ORIGINAL

Echocardiographic Findings in Chronic Corpulmonale

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Abstract

M - mode & two dimensional findings in ten cases of Chronic Corpulmonale due to Chronic obstructive airway disease were studied. In M - mode, the findings were (1) visualisation of tricuspid valve in all phases of Cardiac Cycle(2)triangular Configuration of tricuspid valve (3) visualisation of pulmonary valve in all phases of Cardiac cycle (4) systolic notch in pulmonary valve (5) paradoxical motion of inter ventricular septum (6) prominient diastolic notch in interventricular septum. In two dimension, the findings were (a) right ventricular dilatation. (b) pulmonary artery dilatation. (c) right atrial dilatation (d) incomplete closure of tricuspid valve (e) deminished septal leaflet motion of tricuspid valve (f) two step relaxation of inter ventricular septum. The left ventricular function parameter study showed statistically significant decrease in (i) left ventricular internal diameter in diastole and (ii) left ventricular mass as compared to controls. The above findings are discussed.

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Introduction

Chronic obstructive airway disease is one of the major health problem of Nepal (Pandey, etal 1984) Many of these patients develop Chronic Corpulmonale. (Pandey etal 1984) In the present paper, echocardiographic findings in Chronic Corpulmonale have been described.

Material and Methods

Ten cases of Chronic obstructive airway disease with Chronic Corpulmonale were selected for study. There were 5 males and 5 females with age ranging from 35 years to 73 years. The following Criteria was used for diagnosis of Chronic obstructive airway disease with Chronic Corpulmonale:–

(1) History of Cough for at least three months a year for more than three years.

(2) Presence of dyspnoea.

(3) Presence of following X-ray Chest PA findings –

  (a) Cardiomegaly

  (b) lung findings "consistent with Chronic obstructive airway disease" as reported by radiologist

(4) Presence of at least two of the following ECG findings indicating right ventricular overload–

  (i) S_1Q_3 pattern

  (ii) Right axis deviation

  (iii) $S_1S_2S_3$ pattern

  (iv) R : S ratio in V_1 less than or equal to 1.0

  (v) Tall R wave in V_1 (R : S ratio more than 1.0)

  (vi) Tall peaked P waves (P Pulmonale) in L II, L III & avF

(5) Absence of other associated Cardiovascular disorder.

These were the cases attending out patient department or admitted to indoor at Tribhuvan University Teaching Hospital. Both M Mode and two dimensional echocardiography were done,Ten Controls, matched for age, sex, height & weight were also studied for comparision. Besides the study of abnormal echocardiographic findings in patients of Chronic Corpulmonale, their left ventricular function was also studied in detail. The following parameters, in relation to left ventricular function, were calculated from M – Mode recordings obtained in a poloroid film in Chronic Corpulmonale cases as well as in contral cases:—

1. Left ventricular internal diameter in end diastole and in systole.
2. Left ventricular end diastolic volume and systolic volume
3. Stroke volume
4. Ejection fraction
5. Percentage shortening
6. Left ventricular mass

The following formula were used to calculate the above parameters—

$$\text{Diastolic volume} = \frac{7 \times \text{Diastolic diameter}^3}{2.4 + \text{Diastolic diameter}}$$ (Teichholz etal 1976;Kronik etal 1979)

$$\text{Systolic volume} = \frac{7 \times \text{Systolic diameter}^3}{2.4 + \text{Systolic diameter}}$$ (Teichholz etal 1976;Kronik etal 1979)

$$\text{Stroke volume} = \text{Diastolic volume} - \text{Systolic volume}$$

$$\text{Ejection fraction} = \frac{\text{Diastolic volume} - \text{Systolic volume}}{\text{Diastolic volume}} \times 100$$

$$\text{Percentage shortening} = \frac{\text{Diastolic diameter} - \text{Systolic diameter}}{\text{Diastolic diameter}} \times 100$$ (Feigenbaum 1976)

$$\text{Left ventricular mass} = 1.04 [(\text{Diastolic diameter} + \text{I V post wall thickness})^3 - \text{Diastolic diameter}^3] - 14$$ (Troy 1972)

Similarly, right ventricular diameter of chronic corpulmonale cases and the control cases were measured. Right ventricular diameter was recorded in the left lateral position, in the view which revealed the maximum deapth of that chamber.

Statistical analysis :

Statistical analysis of the data obtained was performed by the use of student 't' test

$$t = \frac{x_1 - x_2}{\sqrt{\frac{(SD_1)^2}{n1} + \frac{(SD_2)^2}{n2}}}$$

Where,

x_1 = Mean value of chronic corpulmonale cases.
x_2 = Mean value of control.
n1 = Number of chronic corpulmonale cases
n2 = Number of control.
SD1 = Standard deviation in chronic corpulmonale cases.
SD2 = Standard deviation in Control

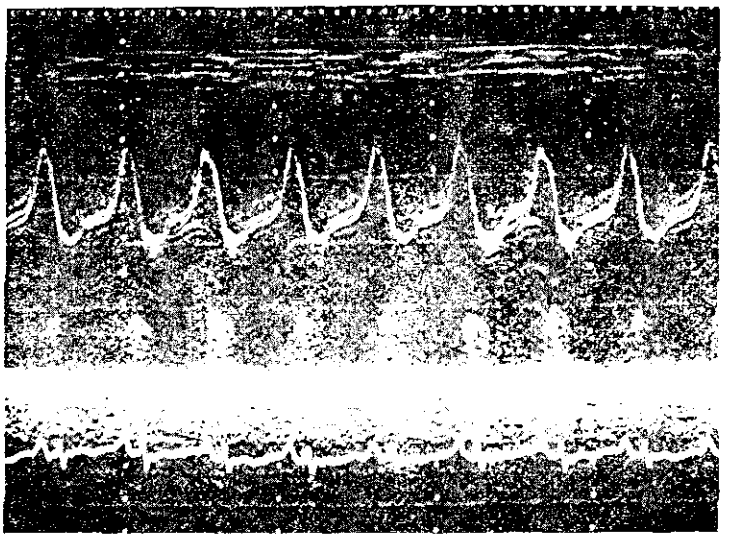
At 18 degree of freedom (Df = n1 + n2 - 2), P value of less than 0·05 was Considered statistically significant.

Observations

I Abnormal M-Mode Echocardiographic findings in Chronic Corpulmonale cases :

(A) Tricuspid valve was visualised in all phases of cardiac cycle. In was noted In five out of ten cases. (Figure 1)

(B) Tricuspid valve had triangular configuration. It was noted in 5 out of 10 cases. (Figure 1)



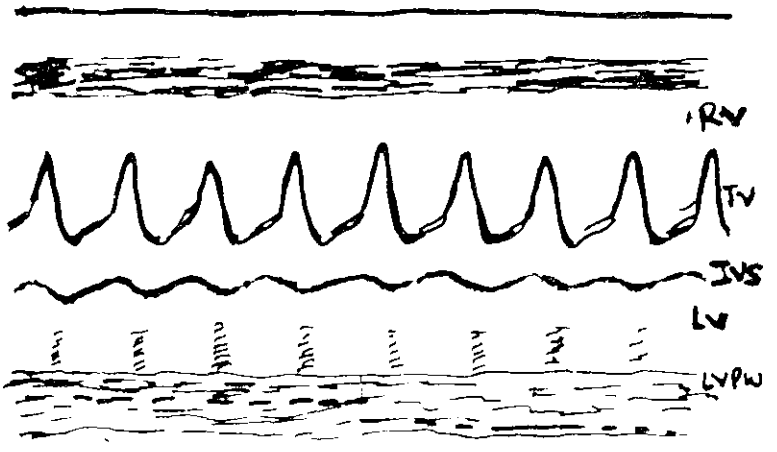


Figure 1:

(a) Tricuspid valve is visualised in all phases of cardiac cycle

(b) Tricuspid valve has triangular configuration

Rv = Right ventricle, Tv = Tricuspid valve

Ivs = Interventricular septum

Lv = Left ventricle, Lvpw = left ventricular post wall

(C) Pulmonary valve was visualised in all phases of cardiac cycle. It was noted in 4 out of 10 cases. (Figure 2)

(D) Systolic notch was noted in the pulmonary valve. It was noted in two out of ten cases. (Figure 2)

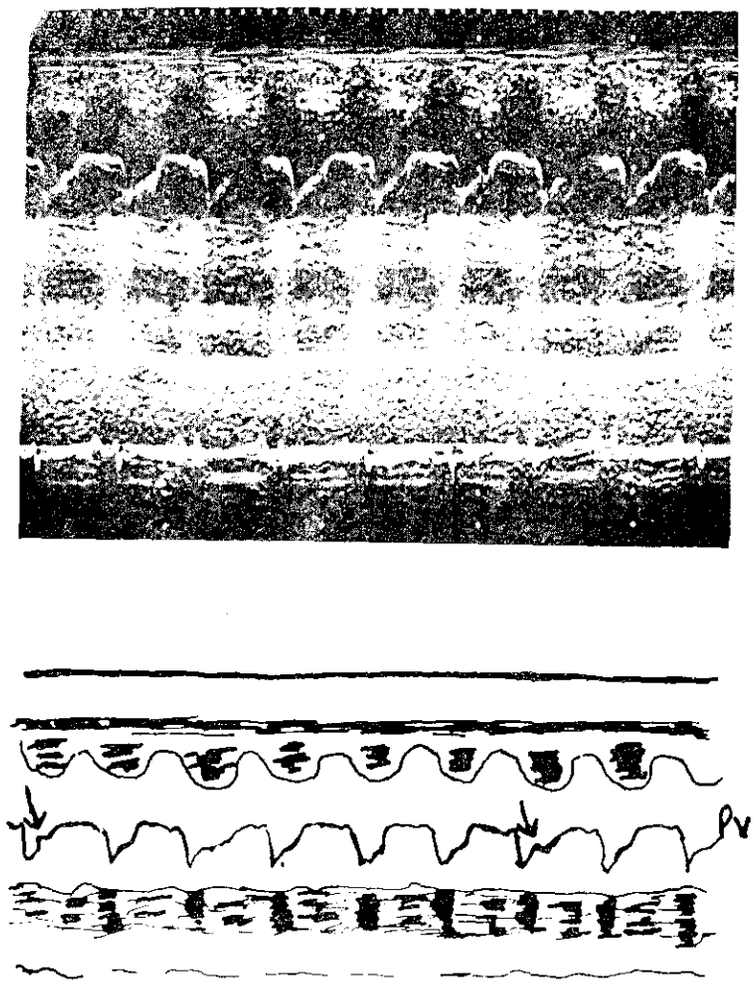


Figure 2:

(a) Pulmonary valve is visualised in all phases of cardiac cycle

(b) There is a systolic notch in the pulmonary valve as indicated by the arrows

Pv = Pulmonary value

↑ = Syslolic notch in pulmonary valve

(E) Paradoxical motion of inter ventricular septum was noted in two out of ten cases. Figure 3

(F) Diastolic notch in inter ventricular septum was noted in one out of ten cases. (Figure3)

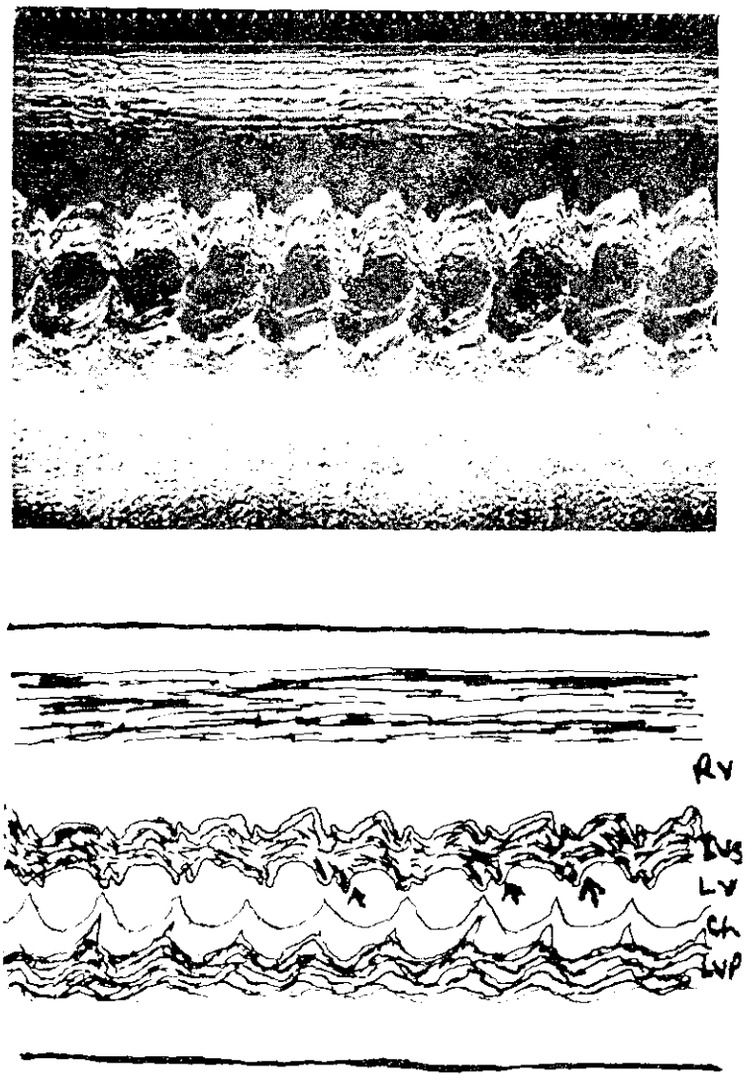


Figure 3: (a) Paradoxical motion of interventricular septum

(b) Diastolic notch in interventricular septum as indicated by the arrows

Rv = Right ventricle, lvs = Interventricular Septum
Lv = left ventricle Ch = Chordae
Lvpw = left ventricular post. wall
↑ = Diastolic notch in I. v. septum

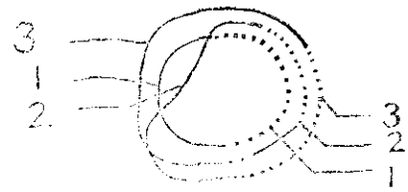


Figure 4

It shows two step relaxation of interventricular septum

1. begining of diastole: I.v. septum moves anterior
2. immediatly ofter onset of diastole: I.v. septum moves posteriorly
3. rest of diastole: I.v.septummoves remains anteriorly.

II Abnormal two dimensional Echocardiographic findings in chronic corpulmonale cases.

(a) Pulmonary artery dilatation – in two out of ten cases.
(b) Right ventricular dilatation in ten out of ten cases.
(c) Septal leaflet motion of tricuspid valve was noted to be diminished in one out of ten cases.
(d) Incomplete closure of tricuspid valve – in one out of ten cases.
(e) Two step relaxation of interventricular septum in two out of ten cases. (Figure 4)
(f) Right atrial dilatation in two out of ten cases.

III Table I Right ventricular diameter in control and chronic corpulmonale cases,

Serial number	Right ventricular diameter	
	Control	Ch. Corpulmonale
1	2.6	2.2
2	2.0	4.5
3	2.2	4.3
4	1.5	3.0
5	2.1	2.8
6	2.1	3.5
7	2.1	3.5
8	1.8	3.1
9	2.5	3.7
10	2.2	3.2
Mean	2.1	3.4
Standard Deviation	0.31	0.68
P value	Less than 0.05	

ır diameter in M-Mode

ɔntricular diameter was 3.4 cm ± 0.68 in chronic corpulmonale cases as right ventricular diameter of 2.1 cm ± 0.31 in control cases. Such a ɜtically significant(P value less than 0.05).It was an expected difference, ɱajor criteria to inclusion in the present study in chronic corpulmonale nce of cardiomegaly in x-ray chest.

ɜ Echo in M-Mode

de, usually, only the posterior cusp is recorded (Malergue etal 1977). r diastolic echo and atrial systole causes a small posterior motion just ɪning. As soon as right ventricular systole starts, the valve opens motion. Normally, this motion is seldom recorded throughout systole n our present study of chronic corpulmonale cases we were able to note ɪary valve throughout the cardiac cycle in four out of ten cases.(Figure 2)

ɹre or "notching" is a valuable sign for pulmonary hypertension (Shiina ɪtal 1974) Figure 2 shows systolic "notching". It was seen in two out of ɔrpulmonale in the present study, The explanation for the mid systolic valve with pulmonary hypertension is not yet clear (Tahara & Tanaka ıen present, it is one of the reliable sign of pulmonary hypertension 9). The biggest problem with this sign is that it is not always present

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Echo in M-Mode

ɜ appearances of tricuspid valve are limited to the recording of the early the anterior or septal leaflets (Feigenbaum 1975, Malergue etal 1977). o record them in all of diastole, its motion resembles that of mitral shaped (Schiller 1978). In situations' which give rise to elevated ɔolic pressure, no important findings in tricuspid valve echo has been ɾe. Where as, in conditions which give rise to elevated right ventricular ɔnormal closure of tricuspid valves in the form of delayed tricuspid A C interval) has been described (Feigenbaum 1981). In the present ɔulmonale cases,the tricuspid valve was seen throughout the full cardiac f ten cases (Figure 1), These tricuspid valves were triangular in ɜ 1). Thus, triangular configuration of tricuspid valve, which can be t the cardiac cycle seems to be one of the major finding in chronic- Chronic corpulmonale is a situiation where both systolic and diastolic d in the right ventricle at a stage when right ventricle dilates.

Pvalu

Interventricular septum Echo in M-Mode

Normally, in the M-Mode, the inter ventricular septum and the posterior wall of left ventricle is seen to move towards the left ventricular cavity during systole.But in situations where there is right ventricular volume overload, paradoxical septal motion may be seen, so that during systole, the septum moves anteriorly towards the right ventricle (Weyman etal 1975, Hayashida etal 1976, Kahasawa etal 1978) In the present study in chronic corpulmonale cases, such paradoxical motion of inter ventricular septum was seen in two out of ten cases (Figure 3).

Exaggerated diastolic notch in inter ventricular septum was noted in one out of ten cases of present corpulmonale cases (Figure 3). Such an exaggerated diastolic notch is again an indication of right ventricular overload (Weyman etal 1977).

Two dimensional Echo findings

Two dimensional ECHO study revealed right ventricular dilatation in all the present cases of chronic corpulmonale. Pulmonary artery & right ventricle were seen dilated in two out of ten cases. Such findings go in favour of long standing pulmonary hypertension. Incomplete closure of tricuspid valve was noted in one out of ten cases indicating the presence of tricuspid regurgitation in that case as a result of atrio ventricular ring dilatation. The same is true of diminshed septal leaflet motion of tricuspid valve seen in one of the present cases. One of the interesting finding noted in the present study was the fincing of two step relaxation of inter ventricular septum in two of the ten cases . During diastole the sequence of inter ventricular septum movement was as follows:- anterior motion-> posterior motion-> anterior motion (Figure 4). These were the cases who did not have paradoxical motion of inter ventricular septum.

Such kind of two step relaxation of inter ventricular septum has been described in cases of mirtal stenosis who had right ventricular overload (Weyman etal 1977, Weyman 1982). Such a motion has been demonstrated to result from an inequality in filling of the two ventricles during early diastole (Weyman etal 1977). The development of right ventricular overload in mitral stenosis is the result of pulmonary hypertension. In Chronic Corpulmonale cases also, the right ventricular overload is the result of pulmonary hypertension.It is possible that similar mechanism may be operating in both the situations.

Left ventricular function parameters

Left ventricular internal diameter diastole and left ventricular mass were significantly less (P value less than 0.05) in Chronic Corpulmonale cases, as compared to Controls (Table 1). There is right ventricular overload situation in Chronic Corpulmonale cases. The interventricular septum tends to move more leftward in such situations which might then effect the left ventricular internal diameter.

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