OPTIMAL TIME FOR OPERATION IN AORTIC REGURGITATION

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SUMMARY

Echocardiographic data of adult patients with mild to severe (+2 to +4) Aortic regurgitation (AR) was retrieved from online data of the last 03 years. 900 patients were analysed. Mean age was $32 \pm 17.36$ years. Mean left ventricular end diastolic (LVED) dimension was $6.06 \pm 1.07$cm and End systolic diameter (LVES) was $4.37 \pm 1.08$ cm. LV end diastolic and end systolic diameters increased with severity of regurgitation and advancing age. LV End diastolic was $5.8$cm in patients with AR+2, $6.4$ cm in patients with AR+3, more than $7$ cm in patients with AR+4. Left ventricular function as estimated by fractional shortening (FS) was inversely proportional to LV end diastolic and systolic dimension. FS decreasing below 30% as LVED increased beyond 7 cm and LVES increase beyond 5.5cm ($p < 0.001$). LA size remained normal in a majority of patients and had no relationship with LVED, LVES dimension or FS. RV size did not correlate with any other parameter. LV wall thickness remained within normal limits. This testifies that LV in AR responds by dilatation in contrast to hypertrophy as in AS, as it confronts diastolic overloading. LVED of 7 cm and LVES of 5.5 should be considered as markers of severity of AR as LV function starts deteriorating beyond that. These dimensions may serve as guidelines while deciding about optimal timing of Aortic valve replacement.

INTRODUCTION

Response of left ventricle to regurgitant blood from aorta in chronic condition regardless of etiology follows a predictable path. Left ventricle initially dilates to accommodate the increased volume while preserving systolic function. In chronic aortic regurgitation left ventricular enlargement produces a large stroke volume that is entirely ejected into the aorta. Increased stroke volume increases pulse pressure
causing systolic hypertension which imposes increased, after load on the left ventricle. This haemodynamic burden increases left ventricular filling pressure and reduces compliance causing diastolic dysfunction. Left untreated this eventually leads to systolic dysfunction and left heart failure.\textsuperscript{14}

Basic haemodynamic questions regarding aortic regurgitation remain unanswered. At what stage does left ventricle start dilating, what determines the rate of progress and what causes deterioration of left ventricular function? When does pulmonary hypertension set in and right ventricle begins to dilate? How much left ventricular size increase with increasing regurgitation? Does left atrium dilate at any stage of progression of disease. Does left ventricular wall hypertrophy during progression of disease? Many such questions intrigue the minds of basic research workers.

Aortic valve should be ideally replaced before the impairment of function sets in. The decision to replace aortic valve is critical and has to be based on sound understanding of haemodynamics. Laying down of meticulous guideline for aortic valve replacement had been fraught with many confounding factors till late. Response of left ventricular wall thickness, dimension, and function to regurgitation presents an interesting interplay of different factors and physics principles.

This study was undertaken to analyse the effects of aortic regurgitation on various parameters as documented in echocardiography and to try to establish some criteria for optimal timing for aortic valve replacement.

**MATERIAL AND METHODS**

This is retrospective analysis of computer based data base of 900 adults patient undergoing M Mode, two dimensional and Doppler echocardiographic examination at cardiology department Postgraduate Medical Institute, Lady Reading Hospital, Peshawar. The study period started in 1997 and lasted for 05 years. All patients underwent detailed echocardiographic examination and parameters were entered on line. The data was analyzed for patients with aortic regurgitation ranging from mild to severe. These patients did not have significant aortic stenosis or other valvular involvement. The data so obtained was analyzed by SPSS 8.0 for windows Multivariable correlation was established between various parameters and subjected to statistical significance.

**RESULTS**

Total number of patients with pure aortic regurgitation in the data bank were 900. Different parameters were analysed and compared against each other. Mean age was 32±17.36 years, males were 63% and females were 37%.

a. Relationship between LV size and severity of regurgitation: Mean left ventricular end diastolic (LVED) dimension was 6.06 ± 1.07 cm and End systolic diameter (LVES) was 4.37 ± 1.08 cm. Left ventricular responds to diastolic overloading of regurgitation by increasing in size. LV size diastolic dimension for mild AR was 5.8 ± 1.07 cm and systolic dimension was 3.8±1.06 cm. As regurgitation increased to moderate LV diastolic dimension was 6.4 ± 1.08 cm and systolic dimension was 4.2 ± 1.04 cm. LV diastolic dimension increased beyond 7.00 ± 1.07 cm and systolic to 5.2 ± 1.04 cm as regurgitation increased to four plus.

b. Relationship between LV size and function: LV function was assessed by determining fractional shortening difference between systolic and diastolic dimension normalized for diastolic di-
mension. LV function started deteriorating as LV size increased beyond 7.0 cm diastolic and 5.5 cm systolic (p < 0.001). This is one of the most significant and important findings.

c. Relationship between LV wall thickness and LV size and severity of aortic regurgitation: LV wall thickness remained within normal limits regardless of LV size and severity of regurgitation.

d. Relationship between LA size and LV dimension and function.

LA size remained within normal limits and was not affected by either LV systolic/diastolic dimension or LV function.

e. Relationship between RV size and LV dimension and function.

No increase in RV size was documented in this series regardless of LV dimension or function.

**Discussion**

a. Our study offers a very robust database to study the effects of different parameters on each other and their correlation among themselves. All these patients were adults and they had no other significant obstructive or regurgitant lesions. Our study shows that when left ventricular end diastolic diameter increases beyond 7 cm and end systolic dimension increase more than 5.5 cm there is significant deterioration in left ventricular function as is evident by fall in fractional shortening. Surgical intervention is indicated before left ventricular function deteriorates. These end diastolic and end systolic dimension may be used as important markers beyond which left ventricular function starts deteriorating. There measurements are easy to derive and follow non invasively.

The indexes of preoperative left ventricular systolic function are valuable in identifying patients at low risk and at high risk for postoperative heart failure and death. Left ventricular systolic dysfunction is not always an irreversible process, because left ventricular function may improve and even normalize after surgery in a substantial fraction of patients.22 Preoperative left ventricular dysfunction is most likely to normalize in patients who are either asymptomatic or mildly symptomatic. Such patients undergo surgery without waiting for more advanced symptoms or deterioration of function. The studies of the natural history of asymptomatic aortic regurgitation inducible that symptoms, left ventricular dysfunction or both develop in approximately 4 percent of patients per year.23-25 If asymptomatic patients are followed carefully and undergo surgery only after development of symptoms or deterioration of left ventricular function the operative mortality is very low, left ventricular function improves in almost every patient and long term survival in excellent.

To conclude this study offers extensive information about haemodynamic in aortic regurgitation. It shows the interplay of various parameters as the disease progresses. This study helps us to identify the relationship between left ventricular dilation and deterioration of function. End diastolic diameters of 7.0 cm and end systolic diameter of 5.5 cm in asymptomatic patients of aortic regurgitation should be taken as upper limit beyond which left ventricular function deteriorates.

b. Echocardiography is indicated in patients with aortic regurgitation to confirm the presence and severity of AR, determine etiology of regurgitation, assess Left Ventricular hypertropy, dimen-
sion, and systolic function. It is helpful to re-evaluate patients with mild, moderate or severe regurgitation with minimal or changing symptoms. It is employed to evaluate LV size and function in asymptomatic patients with severe regurgitation. It is needed to re-evaluate enlarged aortic root in patients with mild, moderate or severe regurgitation. In patients with chronic severe aortic regurgitation, valve replacement is recommended in patients who are symptomatic with preserved systolic function, asymptomatic or symptomatic with mild to moderate LV dysfunction at rest (EF 0.25-0.49) or patients undergoing CABG or other heart valves surgery. It is also recommended, with a little divergence of views but the weight of evidence is in favour, in patients who are asymptomatic with normal LV systolic function (EF>0.50) but severe LV dilatation EDD > 75 mm or ESD >55mm.10-11

c. Echocardiography has been adopted as the main tool to evaluate patients with valvular heart problems. The main advantage being noninvasive and the ease of its application and reevaluation. This has been favourably compared against invasive techniques.12-14 With refinement in techniques and increase in experience non invasive assessment has taken over from invasive assessment. In a majority of cases non invasive assessment is sufficient and all important decision regarding management can be based on them. Various studies conducted in this scenario show very good correlation for most of the valvular lesions. Echocardiography coupled with doppler is the most useful examination offering most of the information. The information is easy to obtain reliable, reproducible and can be repeated as frequently as desired.15-17

d. Patient with moderate to severe aortic regurgitation may remain asymptomatic for a long time. Onset of symptoms may appear late in the course of disease. This may be too late for surgical intervention. Serial clinical and echocardiographic examinations at suitable intervals are recommended. Patients with deterioration left ventricular function or enlargement in left ventricular diastolic and systolic function can be identified and surgery can be offered in time.18-21

REFERENCES


