APPLICATION OF DOPPLER COLOR FLOW IMAGING TO DETERMINE VALVE AREA IN MITRAL STENOSIS

THESIS

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by

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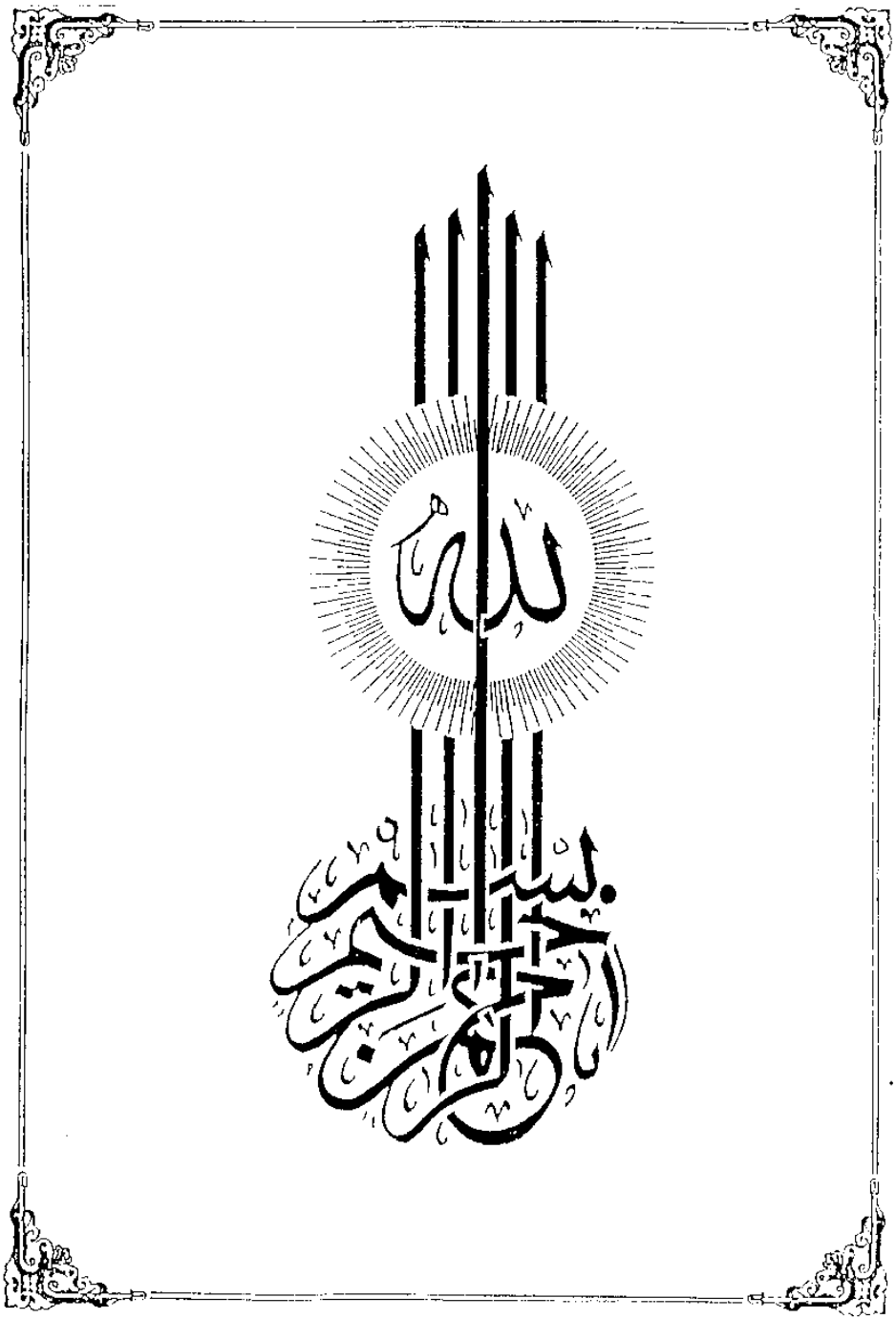
TO

MY PARENT



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INTRODUCTION
AND
AIM OF THE WORK

INTRODUCTION

Determination of mitral valve area is of clinical importance in assessing the severity of mitral stenosis because valve area is not altered in various hemodynamic conditions **(Braunwald, 1992).**

The evaluation and follow-up of patients with mitral stenosis require a reliable non invasive method for assessing mitral valve area.

Two-dimensional echo cardiography used to be the most widely used method for quantifying mitral valve area. However, when the mitral valve is extensively distorted or severely calcified accurate measurement of its area by this method may not be feasible. Moreover, two-dimensional echo cardiography is highly dependent on optimal technique both in achieving the proper gain settings and in locating the true mitral orifice in the short axis view **(Smith, 1986).**

Pressure half-time method proposed by **Hatle et al. (1977)** has also gained wide spread acceptance as a non invasive form of assessing mitral valve area. However, several reports have indicated that this method cannot accurately estimate the mitral valve area in the presence of aortic regurgitation and left ventricular dysfunction.

Recent investigation have demonstrated that Doppler color flow imaging allows estimation of the severity of the stenotic lesion and the size of the defect in cardiovascular

system **(Pollick, 1988).** Some reports have indicated the width of the central laminar core just at the orifice corresponds to the actual orifice diameter. Therefore, accurate measurement of the width of the color jet passing through the mitral valve orifice may provide quantitive assessment of the severity of mitral stenosis.

AIM OF THE STUDY :

The purpose of this study is to examine whether Doppler color flow imaging could provide an accurate estimate of the valve area in mitral stenosis.

REVIEW OF LITERATURE

ANATOMY AND PATHOLOGY

Robert in a relatively recent publication (1983) reviewed the anatomic findings in both the normally and abnormally functioning mitral valves.

*** The normal mitral valve :**

The mitral valve, is a complex structure consisting of 4 major components: leaflets, chordae tendineae, papillary muscles and annulus, the mitral valve consists of only 2 leaflets, the ant. one has a much longer basal-to- margin length than does the post. leaflet, but the length of the annular attachement of the post. leaflet, is about twice that of the ant. leaflet (about 3Cm).

Although the basal-to-margin lengths and the lengths of the basal attachements of each mitral leaflet are quite different, the surface area is virtually identical. The post. leaflet has a true bundle of fibrous tissue (the annulus) separating the myocardium of left atrium from the myocardium of left ventricle. The post leaflet, is simply an extension of mural endocardium From the Free walls of left atrium.

In contrast to the post. leaflet the ant. leaflet does not have a true annulus but is continuous with the wall of the ascending aorta, aortic valve, membranous ventricular septum, and atrial septum. The area of the

leaflets is about 2.5 times that of the area of the mitral orifice at the level of the mitral annulus.

In contrast to the semilunar cusps, which are independent or discontinuous of each other, the mitral leaflets are continuous with each other, being connected at the commissures. Chordae tendineae from both mitral leaflets insert into both papillary muscles. About 5 times as many chordae are attached to the leaflets as to the papillary muscles. On an average, 24 chordae tendineae are attached to the papillary muscles (12 to each), and 120 chordae are attached to the leaflets. The chordae insert into the under surfaces. That is, the ventricular surface of both leaflets. The chordae subdivide as they progress from papillary muscle to leaflet.

The subdivisions may be viewed as primary (first order), secondary (second order), and tertiary (third order) chordae. The spaces between the chordae serve as secondary orifices between LA and L.V. obviously the major orifice is the area between the leaflets, but much blood passes between the inter chordal spaces. Therefore fusion of chordae tendinae may narrow the mitral inlet.

The two left ventricular papillary muscles are preferably designated anterolateral and posteromedial. There is considerable variation in the appearance of these

structures in the same person, and comparison of corresponding structures in different people disclosed considerable variation.

The anterolateral papillary muscle is generally the more uniform of the two. It usually consists of a single trunk that protrudes more into the cavity than does the posteromedial one the posteromedial papillary muscle is generally smaller than the anterolateral structure and often consists of 2-3 smaller pillars than a large pillar. The posteromedial muscle usually has several connections to the left ventricular wall.

In addition to the base of the major trunk, both papillary muscles are attached to the left ventricular free wall roughly at the junction of the caudal third and middle thirds. **(Robert and Cohen, 1972).**

*** Pathology of rheumatic mitral stenosis and features of the stenotic mitral valve :**

Isolated M.S.,is with rare exception,always rheumatic in origin. The fact that rheumatic heart disease may be viewed as a disease of the mitral valve, other valves may be involved anatomically and functionally but the mitral valve is always anatomically involved. **(Virmany and Robert, 1977).**

Microscopically Aschoff bodies, the only pathognomonic lesion of rheumatic heart disease, have never been found in hearts without anatomic disease of the mitral valve, the functional lesion in large series of autopsies studied with Aschoff bodies found is usually mitral stenosis **(Virmany and Robert, 1977; Robert and Virmany, 1978).**

The healing of acute rheumatic endocarditis may results in mitral valve stenosis which was observed frequently in the young and middle aged with females showing a greater tendency to deformity of the mitral valve than males ratio of about 3:2 **(Gould, 1968).**

Calcium was present more frequently and in large quantities in men than in women, in older than in younger patients and in patients with higher pressure gradients between left atrium and left ventricles in diastole. An interesting finding was that calcification did not correlate with previous mitral commissurotomy **(Lachman and Roberts, 1978).**

A major complication of mitral stenosis is thrombus formation in the left atrial cavity. The thrombus may be limited to the left atrial appendage and body (left atrial body thrombus), recently new angiographic criteria of new coronary fistulous vessel formation draining the thrombosed LA was described **(Roca et al., 1988).**

Thrombi tend to occur usually in patients with severe M.S. and A.F, although it could occur in sinus rythm, thrombus appears to occur in the body of the left atrium only in patients with M.S, and A.F without M.S is incapable of forming a thrombus in the left atrial body,embolism from this LA thrombi sometimes occur, recently behavioral disturbances in the setting of mitral stenosis were found predictive of embolic events **(Frisbic, 1986).**

Keren et al., 1987 analysed the factors responsible for L.A dilatation in 155 subjects with M.S and found that the severity of M.S accounted for 38% and age for 7% and A.F of 11% of the change in the size of the L.A analysis done by multiple regression equation suggests that the onset of L.A dilatation in M.S is the result of an early increase in L.A pressure, while A.F which develops irrespective to the severity of M.S contributes to a further enlargement in L.A and right atrial size.

Normal A.V filling occurs with a valve area of 3 cm^2 mildest M.S is with valve area 2.3 Cm^2 mild M.S. with valve area between 1.4 and 2 Cm^2 moderate M.S. valve area 0.9-1.4 Cm^2 and tight M.S valve area less than, 9 cm^2. **(Selzer and Cohn, 1978).**

Interesting observation which termed physiologic-anatomic dissociation of mitral stenosis where the degree of apparent valve narrowing as evidenced clinically and