ASSESSMENT OF LEFT-TO-RIGHT ATRIAL SHUNTING AFTER PERCUTANEOUS MITRAL VALVULOPLASTY BY TRANSESOPHAGEAL COLOR DOPPLER FLOW-MAPPING

Thesis submitted for partial fulfilment

of the master degree of cardiology

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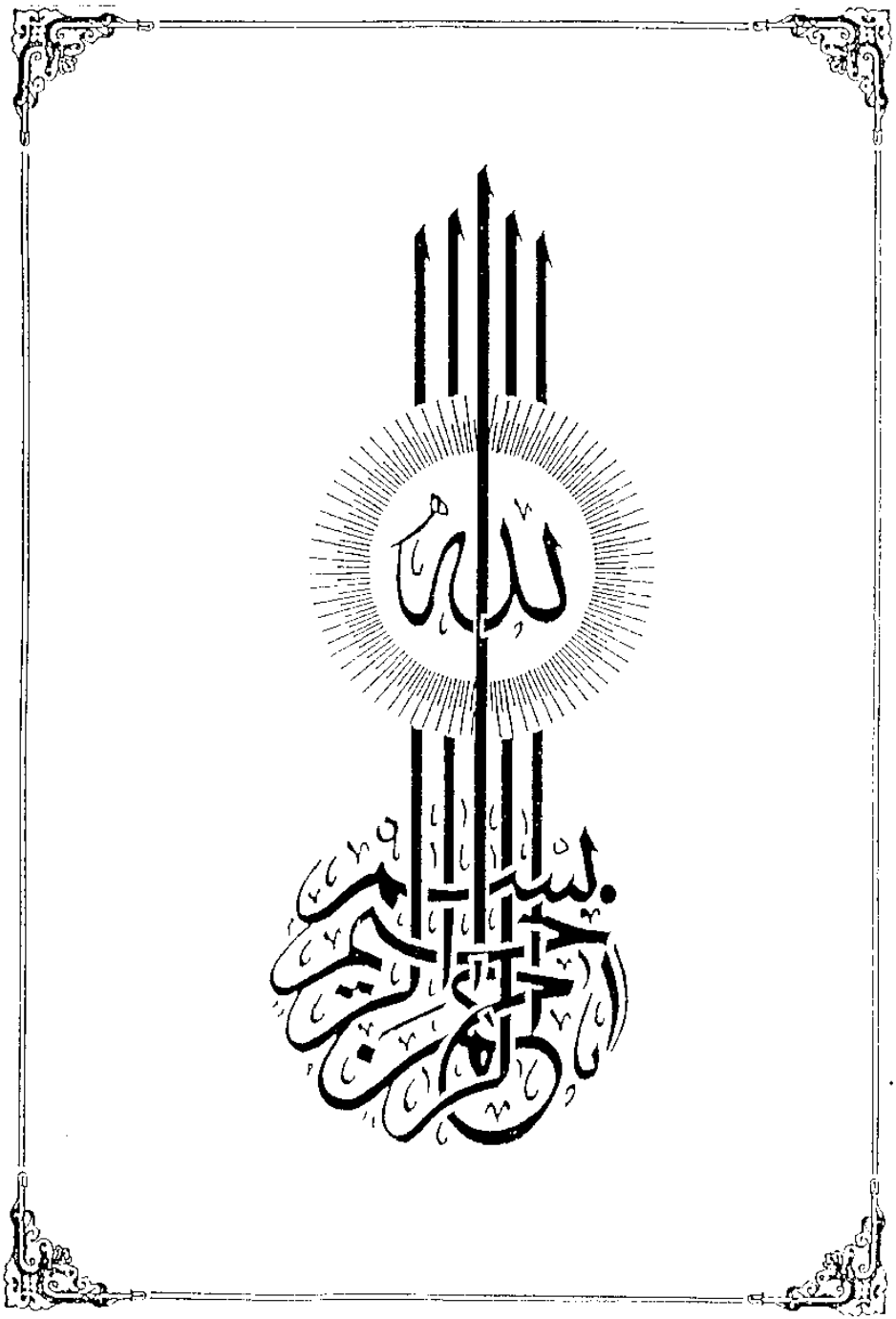

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CONTENTS

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INTRODUCTION &

AIM OF THE WORK

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Recently, percutaneous balloon mitral valvuloplasty (PBMV) through a transseptal approach has been developed as a less invasive alternative to surgical treatment (Inoue 1984).

The Occurrence of small left-to-right shunt is expected in some patients after transseptal catheterization (Ross 1963). After septal dilatation, larger openings are created in the interatrial septum. Therefore, production of left-to-right shunts in some patients after percutaneous balloon mitral valvuloplasty is not surprising.

Although, there are some reports in regard to left-to-right shunts after PBMV using oximetric method, the primary limitation of the oxygen step-up method in the detection of interatrial shunts is that it lacks sensitivity.

Recent development of transesophageal echocardiography (TEE) permits recognition of site and size of atrial septal defect (ASD) accurately.

In contrast to the transthoracic approach, the interatrial septum is imaged in total without echodropout from the transesophageal approach. This is because the ultrasonic beam hits the interatrial septum nearly perpendicular from the esophageal transducer position. Thus, atrial septal defects can be detected with high diagnistic

accuracy with transesophageal color Doppler echocardiography.

AIM OF THE WORK

This work aims at evaluating the size and the incidence of the left-to-right atrial shunting after percutaneous mitral balloon valvuloplasty by color Doppler echocardiography.

REVIEW OF LITERATURE

Percutaneous Balloon Mitral Valvuloplasty

Rheumatic heart disease is still common in under developed and developing countries, accounting for 25% to 40% of all cardiovascular diseases (WHO Chron 1980). Surgical mitral commissurotomy is a low-risk surgical technique that results in symptomatic and hemodynamic improvement in selected patients (Palacios 1987). Recently several workers have purposed percutaneous balloon dilatation as a treatment of valve stenosis, such as congenital pulmonary stenosis and congenital aortic stenosis, in children (Lababidi 1983 and 1984). Percutaneous balloon mitral valvuloplasty "PBMV" has also been recently developed as a less invasive alternative to surgical treatment (Inoue 1984, Lock 1985, Al Zaibag 1986, McKay 1986 and Palacios 1986).

The equipment, technique, complications, and indications for balloon valvuloplasty are all undergoing rapid evolution. At least four different types of balloon catheters have been developed, including single, modified, double, and trefoil. In addition, numerous improvements in balloon technology will probably occur in the next several years, including reduction in the profiles of deflated balloons, increases in balloon burst string, and lowered inflation-deflation times. Both antegrade and retrograde approaches to mitral valve dilatation have been described (McKay and Grossman 1988).

Historical Developments:-

Early surgical experience with the treatment of mitral stenosis provided the conceptual framework for the use of a percutaneously introduced balloon catheter to effect mechanical dilatation of the stenotic valve. In particular, reports dating from as early as 1920 by Cutler, Bailey, Harken and their associates on the various techniques of closed and opened mitral commissurotomy using valvulotomes and simple finger-fracture suggested that fused mitral commissures could be separated with simple mechanical dilatation. On the basis of this experience, successful use of a balloon technique for opening stenotic mitral valves might have been predicted. Equally important in the development of the technology for balloon mitral valvuloplasty was the development of two techniques transseptal left heart catheterization (Brochenbrough 1960) and balloon atrial septostomy (Rashkind 1966). Both of these procedures are an integral part of the technique that currently is most commonly used to dilate stenotic mitral valves with balloon catheters (McKay and Grossman 1988).

In 1984 Inoue et al. provided the first report of successful balloon mitral valvuloplasty . With use of a single-balloon technique with an outer diameter ranging between 23 to 26 mm, six patients with critical mitral stenosis underwent PBMV via a transseptal approach. Balloon dilatation resulted in a reduction of the mean mitral gradient from 18 mm Hg to 7 mm Hg. The procedure was associated with significant reduction in the left atrial pressure and no major complications.

In 1985 Lock et al. extended Inoue›s findings and described results in eight children and young adults with rheumatic mitral stenosis who underwent PBMV. In Lock›s series, the atrial septum was traversed by needle puncture via a standard transseptal approach and subsequently dilated with an 8-mm angioplasty balloon advanced over a guidwire. Following atrial septal dilatation, valvuloplasty balloon catheters ranging from 18 to 25mm in diameter were used to dilate the mitral valve. Valve dilatation resulted in a reduction of the mean mitral gradient from 21 $\pm$ 4 mm Hg to 10 $\pm$ 5 mm Hg, an increase in cardiac output from 3.8 $\pm$ 1 to 4.9 $\pm$ 1.3 liters/min, and an increase in calculated mitral valve area index from 0.73 $\pm$ 0.29 to 1.34 $\pm$ 0.32 cm^2/M^2. The intensity of the murmur diminished immediately after balloon commissurotomy in all patients. Of note, the greatest reduction in pressure gradient was achieved with the largest balloon diameter _25 mm. Mitral valvuloplasty resulted in mild mitral regurgitation in only one patient. Follow-up catheterization at 2 to 8 weeks demonstrated persistence of the hemodynamic improvement, with evidence of partial restenosis in only one patient.

Following Lock›s report, Al Zaibag et al. in 1986 reported the successful use of double-balloon technique for treating rheumatic mitral valve stenosis in adolescents. Successful valvuloplasty was achieved in seven of nine patients with severe mitral stenosis, with improvement in the mitral valve area from 0.7 $\pm$ 0.2 to 1.5 $\pm$ 0.2 cm^2, cardiac index from 2.6 $\pm$ 0.5 to 3.0 $\pm$ 0.9 liters/min/M^2, and mean transmitral gradient from 15 $\pm$ 3 to 5 $\pm$ 3 mm Hg.

The technique described by these investigators involved two transseptal punctures, followed by dilatation of the interatrial septum with an 8-mm balloon, followed subsequently by placement of two 15-mm balloons across the mitral valve. The effect of balloon valvuloplasty on mitral valve competency was minimal, with no change in mitral regurgitation in four patients and an increase in mitral regurgitation from trace to 1+ in the remaining five.

Reports by Inoue, Lock, and Al Zaibag and their associates essentially were limited to young patients without evidence of calcific mitral valve disease and no evidence of mitral regurgitation at baseline. The first studies of successful PBMV in adult patients with calcific mitral stenosis were reported simultaneously by McKay and Grossman in 1986 and by Palacios et al. in 1986. In the study done by Mckay and Grossman, a 75-year- old man with longstanding rheumatic mitral stenosis with marked valve calcification and severe pulmonary hypertension underwent valvuloplasty with a 25-mm balloon. This resulted in reduction of the mean mitral valve gradient from 18 to 12 mm Hg, an increase in cardiac output index from 1.7 to 2.5 liters/min/M^2, and an increase in mitral valve area from 0.6 to 1.4 cm^2. Mitral regurgitation increased from mild (1+) to moderate (2+). Repeated catheterizations 2 and 6 months after valvuloplasty showed complete resolution of pulmonary hypertension and no evidence of valvular restenosis or worsening mitral regurgitation. It is notable, however, that the procedure did result in an ASD with a pulmonary to systemic blood flow of 1.8/1.0.

Palacios et al. in 1986, described successful PBMV in a 57-year-old man, also with calcific mitral stenosis. Dilatation with a 25-mm balloon resulted in a decrease in mitral gradient from 20 to 4 mm Hg, an increase in cardiac output from 3.4 to 5.7 liters/min, and an increase in mitral valve area from 0.7 to 2.5 cm^2. The peocedure was not associated with any significant increase in mitral regurgitation or creation of an ASD.

Following initial reports of the use of PBMV in adult patients, several larger studies have appeared in the literature. McKay and Grossman in 1987, reported PBMV in 18 patients with severe mitral stenosis, including nine with heavily calcified disease. Fourteen patients were treated with a single 25-mm valvuloplasty balloon, while the remaining four undewent a double-balloon procedure. The procedure resulted in an increase in cardiac output from 4.3 $\pm$ 1.1 to 5.1 $\pm$ 1.5 liters/min and in mitral valve area from 0.9 $\pm$ 0.2 to 1.6 $\pm$ 0.4 cm^2, and a decrease in mean mitral pressure gradient from 15 $\pm$ 5 to 9 $\pm$ 4 mm Hg, and pulmonary wedge pressure from 23 $\pm$ 7 to 18 $\pm$ 7 mm Hg. Left ventriculography before and after valvuloplasty in 14 of the 18 patients showed a mild (less than 1+) increase in mitral regurgitation in five patients and no change in the remainder. Embolic phenomena were not observed in any patient. All patients were discharged from the hospital with decreased symptoms.

Palacios et al. in 1987, reported similar results in 35 patients with severe mitral stenosis, including 16 patients with mitral valve calcification. In their series, balloon dilatation resulted in a reduction of

the mean mitral gradient from 18 ± 1 to 7 ± 1 mm Hg, an increase in the cardiac output from 3.9 ± 2 to 4.6 ± 2 liters/min, and an increase in the mitral valve area from 0.8 ±01 to 1.7 ±02 cm^2. Complications included death of one patient, an embolic episode in one patient, the development of moderate to severe mitral regurgitation in one patient, and complete heart block requiring temporary ventricular pacing in two.

Charles McKay and coworkers in 1987, reported similar results using a double-balloon technique in 12 patients with rheumatic mitral stenosis. In their series, the mean mitral gradient decreased from 16 ± 6 to 5 ± 2 mm Hg, cardiac output increased from 4.4 ± 1.2 to 5.5 ± 1.4 liters/min, and mitral valve area increased from 1.0 ± 0.3 to 2.4 ± 0.8 cm^2. Mitral regurgitation did not increase in any patient and no embolic episodes occurred. Oximetry demonstrated small left-to-right shunts in two of the 12 patients.

An additional modification of the mitral valvuloplasty technique is the development of a retrograde approach to valve dilatation. This technique was reported by Babic et al. 1986. In three patients with moderate mitral stenosis, a balloon catheter was inserted percutaneously from left femoral artery over a long guide wire and advanced retrograde to the level of the mitral valve and inflated. The guide wire that was used had been previously introduced into the right femoral vein and advanced transseptally through a Brockenbrough catheter into the left ventricle. It was subsequently withdrawn via the left femoral artery using an intravascular retriever set. Successful balloon dilatation was achieved in all three patients without increases in