SUBJECTS AND METHODS

SUBJECTS AND METHODS

Subjects :

Since there were preliminary reports that indicated a high incidence of unsuspected mitral and aortic valve disease in small number of acute rheumatic patients without evidence of carditis ***(Folger et al., 1992).*** This study was conducted on 100 rheumatic patients. They were selected from children attending to Cairo University pediatric hospital. They were either coming with acute attack of rheumatic fever or coming for follow-up and two weekly prophylaxis. All patients had silent heart (no murmur).

* Exclusion criteria :

1- All cases coming with carditis were excluded from the study.

2- All cases coming with murmur were excluded as well.

50 normal children attending to Cairo University pediatric hospital outpatient clinic for a trivial illness or with their relatives, they were of matched age and sex with no history of rheumatic fever or chronic tonsillitis. Rheumatic patients were 41 males and 59 females. Control were 26 males and 24 females. The mean age of both studies groups was < 5-10+ years. Rheumatic patients were divided according to rheumatic activity into two main groups. Group I were 69 patients without evidence of rheumatic activity, they were coming for follow up and prophylaxis i.e. quiescent cases. 57 cases had past history of rheumatic arthritis and 12 cases with past history of rheumatic chorea. Group II were 31 patients they were coming with active rheumatic fever, 13 cases presented with arthritis and 18 cases presented with chorea. These active patient (31 cases) 11 cases of them presented with recurrent attack of rheumatic fever and 20 cases presented by acute first attack.

All patients with recent or previous attacks of rheumatic fever were subjected to the following steps.

1- Through history taken emphasizing the rheumatic fever history.

2- Complete physical examination including general examination with assessment of weight and height also vital signs were determined, blood pressure, pulse, temperature and respiratory rate. Finally local examination of the heart was done to exclude any clinical manifestations of heart lesions.

3- Routine blood picture, acute phase reactants (ESR, C-reactive protein) and evidence of preceding streptococcal infection (ASOT).

4- Twelve ECG leads to exclude chamber enlargement and to show signs of rheumatic activity.

5- Chest radiograph P-A and lateral views with barium swallow.
*Laboratory data, ECG and chest radiograph were done to active cases only but quiescent cases, these data were taken from their files.

6- Echocardiography [M-mode, 2-D, Doppler pulsed, continuous and colour coded Doppler).

Methods :

Echocardiography using Toshiba SSH-65A ultrasound phase array scanner with 2.5 or 3.5 MH transducer.

Patient preparation :

Assurance that the test is painless and involve no hazardous radiation to allay the fear of both the parent and the patients. Consideration must be given to optimize the position of the heart within the chest. Patients can be scanned best in the supine position or may be rotated to the left lateral decubitus. The patient's left arm should be tucked upward under the head so that it does not interfere with the transducer. The patient's right

arm lies along the right side of the table ***(Harrigan, 1991).*** All patients and control had been examined in the main five views i.e. parasternal long axis, short axis view (at the level of mitral valve and great vessels), apical four chambers view, right ventricular outflow tract view and subcostal view.

M-mode echocardiography :

Mitral valve serves as a constant reference point in M-mode examination of the heart with the transducer placed perpendicular to the chest wall in the third, fourth or fifth intercostal space along the left sternal border search for the mitral valve ***(Ansert, 1983).***

Echocardiographic measurements :

LV size : between edge of the left side of interventricular septum and edge of the endocardium at the level of papillary muscle. This dimension is measured in end diastole and end systole.

RV size : between leading edge of RV endocardium to the leading edge of right side of IVS.

IVS thickness : leading edge of endocardium to leading edge of epicardium during diastole.

Aorta : anterior mitral leaflet is seen blending with the posterior aortic wall echoes. The aortic cusps will appear within the two parallel echoes generated by aortic root ***(Ansert, 1983).***

LA : The area behind the posterior aortic wall represent the left atrial cavity. Which can be recognized by its immobile wall.

PA : is measured from 2-D short axis left parasternal view.

FS : (fractional shortening) is the difference between left ventricular end diastolic dimension and left ventricular end systolic dimension divided by end diastolic dimension X 100 ***(Quinones et al., 1978).*** Echocardiography

underestimates volumes calculation compared to other methods of volume calculation, but this error is concealed out in the ejection fraction calculation (EF) ***(Feigenbaum, 1986).***

EF : calculated from volumes measured on either 2-D or M-mode image.

EF = [EDV-ESV/EDV] X 100

SV = EDV - ESV

(Kan et al., 1981).

Two dimensional echocardiographic examination :

It had been done to children in short axis left parasternal image of left ventricle at the level of aortic valve, mitral valve and papillary muscle. Long axis left parasternal view delineate mitral valve, aortic valve and left ventricle. Apical four chambers to show atrioventricular valves and right ventricular outflow tract to show pulmonary valve. From the previous views, we studied anatomy, mobility and deformity of mitral apparatus (leaflet both anterior and posterior, annulus, chordae and papillary muscles), aortic valve, tricuspid valve and pulmonary valve.

Doppler examination :

The pulsed Doppler technique was used. The transducer was placed in long axis parasternal view at left atrium region and subaortic region were scanned. Mapping of the regurgitant jet into the left atrium. Mitral regurgitation was graded from 1+ mild to 4+ severe. Only retrograde flow occurring throughout systole was considered indicative of mitral regurgitation ***(Dang et al., 1987).***

As with mitral regurgitation, mapping of the location of the regurgitation jet into the left ventricle to estimate the degree of aortic regurgitation. Aortic regurgitation was trivial when signals were obtained

just proximal to the valve, mild when signals were located from the tip of mitral valve to the papillary muscle and was severewhen signals was obtained behind this point *(Yock et al., 1984)*. Pulmonic regurgitation was diagnosed as trivial or mild when retrograde signals were located 1.5cm or less in the right ventricular outflow tract. Significant regurgitation when signals were 1.5cm or more proximal to pulmonic valve in right ventricle *(Akasaka et al., 1987)*.

Colour Doppler echocardiography :

Colour Doppler examination was performed with the flow directed to the transducer was coded in red whereas flow directed away was coded in blue. If turbulence occurs, green is added to the red or blue underlying colour, thus changing the basic colour tonality which result in a mosaic pattern *(Miyatak et al., 1986)*. Mitral regurgitation was considered to be present if blue, green or mosaic signals were seen originating from mitral valve and spreading into the left atrium during sysole. We can estimate the degree of mitral regurgitation by mapping the size of regurgitant flow into left atrium.

* 1+ (mild : jet length < 1.5 cm.
* 2+ (moderate) : jet length ≥ 1.5 cm.
* 3+ (moderate to severe) jet length ≥ 3.0 and < 4.5 cm.
* 4+ (severe) jet length ≥ 4.5 cm.

(Sinder and Serwer, 1990).

Aortic regurgitation was considered to be present if red, yellow or mosaic signals were seen originating from the aortic valve and spreading into the left ventricle during diastole .

- Mild AR (1+) if jet is seen only in the left ventricular outflow tract.
- Moderate (2+) if jet extends to the tip of the anterior mitral leaflet.

- Severe (3+) if jet extends to the apex *(Logan, 1991).*

Pictures were obtained with polaroid camera placed in front of a colour television monitor.

Regurgitation fraction (RF) to mitral regurgitation :

Both flow mapping of regurgitant jets by pulsed Doppler echocardiography and planimetery of jet area by Doppler colour flow imaging in the left atrium during ventricular systole have been used to evaluate the degree of mitral regurgitation. These approaches however give semiquantitative rather than actual volumetric assessment of regurgitation *(Shah, 1989).* Pulsed Doppler used for measuring the regurgitant fraction based on the aortic and mitral flow *(Blumlein et al., 1986).*

Despite of satisfactory correlation between Doppler and haemodynamic results, the accuracy and reliability of measuring regurgitation remain uncertain. This is because mean flow velocity and mitral valve area are used to determine mitral inflow *(Tribouilloy et al., 1991).*

Method to calculate RF :

1- Mitral flow :

Mitral flow was obtained and quantified. First the mitral valve was imaged in the parasternal short axis view. A 2-D echocardiography guided M-mode of mitral valve was recorded at the same level. The mitral valve area was measured by tracing the inner edge of leaflet echoes from the frame showing maximal opening and mitral valve area was measured by planimetery *(Steele and Perez, 1986).* The time velocity integral was

obtained from the area under mitral (diastole) velocity profile was traced. The area under this curve was measured to yield the flow velocity integral in units of distance (cm). The mitral forward flow was then calculated from the product of mitral flow velocity integral, mean valve area and heart rate ***(Chen et al., 1991).***

Aortic outflow :

The diameter of the aortic annulus was determined in the left parasternal short axis proximal to the point of insertion of the aortic cusps. The aortic area was calculated by assuming a circular geometry. The aortic flow velocity was measured by continuous Doppler method in the apical view at the level of aortic annulus. The time velocity integral, a product of mean time velocity and ejection time was calculated by directly tracing the area above the instantaneous velocity curve on the screen. The aortic outflow was derived as the product of aortic surface area, flow velocity integral and heart rate ***(Lewis et al., 1984).***

Regurgitation fraction RF was calculated from standard formula

$$RF = \frac{\text{(mitral inflow - aortic outflow) x 100}}{\text{mitral inflow}}$$

RF was used in patients with valvular mitral regurgitation only without other valvular affection ***(Chen et al., 1991).***

STATISTICAL ANALYSIS

Data were collected, tabulated, coded and entered into a computer then analyzed.

Formulae used in statistical analysis of results were.

1- Arithmetic mean (x) :

$$X = \frac{\Sigma X}{n}$$

where : ΣX = sum of all observations.

n = number of observations.

2- Standard deviation (SD):

$$SD = \sqrt{\frac{\Sigma x2 - \frac{(\Sigma x)^2}{n}}{n-1}}$$

Where : Σx^2 = Sum of squares of each observation.

$(\Sigma x)^2$ = Square of the sum of all observations.

n = Number of observations.

3- The student's t-test :

Was used as a test of significance for comparison between two arithmetic means.

$$"t" = \frac{X_1 - X_2}{\sqrt{\frac{S2P}{n1} + \frac{S2P}{n2}}}$$

$$S_2P = \frac{S1^2 (n_1-1) + S^2 (n2-1)}{n_1 + n_2 - 2}$$

where :

S^2P = Pooled variance