heart disease, gross anaemia with heart failure, primary pulmonary hypertension. Chronic liver disease, chronic kidney disease.

Procedure:

All patients with cor pulmonale who are fulfilling the inclusion criteria are taken into the study. After taking informed consent , demographic data, detailed clinical history and comorbid conditions were noted Physical assessment and radiological findings were noted Laboratory investigations done to know the underlying causes of cor in addition its consequences. These include:

Chest radiograph: Cardiomegaly is confined primarily, if not completely, to the right ventricle and additional abnormalities may be identified depending on the reason. The pulmonary artery may appear enlarged.

Doppler echocardiography, which is the most useful yet very operator- dependent: At the moment, echocardiography is the foundation for the non- invasive diagnosis of pulmonary hypertension. The trans tricuspid pressure gradient can be calculated using continuous-wave Doppler echocardiography using the peak velocity of the tricuspid regurgitant jet.

Features of RV/RA hypertrophy are visible on the electrocardiogram.

PFTs and the 6-minute walk test are used to evaluate the extent of lung disease and one's ability to exercise.

Chest CT angiography whenever necessary used to exclude PTE as a contributing factor. For the diagnosis of pulmonary hypertension, main pulmonary artery diameter measures more than 29 mm have a sensitivity of 84% and a specificity of 75%.

IV. Results

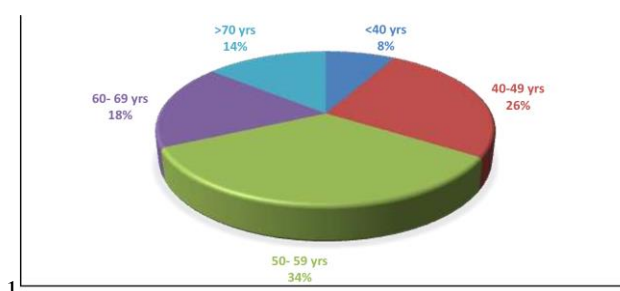
The following results are observed in the present study

Table 1: Showing the Distribution of Patients according to Age

Age	Frequency	Percentage
<40yrs	4	8%
40-49yrs	13	26%
50-59yrs	17	34%
60-69yrs	9	18%
>70yrs	7	14%
Total	50	100%

Mean Age is 55.56±11.47yrs

Out of 50 patients, most common age group belongs to 50-59yrs age group followed by age group and the least percentage was found in <40yrs age group. The mean age group of the patients was 55.56±11.47yrs.



Graph 1: showing distribution of patients according to age

Table 2: Showing the Distribution of Patients according to Sex

Sex	Frequency	Percentage
Male	34	68%
Female	16	32%
Total	50	100

Sex distribution in the present study showed males around 34(68%) patients and females were 16(32%) patients. Male predominance is seen.

Graph 2: distribution of patients according to sex

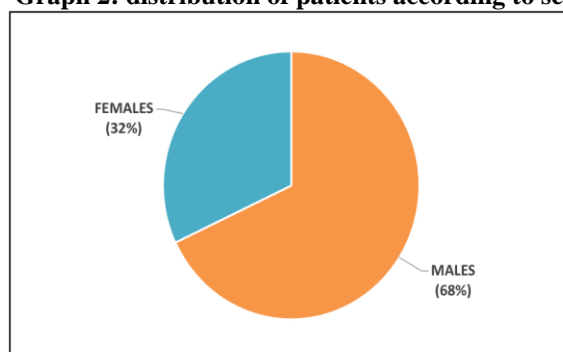


Table 3: Showing the Distribution of Patients according to their occupation

OCCUPATION	Frequency	Percentage
Agricultural labour	18	36%
Autodriver	4	8%
Cooli	10	20%
Home maker	8	16%
Farmer	1	2%
Fisherman	2	4%
Private job	3	6%

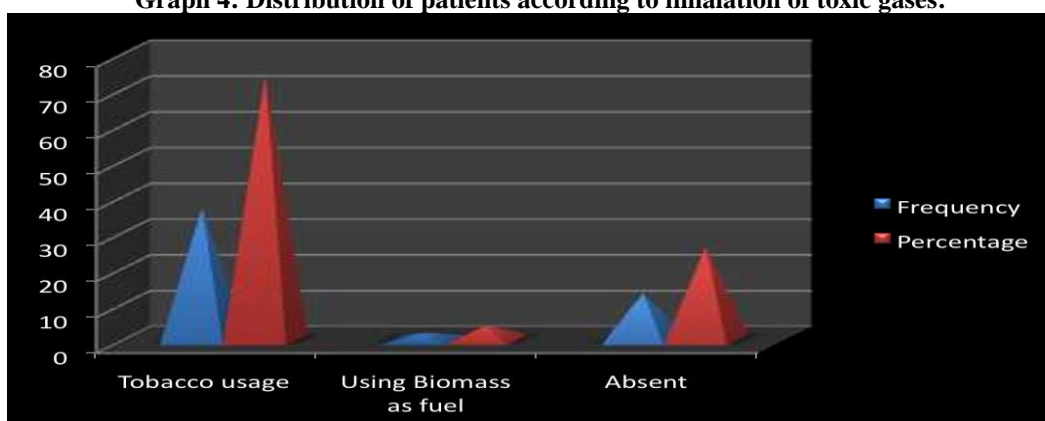
Shop keeper	1	2%
Tailor	1	2%
Watch man	2	4%
Total	50	100%

Most of patients occupation in the present study was Agricultural labourers 18 (36%) and coolie 10 (20%). Followed by Homemakers 8 (16%) which was equal to Half of the women patients in the present study.

Table 4 : Distribution of patients according to inhalation of toxic gases:

Any form of inhalation of toxic gases	Frequency	Percentage
Tobacco usage	37	74%
Using Biomass a fuel	2	4%
Absent	13	26%

Graph 4: Distribution of patients according to inhalation of toxic gases:



74% of patients in the present study were smokers and 4% of our patients use Biomass fuel for cooking purposes.

Table 5: Distribution of sex among smokers

Smokers	No. Of cases	%
Males	33	89%
Females	4	10.8%

Among 37 cases of smokers 33 (89%)cases were males and 4 (10.8%)cases were females

Graph 5: Distribution of sex among smokers

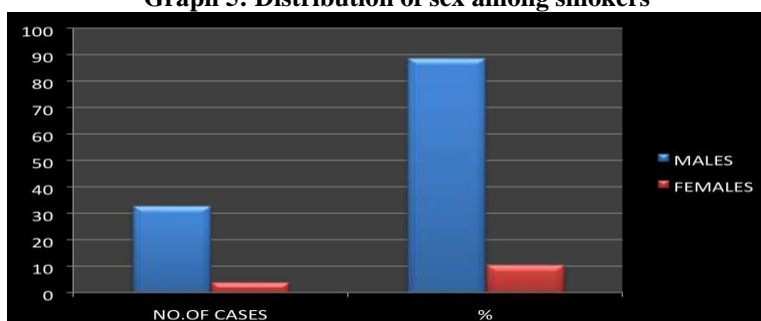
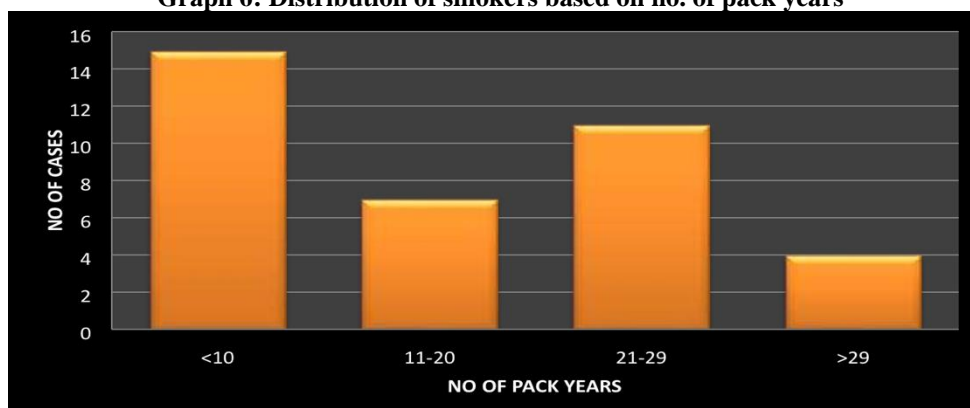


Table 6: Distribution of smokers based on no. of pack years

No. Of pack years	No. Of cases
<10	15
11_20	7
21-29	11
>29	4

Graph 6: Distribution of smokers based on no. of pack years



Among 74% (37) of smokers, 40% (15) cases had <10 pack years, 18.9% (7) cases had 11-20 pack years, 29.7% (11) cases had 21-29 pack years, and 10.8% (4) cases had >29 pack years.

Table 7: distribution of patients according to socio economic status

Socioeconomic status	Frequency	Percentage
Lower	45	90%
Lower middle	1	2%
Upper lower	2	4%
Upper Middle	2	4%
Total	50	100%

Almost all patients i.e 90% of the patients in the present study belong to Lower socioeconomic status. Only 8% belongs to upper class including upper Lower and upper middle.

Graph 7: Distribution of patients according to socio economic status

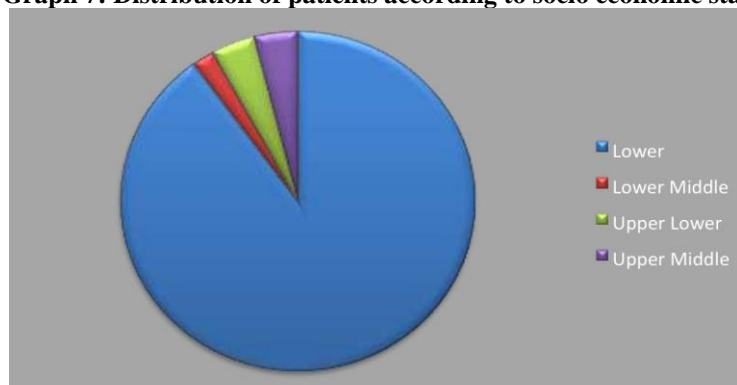
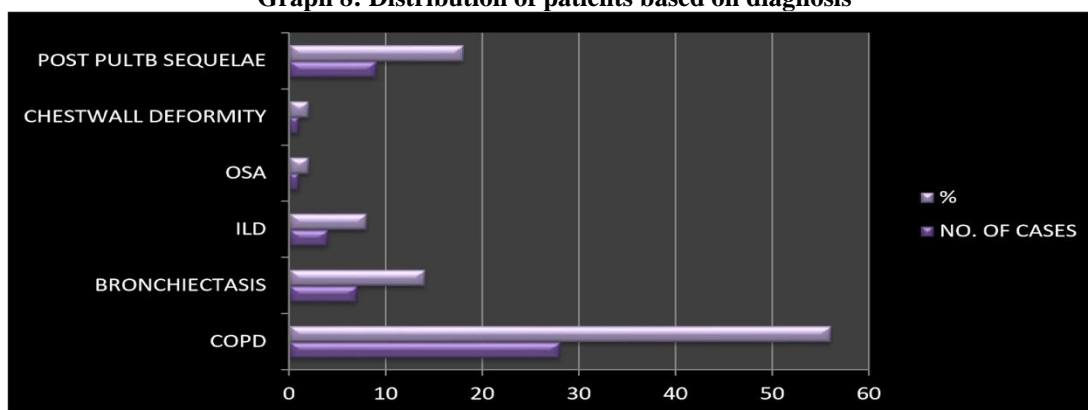


Table 8: Distribution of patients based on diagnosis

Diagnosis	No. Of cases	%
COPD with chronic bronchitis with or without emphysema	28	56%
Bronchiectasis	7	14%
ILD	4	8%
OSA	1	2%
Chest wall deformity	1	2%
Post PTB sequale	9	18%

Graph 8: Distribution of patients based on diagnosis



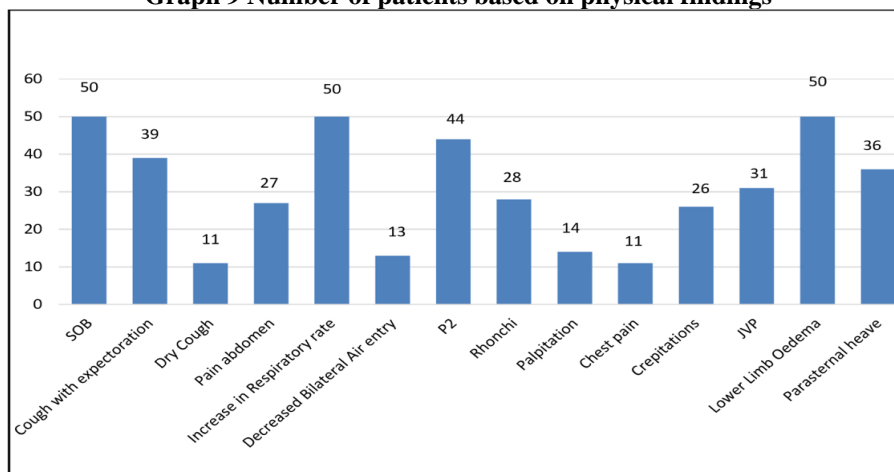
Among 50 patients majority of cases were COPD 28(56%) , followed by post TB sequelae 9(18%).

Table 9: Distribution of patients based on spirometry pattern

Spirometry abnormality	No. Of cases	Percentage
OBSTRUCTIVE	38	76%
Restrictive	12	24%

Most common spirometry pattern was obstructive type in 38(76%) patients

Graph 9 Number of patients based on physical findings



Among the Physical findings of the patients Shortness of Breath(SOB), Increased Respiratory rate, Lower limb Oedema were present in all patients, followed by Loud P2 in 86%. Cough with expectoration(78%) and presence of Parasternal Heave(72%) were next common findings. Dry cough(22%) and chest pain(22%) were the least complaints raised by Patients.

Mean duration of symptoms was found to be 5.60±3.27yrs

Table 11: showing the Distribution of patients according to Chest X-Ray Findings

	Frequency	Percentage
Emphysema	6	12%
Cardiomegaly	28	56%
Main pulmonary artery enlargement	26	52%
Tubular heart	9	18%
Increased bronchovascular markings	25	50%
Bronchiectasis	16	32%
Reticulonodular pattern	4	8%
Pulmonary tuberculosis sequale	14	28%

Most common finding on chest X ray observation was Cardiomegaly which is 56% next was Emphysema(40%) followed by Bronchiectasis(32%), main pulmonary artery enlargement was seen in 52% of cases, increased broncho vascular markings noted in 50% and reticulonodular Pattern only in 8%

II. Findings

Graph 11: showing the Distribution of patients according to Chest X-Ray

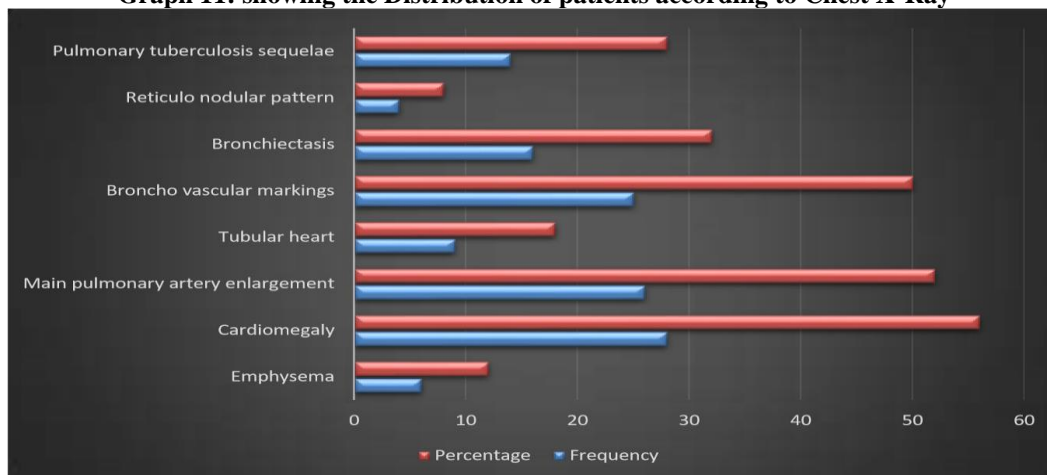


Table 12: Showing the distribution of patients according to ECG finding

Findings	Frequency	Percentage
Right axis deviation	29	58%
Low voltage complexes	17	34%
P pulmonale	36	72%
RBBB	12	24%
Right Ventricular hypertrophy	13	26%
Others	4+1	10%

Most of the patients i.e 36 patients on ECG investigation showed P- Pulmonale (72%), followed by right axis deviation 58% and RBBB(24%) and other minor changes(10%).

Graph 12: Showing the distribution of patients according to ECG findings

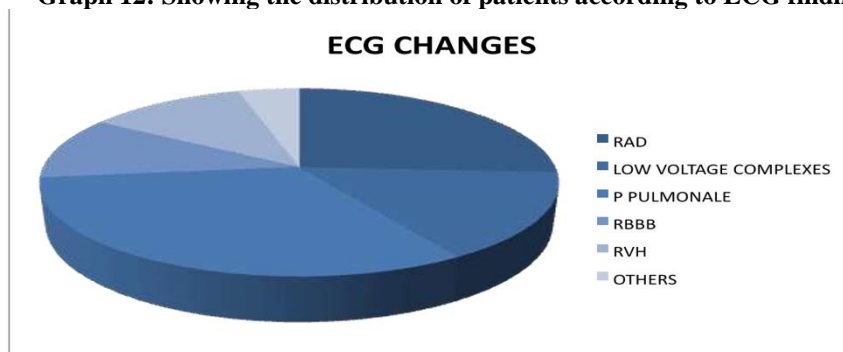


Table 13: Common 2decho finding seen in all patients

Findings	Frequency	Percentage
Right Ventricular dilatation	50	100%

Table 14: Distribution of patients according to severity of 2D ECHO changes

2D echo	Mild	Moderate	Severe
Tricuspid regurgitation	24	8	18
PAH	10	13	27
Right Ventricular dysfunction	20	10	20

On 2D ECHO right ventricular dilatation was present in all patients. And Tricuspid regurgitation was found to be severe in 18(36%), Moderate in 8 (16%) and Mild in 24(48%) of patients. Pulmonary artery Hypertension was found in 27(54%) of patients followed by Moderate in 13(26%) , Mild in 10 (20%) of patients.

patients Right Ventricular Dysfunction was found to be present severely in 20(40%), Moderately in 10(20%) and Mild in 20 (40%) of patients

V. Discussion:

Cor pulmonale is a consequence of COPD, a complication of tuberculosis, in addition numerous other lung conditions, and has a high rate of morbidity and mortality. CCP is understood to be the terrible, persistent, and eventually fatal human experience that frequently claims a significant portion of the life of the patient. Consequently, it represents a significant issue for public health and preventative medicine.(17)

PAH development has substantial prognostic ramifications because it is linked to decreased survival and greatly raises the likelihood of hospitalisation. (18)

For two reasons, it is challenging to determine the true prevalence of cor pulmonale.

First, not all individuals with persistent lung disease will develop cor pulmonale, and second, PAH and cor pulmonale are relatively difficult to diagnose by standard physical examination and laboratory tests.

The availability of echocardiography made it feasible to determine the intensity of PAH and RVH without using any invasive methods.

III. Factors Predisposing To Cor Pulmonale:

1. **SEX:** Males are more likely to get the illness because the most likely factor is smoking which is more typical in men.

2. **AGE :**More people experience cor pulmonale during the fourth and sixth decade because a persistently obstructed lung illnesses are more widespread in middle- aged and senior age groups. (7) .

3. **ATMOSPHERIC POLLUTION :** Pollution's effects can manifest as early as childhood. People have been characterised with an acute form of respiratory distress that resembles acute bronchitis and frequently progresses into a chronic form with prominent wheezing..

4. **TOBACCO SMOKING:** The most frequent factor linked to the CP is smoking. Chronic bronchitis mortality rates were discovered to be considerably greater in smokers than in non-smokers & to rise with cigarette consumption. Cough & expectoration are substantially more common among smokers, according to sample surveys in respiratory symptoms among the common people. Regardless of the criterion employed in these studies, chronic bronchitis has virtually always been limited to smokers.(19)

5. **OCCUPATION :** Workers who work in occupations that expose them to noxious gases or inorganic dusts are more probable to develop chronic obstructive pulmonary disorders.

6. **INFECTION :** Lebowitz and Burrows discovered a significant connection between poor respiratory health and previous history of respiratory disease in infancy or recurring respiratory infections in adulthood in a population survey in Arizona(20). In underdeveloped nations with poor socioeconomic conditions and inadequate medical care, it contributes considerably more to the growth of chronic lung disease..(20)

7. **GENETIC FACTORS:** Alpha-1 antitrypsin deficiency: Eriksson proved that this impairment is hereditary and connected to the early onset of lung illness. The development of COPD, when the chronic bronchitis component is predominate, has also been found to be highly correlated with genetic variants in human - defesin, an endogenous antimicrobial peptide in the airway.

The occurrence of PH correlates linearly with the intensity of COPD, and severe PH is usually always accompanied by cor pulmonale.(21)

8. **CHEST WALL ABNORMALITIES :** In scoliosis, the lobar shape is distorted due to the deformity, and the overall lung volume is decreased. The lungs also differ in size. If scoliosis has been present since a young age, alveolar numbers per acinus may correlate to the developmental stage. Alveolar size may vary. The pulmonary changes linked to substantial vascular medial hypertrophy in severe scoliosis that progresses to cor pulmonale are indistinct from the changes reported in other types of cor pulmonale. even in adolescents who are asymptomatic patients with scoliosis, volumes of lung are decreased in a restrictive pattern..

Lung compliance is frequently low in people with scoliosis, perhaps a sign of minor airway collapse brought on by inability to breathe deeply or sigh. The progression to right ventricular failure or PAH frequently takes place in the fourth decade in patients with a mid- or high-thoracic curve higher than around 100°.

VI. Limitations

Right heart catheterization remains the gold standard for the diagnosis of cor pulmonale which was not done.

VII. Summary

The goal of the study was to understand the aetiology and the clinical profile of chronic corpulmonale, including radiological characteristics, electrocardiographic alterations, and echocardiographic changes.

50 cases of chronic corpulmonale, of which 34 were males and 16 were females were included in the study.

The prevalence of chronic cor pulmonale peaked in the fourth and fifth decades and primarily affected middle-aged and elderly patients..

Smoking significantly contributes to the development and progression of the primary lung disease and, consequently, cor pulmonale. In the current survey, smokers made up to 54% of study population.

Cough, pedal edema, and abdominal pain were the predominant and frequent symptoms in relation to the breathlessness that were being presented. Symptoms lasted on average for 2 to 5 years for the majority of patients.

A thorough clinical examination was conducted to see whether there was any indication of a lung parenchymatous lesion and to confirm the diagnosis of cor pulmonale. 13 instances had bilateral bronchiectasis, 5 cases had kyphoscoliosis, 8 cases had ILD, and the other cases were chronic bronchitis with or without emphysema. Two cases had pulmonary tuberculosis sequelae..

Most common general physical findings were tachypnoea 100%, cyanosis 40% , clubbing 32% and raised jvp in 62% cases.

In each case, chest X-ray was performed. A chest X-ray revealed significant clinical profile information. Therefore, the changes included bronchiectasis (12%), chronic bronchitis (54%), with or without emphysema. 18% of patients had bilateral lung TB with fibrosis and/or compensatory emphysema. In one case (2%) there was a severe thoracic deformity together with kyphoscoliosis. Reticulo-nodular patterns in two (4%) of them were indicative of ILD. In other circumstances, a CT scan was required.

ECG varies between normal (only sinus tachycardia) to evidence of dominant right ventricular activity. The latter was evidenced by RVH (16%). Right Axis deviation (54%) RBBB (20%) and P – Pulmonale (28%). One case had ventricular ectopics.

Patients with shorter-duration symptoms responded to treatment more favourably than those with longer-duration symptoms..

2Decho showed signs of chronic cor pulmonale in all individuals. On comparison with ECG in the current investigation, echo thus proved to be a better diagnostic technique.

VIII. Conclusion :

Different clinical presentations and investigative findings from our study are almost comparable to those from earlier work by other researchers.

Clinical characteristics can be used to suspect cor pulmonale.

When compared to ECG, echocardiogram was determined to be a more effective diagnostic tool.

The major cause of chronic cor pulmonale in our study was found to be Chronic Obstructive Pulmonary Disease followed by bronchiectasis . Smoking formed the major and most important causal association in the present study.

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