

Cardiothoracic ratio and left heart valves regurgitation

Kardiyotorasik oran ve sol kalp kapak yetersizliği

Valvular heart disease is one of the most important heart disorders that causes heart failure in children and it can be congenital or acquired. Almost all acquired valvular heart diseases are rheumatic in origin. Mitral valve involvement occurs in about three quarters of all cases of rheumatic heart disease and aortic valve involvement in about one quarter (1). Mitral regurgitation (MR) is the most common valvular involvement in children with rheumatic heart disease and aortic regurgitation (AR) is less common. Apart from rheumatic heart disease, the major causes of MR and AR are infective endocarditis, collagen-vascular disease, cardiomyopathy, congenital heart disease and annular abnormalities (1). The left ventricle initially compensates in acute MR, in part by emptying more completely and in part by increasing preload, i.e., by use of the Frank-Starling principle. As regurgitation, particularly severe regurgitation, becomes chronic, the left ventricular end-diastolic volume increases and the end-systolic volume returns to normal (1).

Chest roentgenogram (CR) and echocardiographic examinations are essential parts of cardiac evaluation. Chest roentgenogram is often used to detect cardiac enlargement. Overall heart size can be evaluated from chest films in a variety of ways; two of the most popular ways are calculation of the cardiothoracic ratio from posteroanterior (PA) films alone, and determination of the total cardiac silhouette volume utilizing both PA and lateral projections (2). Two-dimensional and Doppler echocardiographic studies are useful for the measurement of left ventricular end-diastolic and end-systolic dimensions, volumes, shortening fraction, ejection fraction and mass (2). Furthermore, the echocardiogram may show thickening of the valve cusps, prolapse of the valve, a flail leaflet, vegetations or dilatation of the annulus (1).

On CR, cardiomegaly with left ventricular enlargement and, particularly, with left atrial enlargement, is a common finding in patients with chronic, severe MR (3). However, there is little correlation between left atrial size and pressure. Interstitial edema with Kerley B lines is frequently seen in patients with acute MR or progressive left ventricular failure. In patients with chronic, severe AR, the left ventricle gradually enlarges while the patient remains entirely or almost entirely asymptomatic (4). An enlarged heart on chest X-ray more reliably reflects a volume overload than a pressure overload (1). Cardiac size is a function of the duration and severity of regurgitation, and the state of the left ventricular function. In acute AR, there may be minimal cardiac enlargement, although marked enlargement is a common finding in chronic AR. Typically, the left ventricle enlarges in an inferior and leftward direction, causing a significant increase in the long axis but sometimes causing little or no increase in the transverse diameter of the heart (1).

It has been demonstrated that the traditional linear cardiothoracic ratio shows an inverse correlation with the left ventricular ejection fraction (5). Recent studies have shown the chest radiography to have a relatively high specificity in predicting cardiac enlargement on echocardiography (6).

Davidson et al. (7) demonstrated that, although there was good correlation between the radiographic total cardiac volume and echocardiographic ventricular volumes, especially for left-sided lesions in children, cardiothoracic ratio and cardiac frontal area did not correlate with echocardiographic measurements. However, Satou et al. (6) found that chest radiography has a limited ability to accurately detect cardiac enlargement in children referred to a pediatric cardiac clinic.

In the study published in the current issue of the *Anatolian Journal of Cardiology*, the cardiothoracic ratios of 107 patients with left heart valvular regurgitation were compared with left ventricular dimensions by echocardiography (8). Aortic regurgitation was detected in 39 patients: 13 had mild AR, 16 had moderate AR and 10 had severe AR. Further, increased cardiothoracic index (CTI) was detected in 5 patients who had severe AR on echocardiographic evaluation, and enlarged left ventricles were detected in 21 patients, of whom 1 had mild AR, 10 had moderate AR and 10 had severe AR. However, Lewis et al. (9) found a high correlation between radiographic cardiac frontal area and left ventricular end-diastolic volume in patients with pure aortic valve insufficiency.

In the study by Öztunç et al. (8), 68 patients who had pure MR were examined, and it was found that 17 had mild MR, 26 had moderate MR and 25 had severe MR. Increased CTI was detected in 10 patients: 6% had mild MR, 15% had moderate MR and 20% had severe MR. However, on echocardiographic examination, enlarged left ventricles were detected in 27 patients: 17% mild, 27% moderate and 68% severe. These results show that CTI is less reliable than echocardiography in showing cardiomegaly in patients with MR or AR. This study proved that chest X-ray is more reliable in patients with MR than in patients with AR, and CTI is not an indicator of the degree of left heart valve regurgitation.

In conclusion, rheumatic heart disease particularly affects left heart valves, and duration and severity of valvular insufficiency affects both echocardiographic and radiological cardiac dimensions. In addition, CR contributes to prognostic information, and two-dimensional and Doppler echocardiographic examination should also be performed.

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