INTRODUCTION

As in mitral regurgitation, optimal timing of surgical intervention in aortic regurgitation remains challenging and controversial. Both conditions deal with volume overload, but in aortic regurgitation there is evident combined overload of volume and pressure imposed on the left ventricle. In aortic regurgitation forward cardiac output is maintained by an increase of the total stroke volume, an increase corresponding to the severity of regurgitation. This increase in total stroke volume is achieved by ventricular dilation. This increased stroke volume has to be ejected into the high impedance aorta leading to a left ventricular pressure overload as well. The left ventricle keeps end-systolic wall stress, a measure for left ventricular afterload, in the normal range by matching dilation with an increase in wall thickness. During progression of the disease, the degree of wall thickening fails to keep pace with left ventricular dilation and wall stress rises. At this time-point hemodynamic decompensation follows with as the first sign a fall in ejection performance related to this increased afterload. Therefore, after surgical correction meaning removal of this excess in afterload, ejection performance should normalize. However, continued overload can lead to depression of contractility and these patients are less likely to improve after surgical intervention.

In the asymptomatic patient, the challenge lies in appropriate timing of surgery in which the benefit of preserving contractile dysfunction has to be weighted against the risks of surgery and the possession of a valve prosthesis. Besides assessment of the cause and severity of the regurgitant lesion, for pre-operative evaluation, measurements of left ventricular function are pivotal since patients with chronic severe aortic regurgitation typically remain asymptomatic for extended periods of time and progression to contractile dysfunction may precede symptom onset.
ETIOLOGY OF AORTIC REGURGITATION

Echocardiography can provide reliable information on anatomy of the aortic valve and root and allows identification of the mechanism of regurgitation. Primary pathologic abnormalities of the aortic valve leaflets account for 2/3 of patients with chronic aortic regurgitation and dilation of the aortic root and a combination of valve and root abnormality for the other 1/3 of patients. Acute severe aortic regurgitation is most often caused by endocarditis, aortic dissection or trauma. For follow-up of patients with severe regurgitation, the etiology is of importance. For example, in aortic root disease surgical timing not only depends on the development of left ventricular changes due to chronic overload but also and in some patients moreover depends on rate and extent of root dilation. In Marfan’s syndrome the degree of aortic root dilation is an important clinical risk factor for dissection. The rate of progression of root dilation is variable and the root dimension should be related to age and body surface area. The aortic root ratio (= actual sinus dimension/predicted sinus dimension) can be used to identify in Marfan patients a lower risk group: when this ratio is less than 1.3 and the annual change in the ratio less than 5%, no complications occurred in this series of 89 consecutive patients.

Diseases as this, aortic root dilation, and bicuspid aortic valve tend to progress and lead to increase in regurgitant severity. These patients should be followed more closely for development of severe aortic regurgitation with sequelae for the left ventricle than patients with mild to moderate regurgitation caused by other etiology.

ASSESSMENT OF SEVERITY OF AORTIC REGURGITATION

Doppler and two-dimensional echocardiographic examination give, besides the anatomic information on the valve, also the parameters to quantify the severity of regurgitation. Furthermore, echocardiography provides precise and reproducible measures of left ventricular dimensions and function, the keystone in decision making for follow up and eventually for surgery. Color flow evaluation of regurgitant severity has become a standard clinical technique and is valid for differentiating minimal from moderate or severe regurgitation. Perhaps the most useful view for this purpose is the parasternal short axis view just on the ventricular side of the aortic leaflets: every trivial jet is noticed, multiple jets can be seen and the regurgitant area in relation to the outflowtract area can be estimated or measured. Semiquantitative grading of severity can be done with color flow Doppler, corresponding to the semiquantitative angiographic grading, as: grade 1+ : trivial or mild: color flow jet limited to the region immediately adjacent to valve closure, may not be seen at every beat (trivial), grade 2+ : mild to moderate: color flow jet filling up to one third of the left ventricle and seen on every beat, grade 3+ : moderate to severe: color flow reaching and filling up to two third of the left ventricle and seen on every beat, and grade 4+ : severe: color flow reaching the apex of the left ventricle and almost filling most of the ventricle, flow reversal present in the descending aorta. Grade 1+ and 2+ are usually considered as being less than surgical severity and grade 3+ and 4+ to be of surgical severity.