Chronic Obstructive Pulmonary Heart Disease: Association with Clinical Ischemic Heart Disease and Left Ventricular Disease

By

S. FAZLULLAH M.B., FACCP., DTM & H.

INTRODUCTION

The characteristic features of cor pulmonale is hypertrophy of the right ventricle. Variable degree of right ventricular dilatation is also present but this is more difficult to evaluate. In case of right sided heart failure usually there is dilatation of the right ventricle and ocasionally hypertrophy of the right atrium.

Right ventricular hypertrophy in case of pulmonary emphysema has been demonstrated by weighing the chambers separately according to Muller method. Linear measurement of extent of the chamber reveals that hypertrophy begins first in the outflow tract of the right ventricle, i.e. anterior half of the chamber extending from the apex to the pulmonary arteries. Right ventricular hypertrophy eventually develops in 25-75% cases of pulmonary emphysema.

Remarkable observation is the frequent presence of left ventricular hypertrophy in autopsied cases of pulmonary emphysema in which hypertension, aortic lesion, coronary atherosclerosis and other causes of the left ventricular hypertrophy and cardiomyopathies had been excluded.

Hypertrophy of the left ventricle is less pronounced than the right ventricular hypertrophy.

A significant number of patients with COPD have coronary arterial disease (Steel et al. 1975 (22), Rees et al. 1964 (18). Steel et al. (1975) have shown that in both the stable and acutely decompensated patient with COPD, the presence of coronary artery disease may depress left ventricular function without clinical evidence for its presence. Ten of 14 patients with COPD who died in acute respiratory decompensation had extensive coronary artery disease at necropsy. It is important to know the role of coronary arterial disease in arrhythmogenesis in patients with obstructive disease of airway as this would have important therapeutic implications.

Flick and Block (1979) (10) confirm high occurrence of arrhythmias in patients with COPD and show that the arrhythmias often reach their maximum during sleep at a time the patients are apt to become most hypoxaemic. These clinical observations have been illustrated in the presented small study at P.S.P.C. Medial Centre.

Patients and methods:

12 cases of chronic obstructive pulmonary heart disease (COPD) were studied clinically at this Centre since past five years. All cases were investigated and followed regularly especially in winter months. They were x-rayed and their surface electrocardiogram were done bi-annually, blood haematocrit, blood lipids and biochemistry

P.S.P.C. Medical Centre, Jinnah Avenue, Malir Halt, Karachi-27.

(Cholesterol, Triglycerides, blood sugar, uric acid, creatinine, CPK) were done and their cardiac and pulmonary functional states were assessed clinically every year.

Three out 12 cases with COPD showed evidence of ischaemic heart disease without evidence of left ventricular involvement. One case showed left ventricular hypertrophy, ischaemic heart without hypertension, 2 cases had hypertension without left ventricular hypertrophy and one of these had ischaemic heart disease. Another case had diffuse interestitial pulmonary fibrosis and supraventricular tachycardia and bidirectional junctional tachycardia. One case had chronic interstitial pulmonary fibrosis, peripheral eosinophilia for years and terminally developed renal haematuria, hypotension, ischaemic heart disease, wide spread muscular dystrophy but no left ventricular involvement. Five cases had supraventricular tachycardia. Five cases had emphysematous lungs and another five had chronic bronchitis. None had hyperlipidaemia, diabetes, severe anaemia or myopathic diseases.

ILLUSTRATIVE CASES

Case-1:

A male fitter in PSPC Workshop aged 55 years was seen at this Medical Centre on 25th December, 1975 for Cough and Pyrexia (Winter bronchitis) breathlessness on exertion and during sleep with unproductive cough, peripheral oedema of the legs and localised retrosternal oppression on exertion for the past three weeks. Past history revealed Winter bronchitis since past few years.

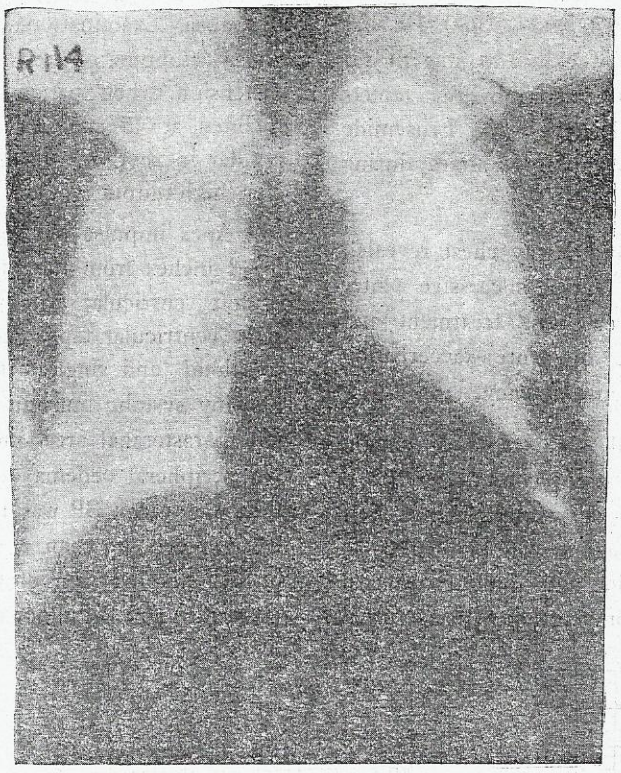
Examination during acute exaccerbation of respiratory insufficiency revealed no cyanosis or clubbing. His pulse was 120 p.m. regular in rhythm, full and bounding (high output type). B.P. was 155/95 mm. Hg. (Casual BP on 4-7-1975 was 140/80 mm.Hg) and there was no distension of the jugular veins in the neck. Peripheral oedema of the limbs was present. Respiration was 40 p.m. and temperature 100.F. Chest examination revealed widespread rhonchi and basal rales, apex impulse was of left ventricular type and located in the 5th intercostal space five and half inches from mind sternal line. The second sound was lound and single. A holo-systolic murmur was heard at left lower-para-sternal line, radiating to axilla.

X-Ray chest showed hypertransluscent upper and mid zones, with prominent left ventricle and right auricle (Fig. 1a). Electrocardiogram revealed P-pulmonale (3 mm) and left ventricular hyprtrophy (Fig. 1b). Blood count and electrolytes and serum enzyme were normal. Blood cholesterol was 204 mg/100 ml. Triglyceride, 120 mg/100 ml. uric acid 6.3 mg/100 ml and blood urea 24 mg/100 ml.

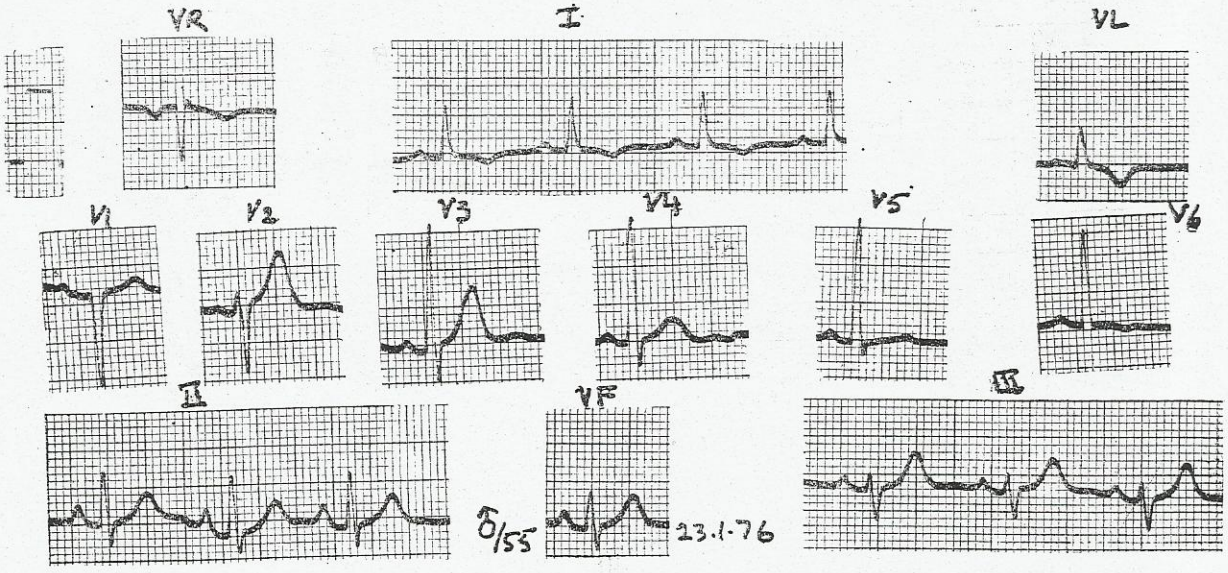
Acute exaccerbation of respiratory insufficiency associated with respiratory tract infection was diagnosed and he was given amino-phylline IV infusion supplemented with broad spectrum antibiotic and oral and parenteral diuretic (Frusemide). Within 30 minutes the symptoms subsided and subsequently he was put on antibiotic, Frusemide 40 mg. daily, Oral aminophylline and Salbutamol tablets for a week.

His BP came down to 145/85. He was put on weekly 40 mg. Frusemide, Salbutamol tablets 1 B.D. and aminophylline tablets 1 B.D. He was followed up weekly and his disease state was well controlled.

Fig. 1(*a*) →



↓ *Fig.* 1(*b*)



His BP on 28-1-1976 was 150/80. He was on Frusemide 40 mg. weekly and was fit for duty on 6-2-1976. On aminophylline tablets 1 B.D. and Salbutamol 1 B.D. and Frusemide 40 mg. weekly in intermittent courses during follow-up period.

Follow up ECG and X-ray chest revealed no appreciable change. During successive winter bronchitis he was given same treatment and showed improvement in his acute exaccerbation of chronic respiratory insufficiency.

11-1-1979 he had an attack of cough, pyrexia with temperature recorded at 102.F and acute exaccerbation of respiratory insu fficiency. At review examination on 11-6-1979, he was breathless on exertion with some retrosternal oppression at rest and on exertion with nocturnal dyspnoea. Examination showed no central cyanosis, clubbing of the fingers and jugular veins distension when patients was sitting up and inclined at 45 angle. He pulse was 120 p.m. regular in rhythm, full and bounding in character (high output type).

Apex impulse was located in the 5th space 5-1/2 inches from the midsternal line and was of left ventricular type with a left parasternal right ventricular tapp. Pulmonary second sound was loud and single with GIII SM and soft blowing systolic murmur was heard at the low left parasteranal area radiating to the axilla. No peripheral oedema of limbs was noted and skin was warm, BP was 150/80, x-ray chest and ECG showed no change, except inverted P-wave in VL, another sign of Cor Pulmonale (Wood 1968) (26) and P-Pulmonale in LII (3 mm), V3

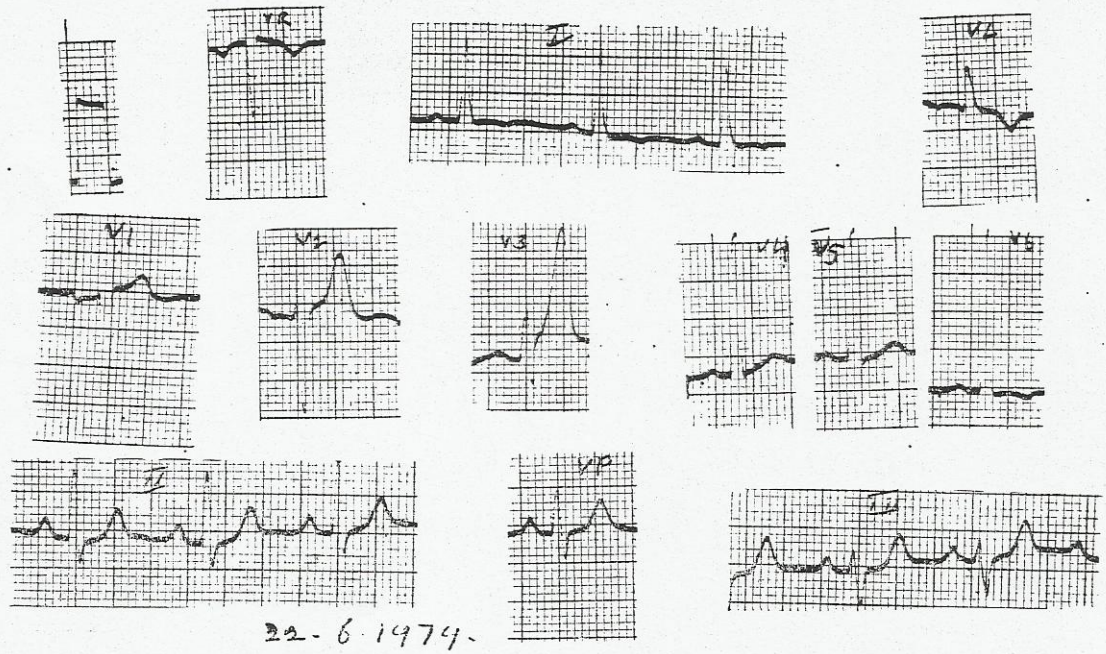


Fig. 1(*c*)

showed slurred QRS of 0.2 second RS pattern and tall peaked T wave of 15 mm, TV2 was 7 mm. (Fig. 1c). He responded well to Frusemide 40 mg. aminophylline orally and parenterally in intermittent courses with Isordil 5 mg. sublingually four times a day. As the patient was deaf it was difficult to elicit history from him.

Year	*Casual B.P.*	*B.P. during exaccerbation in Winter season*
1975	145/85 140/80	155/95
1976	140/80	150/80
1977	145/80 140/80	150/95
1978	145/80	150/95
1979	140/80	150/90

Table 1: Showing casual and exaccerbation B.P. in m.m. Hg.

COMMENTS

The patient was suffering from chronic bronchitis and emphysema and used to get acute exaccerbations during winter months following upper respiratory tract viral infection. During the actue exaccerbation his blood pressure was 10 m.m. up associated with tachycarida, salt and water retention. The sign and symptoms were well controlled by antibiotic, bronchodilators and diuretic. During acute episode of cardiorespiratory insufficiency there was no appreciable enlargement of the cardiac silhoeutte and subsequent regression following treatment as we clinicians usually observe in Winter season in cases of chronic obstructive Pulmonary disease (COPD) as observed especially in Western countries. There was an episodal rise of BP during exacerbation which fell down to casual reading following treatment. In this case there was a sustained progressive enlargement of the cardiac silhouette especially of the left ventricular type and this was maintained during five years follow-up with intermittent and sustained cardio-pulmonary insufficiency responding to broncho dilators and vasodilators.

Case-2:

Male aged 58 complained of productive cough, breathlessness with retrosternal oppression on exertion since past 5 years. His BP was 160/90, ECG showed absence of progressive R in the right ventricular chest leads with coving T-waves in VI-V6-VL and flat I in L1 suggestive of old anterior infarction with involvement of the lateral wall (Fig. 2), x-ray chest showed emphysema of the lungs and no cardiac enlargement.

Blood chemistry revealed fasting cholesterol 184 mg/100 ml, L.D.H. 500 Units, Triglycerides 90 mg/100 ml, blood sugar 81 mg/100 ml, Sodium 140 meq/L, Chloride 100/meq/L, HCO3, 25 meq/L. He was treated with broncho and coronary vasodi ator drugs with loop diuretic (frusemide) and anti-hypertensive drug (Methyldopa) supplemented with broad spectrum antibiotics in winter months and intermittent oxygen therapy.

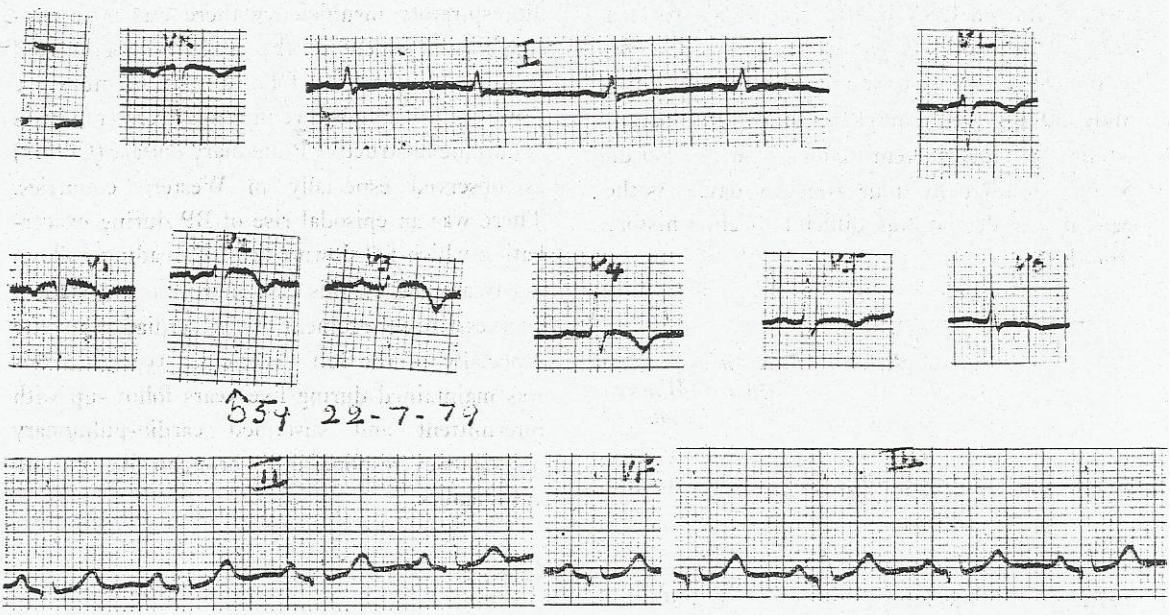


Fig. 2

Comments:

Inspite of COPD with hypoxia and evidence of ischaemic heart disease there was no evidence of left ventricular dysfunction. In stable but restricted patient of COPD, coronary artery disease may exist without clinical evidence of left ventricular dysfunction or angina due to restricted activity.

Case-3:

Female aged 70 complained of breathlessness at rest with wheezy chest since past 5 years. On 26-12-179 she developed rapid beating of heart with breathlessness. Her pulse was 150 p.m. E. C. G. showed sinus tachycardia and P-pulmonale (Tall peaked P wave of 3 mm height, Fig. 3a). X-Ray chest showed diffuse soft nodular shadow and some cardiac enlargement suggestive of acute pulmonary oedema with interstitial pulmonary fibrosis (Fig. 3b). Blood and sputum for acid fast bacilli and bacteriological examination were normal.

She was given Aminophylline IV, Digoxin 1 mg. IV, and oral digoxin 0.25 mg. T.I.D. for 3 days, Lasix 40 mg. and oxygen therapy with prompt improvement (Fig. 3c). On 29-12-1979 she developed bidirectional junctional tachycardia (Fig. 3d) Digoxin toxicity was suspected. Digoxin was withdrawn and Inderal 40 mg. orally was given. One hour later bidirectional tachycardia subsided. ECG showed T invertion in LII with rate of 100/min (Fig. 3e) and flat T wave on 6-1-1980. The patient suddenly died at home.

Comments:

The case was suffering from chronic interstitial pulmonary fibrosis (IPF) and developed

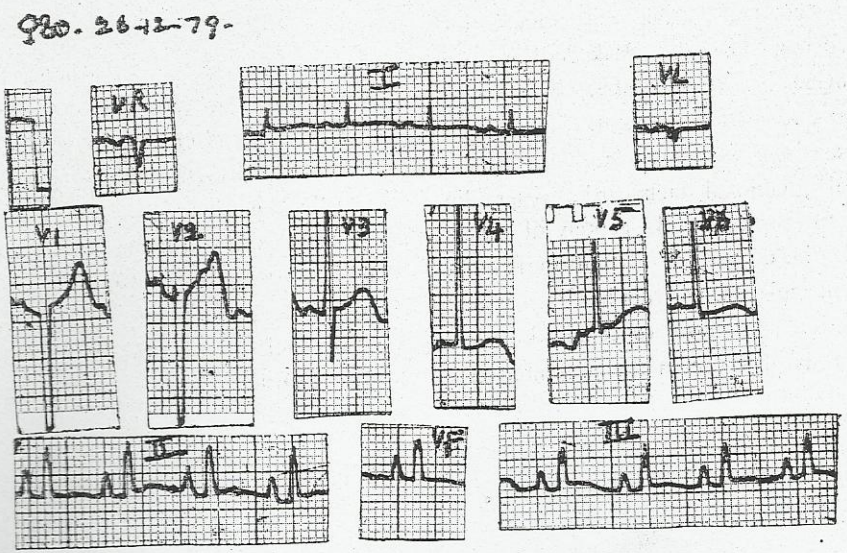


Fig. 3(*a*)

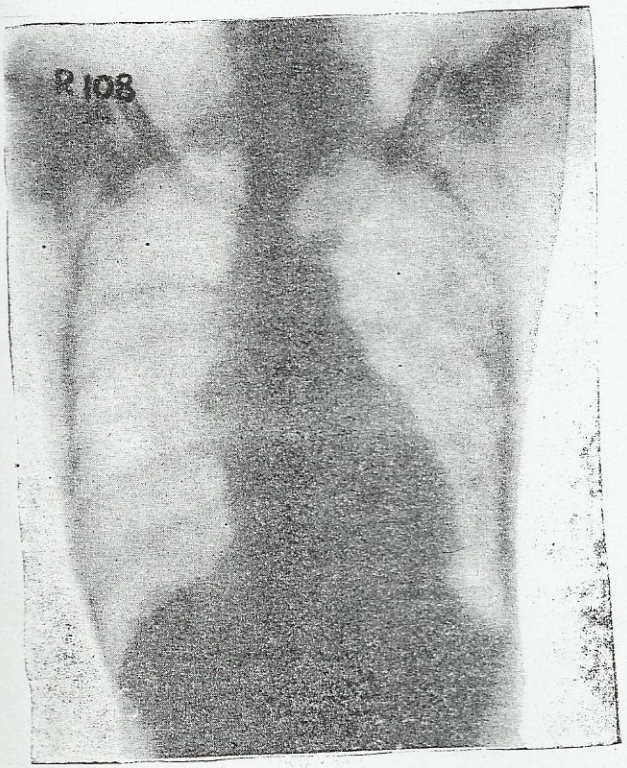


Fig. 3(*b*)

supraventricular tachycardia with acute pulmonary oedema. Tall and Peaked P wave in LII was suggestive of right atrial hypertension which improved with treatment. Such COPD cases are sensitive to digoxin and can develop bidirectional junctional tachycardia responding responding to propranolol. In acutely ill patients with COPD the occurrence of multifocal tachycardia or ventricular tachycardia has been associated with severe prognosis especially in severe cases of IPF as observed in the presented case.

Studies on cardiac monitoring in COPD have confirmed two suspicions. First atrial and ventricular arrhythmia are common among patients with COPD and secondly arrhythmias are often present among patients with severe COPD regardless of acute illness. Atrial and ventricular arrhythmias may occur with greater frequency in COPD cases than in patients with coronary artery disease (Hudson et al, Kleiger et al. 1974) (14,15) in cases with COPD.

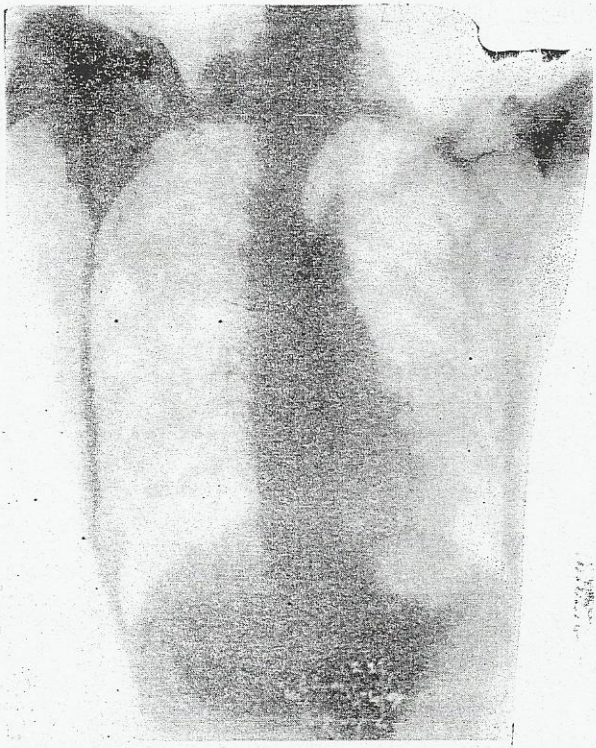


Fig. 3(c)

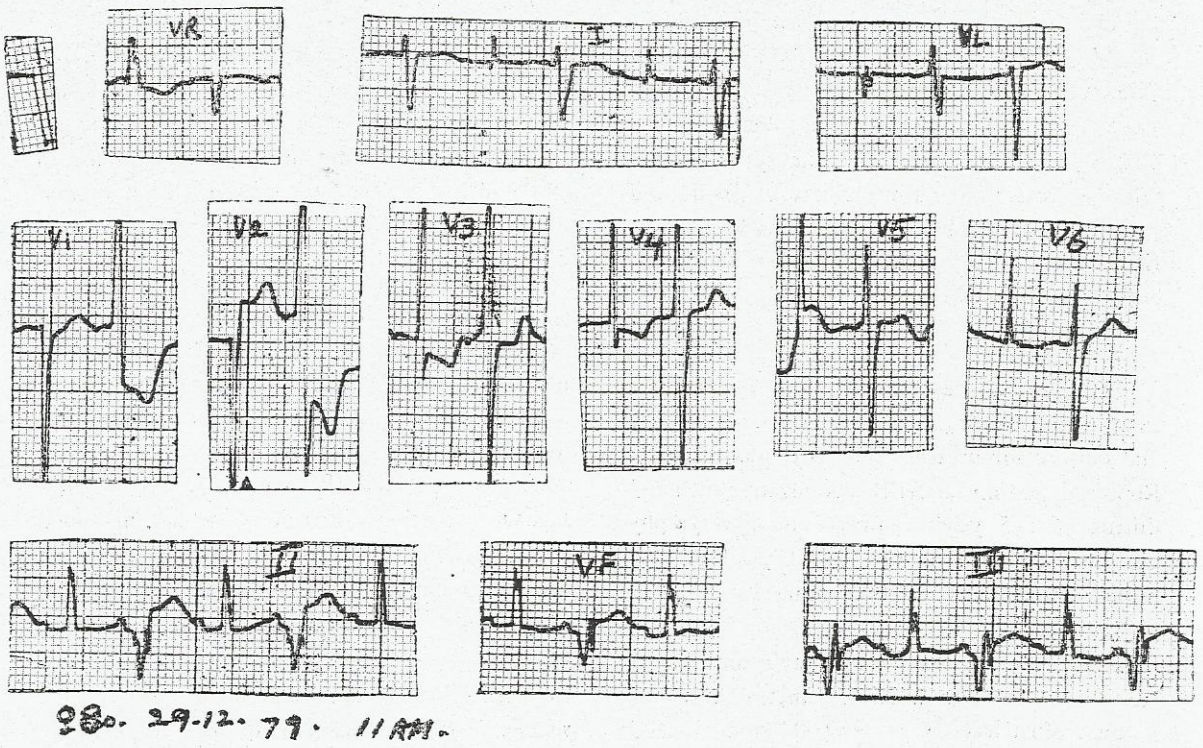


Fig. 3(*d*)

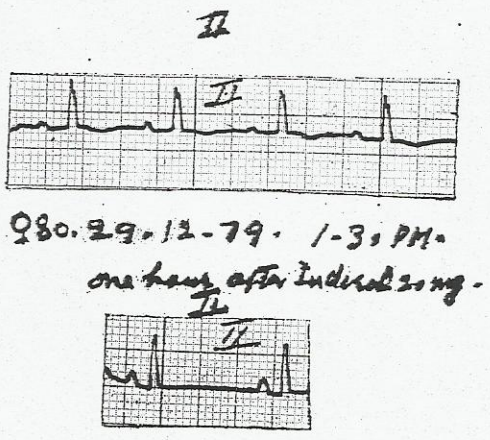


Fig. 3(*e*)

Case-4:

Male aged 50 used to complaint of breathlessness on exertion and on rest with wheezy chest since past five years and was treated as bronchial asthma with Salbutamol, Disodium Cromoglycate inhalation, aminophylline and intermittent steriod, Banocide and two courses of anti T.B. drugs without any appreciable improvements.

His peripheral eosinophilia varied from 60% to 20% since past 5 years. His x-ray chest showed extensive bilateral interstitial fibrosis (IPF) with persistent rales all over the chest on auscultation. Inspite of treatment his condition was gradually deteriorating.

On 21-1-1980 his BP was 100/70 mm.Hg. Persistent wide spread rales were heard on auscultation a characteristic sign for interstital pulmonary fibrosis. He was wheezy and breathless at rest all the time. X-ray chest showed wide spread interstital pulmonary fibrosis. ECG revealed right ventricular strain and ischaemic type changes (Fig. 4).

His urine was smoky and microscopic examination revealed numerous red cells only and culture for bacteria and AFB was negative. Repeated sputum for AFB was negative then and during past 5 years. Intravenous pyelography was normal. His Hb. was 12.2 G%, RBC 4.5 million/cmm, WBC 20,000/cmm. P. 80% L, 12%, Eos-8%. Rheumatoid factor was not present, ASOT was normal and antinuclear factor was not found. Liver function test was normal. Platelets were 210,000/cmm, blood urea 10 mg/100 ml, Serum creatinine 0.5 mg/100 ml., uric acid 4 8 mg/100 ml., 24 hours creatine clearance was 40, protein in urine for 24 hours was 240 mg in 600 urine volume in 24 hours. Investigations showed no renal involvement.

In view of above findings and involvement of multi-systems, immune complex disease was suspected and he was put on Prednisone 60 mg. per day. Synthetic ACTH—(long acting) 40 mg/weekly with antiboitics. His condition improved, haematuria cleared and his pulmonary function also improved and BP went up to 120/80 mm/Hg. On reduction of steroids to 40 mg. his blood pressure went down to 100/70 mm Hg. with recurrence of pulmonary-renal symptoms and his steroid dose was increased to keep him free of symptoms. Patients subsequently defaulted for further follow-up. Later on it was reported that he died in a hospital up north.

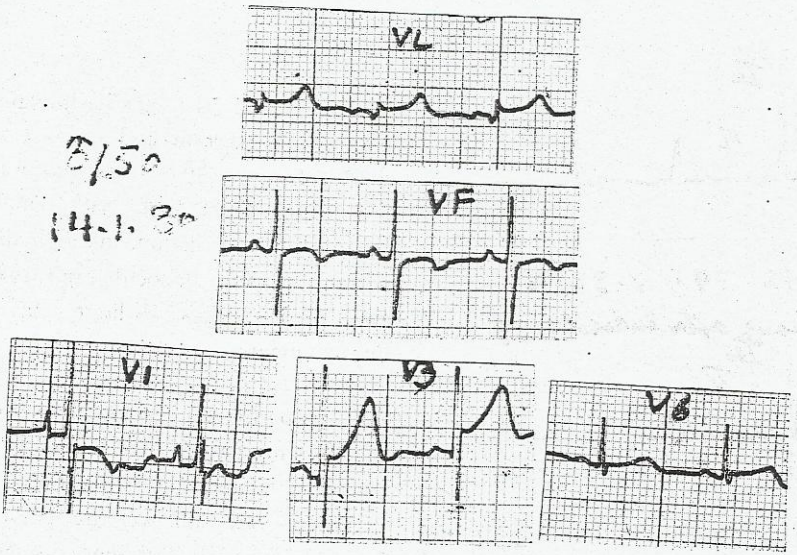


Fig. 4

Comments:

Recent studies show that the immune complexes and complement are present during the active prefibrotic stage of pulmonary interstitial disease but were infrequently present together in end-stage pulmonary fibrosis (Eisenberg et al 1970) (6) as possibly happend in this case causing renal vascular (capillaries and venules) damage, vaso-permeability changes giving rise to haematuria which was arrested by steroids. Immune complexes are present both in lungs as well in the blood stream in idiopathic pulmonary fibrosis according to recent studies by various workers (Ward 1979) (27).

Recently sera from patients with idiopathic pulmonary fibrosis have been shown to contain a complement fixing factor that binds to the surfaces of RAJI lymphocytes (Dreisin et al 1978) (5). This has been interpreted as clinical and therapeutic evidence for the presence of immune complexes both in the sera of the patient as well as in the lungs and kidneys.

DISCUSSION

There was no severe anaemia, hyperlipidaemia or sustained rise of blood pressure in Case No. 1 or valvular disease or myopathies to account for the left-ventricular hypertrophy except in some with coexisting ischaemic heart disease. Cardiac symptoms improved by diuretics and glyceryl trinitrate.

Aminophylline infusion, which is a bronchodilator, also has beneficial systemic haemodynamic effects as shown by the study of Parker et al. (1966) (17). In the state of acute exaccerbation they had observed that during aminophylline

Table II: Cardiovascular findings in 12 cases of COPD

S. No.	*Age*	*Sex*	*B.P.*	*E.C.G.*
1.	55	M	155/55	Left ventricular hypertrophy, P-Pulmonale (P2>3mm.)
2.	58	M	160/90	Absence of progressive-R on the right chest leads, coving T wave VI-V6-VL,Flat TLI.
3.	70	F	120/80	Supraventricular tachycardia, acute P-pulmonale (P2>3 mm.), leading to bidirectional junctional tachycardia and ischaemic changes.
4.	50	M	100/70	"Right ventricular" strain, ischaemic changes and supraventricular tachycardia.
5.	37	M	130/80	Normal
6.	30	M	149/00	Normal
7.	51	M	130/80	VL-T inverted—P=2.5 mm. inverted P-wave in VL.
8.	50	M	135/85	Supraventricular tachycardia. Ischaemic changes.
9.	60	M	140/85	Supraventricular tachycardia. Ischaemic changes.
10.	50	M	150/90	S.V. Tachycardia. Ischaemic changes.
11.	50	M	130/80	S.V. Tachycardia. Ischaemic changes.
12.	50	M	160/100	S.V. Tachycardia. Ischaemic changes.

infusion there was no decrease in the cardiac output, but there was significant fall in pulmonary artery pressure, in end-diastolic pressures of both the ventricles which were raised prior to the infusion resulting in significant improvement in function. That raises the possibility that a raised end-diastolic pressure of the left ventricular due to dysfunction might be a stimulant for the left ventricular hypertrophy. Although the actual cause of the left ventricular hypertrophy in association with COPD remains speculative, a possible explanation of the left ventricular dysfunction has been offered: Combinations of hypoxia, hypercapnia, acidosis, polycythaemia and low cardiac output are sufficient to cause left ventricular dysfunction (Fishman 1971) (7). Hypoxemia is perhaps the main cause of left ventricular hypertrophy (Fluck et al. 1966) (9). It is also claimed that blood gas abnormalities may have adverse effects on the myocardium and may account for the left ventricular hypertrophy in patient with pulmonary heart disease (Fluck et al. 1966) (9).

Recent studies show that left ventricular dysfunction in COPD is less common and when present is due to associated coronary artery disease (Steele et al 1975) (22). In 3 of the presented cases there was immediate improvement in chest discomfort and breathlessness by nitroglycerine suggestive but not diagnostic of coexisting ischaemic heart disease.

Significant number of patients with COPD have coronary artery disease (Steele et al. 1975 (22), Rees at al. 1964) (18). Steele et al. (1975) have shown that in both the stable and acutely decompensated patient with chronic pulmonary disease the presenec of coronary disease may depress left ventricular function without clinical evidence for its presence. Ten of 14 patients who died of acute respiratory insufficiency, had extensive coronary obstruction at necropsy. The trial of coronary vasodilator drugs and result of myocardial scintiscan help identify these cases.

Three of 12 cases of COPD under follow up study of the author had evidence of ischaemic heart disease. There was no recognized risk factor present to explain the cause of coronary artery disease. One of these had healed anterior cardiac infarction. One wonders about the role of COPD and its attendent problems in the genesis of ischemic heart disease in these patients.

Blood gas abnormalities affect the kidneys, haemopoietic system, peripheral circulation, the liver, heart and the lung vessels. Elevation of PCO_2 dilates blood vessels of the brain, raises CSF pressure causing headache, drowsiness and even papilloedema. Peripheral vasodilatation, warm skin and full bounding pulse is also due to CO_2 in cases of cor-pulmonale. If hypoxemia is relieved by high concentration of oxygen then CO_2 narcosis may supervene. Therefore judicous oxygen therapy is needed under careful monitoring of blood gas analysis.

The kidney is affected by renal vasoconstriction and altered tubular function (Aber et al. 1963) (1). The renal blood flow is reduced even when cardiac output is normal. In oedematous patients the low glomerular filteration rate alone seemed insufficient to account for the excess sodium and water retention. (Simpson (1948) (21) pointed the importance of direct effect of blood gas disturbances on the kidney in oedematous patients with normal cardiac output.

There is a possibility of a cycle: Hypoxia, adrenergic reaction, renal vasoconstriction, in assoication with increased aldosterone secretion, eventually salt and water retention and hypertension. These sequence of events might have occurred in one of the presented cases (case 1) giving rise to peripheral oedema and rise of BP due to salt and water rentention, responding promptly to loop diuretic frusemide.

During acute respiratory tract infection hypoxia is enhanced thus initiating this cycle. The frequency of granular and contracted kidneys in cases of pulmonary emphysema on necropsy suggests that there is a high incidence of hypertension among these cases. Similarly unrecognised paroxysmal hypertension or antecedent hypertension may be responsible for left ventricular hypertrophy. Arterial anoxemia and underlying coronary insufficiency may also be a contributing factor in this regard.

In cases of cor-pulmonale, pulmonary artery pressure rises sharply following chest infection, while in other cases in airway obstruction it rises steadily over the years. In some cases pulmonary hypertension is moderate (30-60 mm Hg. systolic pressure) in some pressure is normal at rest or only slightly raised.

Pulmonary hypertension in cor-pulmonale is due to anoxic vasoconstriction, destruction of pulmonary vascular bed and possibly to squeezing of the small lungs vessels by high intrathroacic pressure in obstructive airway disease. The radiological and autopsy evidence of extensive destruction of pulmonary vascular bed in emphysema is supported by postmortem angiogram (Dunhill 1961) (4) and also by angiogram in life, while in cases in whom bronchitis is a major lesion the vascular bed is relatively intact (Scarrow 1966) (20). Fletcher (1963) (8) had shown that pure bronchitics made a good recovery from congestive heart failure, whereas patients with pure emphysema made a poor recovery and failure tended to be progressive as shown in two of the presented cases.

Postmortem angiogram show that small muscular arteries curving round emphysematous spaces would be vulnerable to high extramural pressure (Dunhill 1961) (4). This extra mural pressure is reflected in raised "pulmonary capillary" wedge pressure. There could be a reactive pulmonary vasoconstriction in response to raised wedge pressures. Thus raised intrathoracic pressure could cause reactive and passive pulmonary hypertension. The reversibility of pulmonary hypertension in Cor Pulmonale reflects the importance of vasoconstriction when chest infection and anoxia precipitate congestive failure. The pulmonary artery pressure is raised and falls to normal when patients recover.

Many patients with COPD have frequent and prolong episodes of hypoxemia during sleep. These may be nocturnal or may occur during day time naps. Recently Boysen et al. (1979) (2) have studied the effects of hypoxemic episodes on the pulmonary vasculature. They observed nocturnal episodes of desaturation of arterial oxygen accompanied by elevations in the pulmonary artery pressure. Low flow oxygen abolished the drops in arterial oxygen saturation and the elevation in pulmonary artery pressure. They postualted that in some COPD patients these initial transient events may lead to Cor-Pulmonale and sustained pulmonary hypertension. Cor-Pulmonale patients with COPD may initially desturate only at night. Episodic pulmonary hypertension will occur and then reverse

when saturation returns to baseline. In the awake state patient would remain well saturated with no evidence of haemodynamic abnormalities, but these transient episodes of pulmonary hypertension might eventually become irreversible and cor-pulmonale will eventually result. Noctural oxygen therapy may be indicated in these patients to avoid transient pulmonary hypertension. Oxygen therapy for 15 hours (including sleep) has been shown to reverse established pulmonary hypertension (Legett et al. 1976) (16). Nocturnal oxygen therapy may prevent the development of cor pulmonale if given earlier in the natural history of COPD at a time when desturation is present only during sleep (Boysen et al. 1979) (2).

Both atrial and ventricular arrhythmia may occur with episode of hypoxemia with or without hypercapnia. Rapid decrease in arterial PCO_2 during ventilatory therapy are frequently associated with alarming "arrhythmia". Although arrhythmias have been attributed to "blood gases", but, one study has described microscopic changes in sinus nodes in 25 of 30 patients of chronic Cor-pulmonale. (Thomas and Wee, 1978) (23). Supra-Ventricular arrhythmias were noted in the presented seven out of 12 cases.

Extrasystoles of atrial, junctional and ventricular or multifocal origin are often seen. Supraventricular tachycardia are not uncommon, atrial flutter and fibrillation are occasionally seen. Paroxysmal atrial tachycardial without block is often seen, while it may be a manifestation of digitalis toxicity to which these patients are sensitive, it may also occur in patients who have not had digitalis. Digitalis and diuretics have played a minor role in the management of heart disease related to COPD although these drugs may be beneficial. In the presented series one case had junctional bidirectional tachycarida under modest therapeutic dose of digoxin suggesting of digoxin sensitivity.

Recent evidence suggests that therapy with the "loop" diuretics may aid in reducing pulmonary hypertension in COPD but not primarily as a result of their diuretic effect (Heinemann 1978) (12). Instead these drugs may help by relaxing peripheral vascular tone and favouring redistributing of blood away from pulmonary circulation.

Flick and Block (1979) (10), using E.C.G. monitoring, studied relationship of arrhythmia to COPD and found that arrhythmias were more common at night and their frequency tended to peak during early morning hours. Their data suggest that arterial desaturation may be responsible for some of these arrhythmias. Arrhythmias often reach their maximum during sleep, a time when the patients are apt to be most hypoxemic. Holford and Mithaefer (1973) (13) have also observed similar relationship. There is a possibility of benefit from oxygen therapy with supplemented oxygen at a low rate of flow during night in patients with COPD to avert arrhythmia during sleep and monitoring may be indicated to evaluate the desirability of their receiving therapy with supplemented oxygen throughout night.

The role of coronary artery disease in chronic obstructive airways diaease in arrhythmogenesis deserves further emphasis and the use of vasodilator drugs is a new method that may be applied to this area as has been done in the presented cases. The use of vasodilators in the presented cases in combination with diuretic Frusemide was

much more beneficial to the patient not only in keeping him active at this job but also halted the further deterioration in his cardiac function.

A mass of knowledge has accumulated as to what happens at the cellular level. Pulmonary dysfunction in COPD may initiate atherosclerosis by hypoxia as anaerobic glycolysis may not be able to generate enough energy for the proper function of "sodium pump" resulting in cell swelling and leading to increase permeability of swollen cell membrane and leakage of cholesterol into subendothelial region. The breach of endothelium may cause platelet adhesiveness and aggregation and clotting mechanisms come into play. Normal lungs inactivate thirty percent of norepinephrine and are also rich source of heparin and plasmin. Diseased lungs cause altered levels and disturb the clotting mechanism. Hypoxia being a biochemical stress may enhance catecholamine production which may further aggravate platelet adhesiveness plus lead to hyperlipidaemia and hypertension. Thus hypoxia in COPD may initiate the process leading to coronary artery disease, catechnolamine cardiomyopathy, genesis of arrhythmia and pulmonary hypertension. Impaired sodium pump due to hypoxia may cause myocardial dilatation as well as stimulus for hypertrophy.

SUMMARY

12 cases of chronic obstructive pulmonary disease (pulmonary emphysema 5, chronic bronchitic 5 and pulmonary interstitial fibrosis 2) have been described. One case presented an unusual feature of left ventricular hypertrophy associated with angina pectoris without hypertension, 2 cases had hypertension without left ventricular hypertrophy, three cases showed underlying ischaemic heart disease, five had associated supraventricular tachycardia and one junctional tachycardia. Hypoxia has been suggested in the literature as a most likely mechanism in the initiation of coronary artery disease, arrhythmogenesis, left ventricular hypertrophy and pulmonary hypertension. Experimentally, hypoxia initiates the dysfunction of "sodium pump" mechanism leading to swollen cells of myocardium and endothelial cells damage and deposition of cholesterol on the surface of damaged endothelial cells. Anaerobic glycolysis produces very low energy which is insufficient for the metabolism of cells. Hypoxia may further enhance production of catecholamines initiating systemic hypertension and catecholamine cardiomyopathy.

REFERENCES

1. Aber GM, Balyey TJ, Bishop JM: Interrelationships between renal and cardiac function and respiratory gas exchange in obstructive airways disease. Clin—Sci. 25:159, 1963.
2. Boysen PG, Block AJ, Wynne JW, et al: Nocturnal pulmonary hypertension in patient with chronic obstructive pulmonary disease. Chest 76:542, 1979.
3. Campbell EJ: Respiratory failure. Brit Med J.I: 1451, 1965.
4. Dunhill MS: An assessment of the anatomical factor in Cor pulmonale in emphysema. J Clin Path. 14:246, 1961.
5. Dreisin RB. Schwarz MI, Theofilopoulos AN, et al: Circulating immune complexes in the idiopathic interstitial pneumonias. N Engl J Med. 298:353, 1978.

6. Eisenberg H, Simmon DH, Barnett EV: Diffuse pulmonary interstitial disease. An Immunohistological study, Chest. 75:262, 1979.
7. Fishmann AP: The left ventricle in chronic bronchitis and emphysema. New Engl J Med. 285:402, 1971.
8. Fletcher CM, Hugh P, McNicol MW, Pride NB: The diagnosis of emphysema in the presence of chronic bronchitis. Quart J Med 32:33, 1963.
9. Fluck DC, Chandrasekar RG, Gardner FV: Left ventricular hypertrophy in chronic bronchitis. Brit Heart J. 28:92, 1966.
10. Flick MR, Block AJ: Nocturnal vs diurnal arrhythmia in patients with chronic obstructive pulmonary disease. Chest. 75: 368, 1979.
11. Grant RP: Clinical electrocardiography: The spatial vector approach, P 134. New York Mcgraw-Hill Book Co. 1957.
12. Heinemann HO: Right-sided heart failure and the use of diuretics. Am J Med. 64:367, 1978.
13. Holford FD, Mithaefor JC: Cardiac arrhythmias in hospitalised patients with chronic obstructive pulmonary disease. Amer. Rev. Resp Dis. 108:879, 1973.
14. Hudson LD, Kurt TL, Petty et al: Arrhythmias associated with acute respiratory failure in chronic airways obstruction. Chest 63:661, 1973.
15. Kleiger RE, Senior RM: Long term electrocardiographic monitoring of ambulatory patients with chronic airway obstruction. Chest. 65:483, 1974.
16. Legett RJ, Cooke NJ, Clancy L, et al: Long term domiciliary oxygen therapy in cor pulmonale complicating chronic bronchitis and emphysema. Thorax. 31:414, 1976.
17. Parker JL, Kelkar K, West RO: Haemodynamic effects of aminophylline in Cor Pulmonale. Circulation. 33:17, 1968.
18. Rees HA, Thomas AJ, Rossiter C: The recognition of cornary heart disease in the presence of pulmonary disease. Brit Heart J. 26:233, 1964.
19. Rao BS, Cohn KE, et al: Left ventricular failure secondary to chronic pulmonary disease. Am J. Med. 45:229, 1968.
20. Scarrow GD: The pulmonary angiogram in chronic bronchitis and emphysema. Clin Radiol. 17:54, 1966.
21. Simpson T: Papilloedema in emphysema. Brit Med J. II: 639, 1948.
22. Steele P, Ellis JH, Vandyke D. et al: Left ventricular ejection fraction in severe chronic obstructive airways disease. Am J. Med. 59:21, 1975.
23. Thomas MA, Wee AST: The sinus node in Cor Pulmonale: referred by Feldman and Ingram in "the Heart" by Hurst et al, 4 th. edition, Mcgraw-Hill Book company 1968 P-1487-1494.
24. Turner-Warwick M, Doniach D: Autoantibody studies in interstitial pulmonary fibrosis Br. Med. J. 1:886-1965.
25. Westlake EK, Simpson T, Kaye M: Carbon dioxide narcosis in emphysema. Quart J Med. 24:155, 1955.
26. Wood P: Diseases of the heart and circulation. 3rd revised edition, Eyre and spottis woode London. P-991-997, 1968.
27. Ward PA: Immunological diseases of the lung. Chest. 75:258, 1979.