Value of Dobutamine Stress Echocardiography In Patients Undergoing Coronary Artery Bypass Surgery Associated With Ischemic Mitral valve Disease

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Thesis Submitted For Partial Fulfillment of MD Degree in Cardiothoracic Surgery

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I dedicate this work to the soul of my father, who I really miss a lot.

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I like to salute the memory of the late Dr. Moghazy Tantawi who was a compassionate father, and an honorable professor. Allah's mercy be upon him.

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List of Abbreviations

AMI	Acute Myocardial Infarction
AML	Anterior Mitral Leaflet
AO	Aorta
APM	Anterior Papillary Muscle
CABG	Coronary Artery Bypass Grafting
CAD	Coronary Artery Disease
CFDI	Color Flow Doppler Imaging
DCM	Dilated Cardio-Myopathy
EF	Ejection Fraction
IABP	Intra-Aortic Balloon Pump
ICM	Ischemic Cardio-Myopathy
IMR	Ischemic Mitral regurgitation
LA	Left atrium
LDSE	Low Dose Dobutamine Stress Echocardiography
LV	Left Ventricle
LVOT	Left ventricular Out Flow Tract
NYHA Class	New York Hear Association Classification
PCI	Percutaneous Coronary Intervention
PML	Posterior Mitral Leaflet
PPM	Posterior Papillary Muscle
RMR	Residual Mitral Regurgitation
ROA	Regurgitant Orifice Area
ROA	Regurgitant Orifice Area
SLAC	Septal-Lateral Annular Cinching
TEE	Trans-Esophageal Echocardiography
TTE	Trans Thoracic Echocardiography

Review of Literature

1- Anatomy & Physiology of Mitral Valve
2- Pathophysiology of IMR
3- Diagnosis of IMR
4- Surgical Decision Making
5- Surgical Principles & Techniques

Introduction

Ischemic mitral regurgitation is mitral insufficiency caused by myocardial infarction. The leaflets and subvalvular apparatus are by definition normal. The disease must be distinguished from MR associated with coronary artery disease in which no cause and effect relationship exists.[1]

Despite the relatively high prevalence of chronic IMR, most centers have only a small surgical experience with this disorder.[2]

One thing is certain: Ischemic mitral regurgitation (MR) conveys adverse prognosis, doubling mortality after myocardial infarction (MI), in chronic heart failure, and after surgical or catheter revascularization [3-6] . It is common and increases mortality even when mild. [7-9] In many other respects, however, ischemic MR has been a study in controversy and paradox.[4]

Although most surgeons agree that severe MR should be corrected at the time of Coronary Artery Bypass Surgery (CABG) and that trace to mild MR can be probably be left alone, the optimal management of moderate ischemic MR remains controversial.[10]

Until very recently, chronic ischemic MR has been evaluated almost exclusively at rest.[11] Few groups studied the effect of stress on IMR [12] [13], they observed stress induced changes in the degree of IMR that may have important clinical implications.

We also observed these dynamic changes in our IMR patients referred for low dose Dobutamine Stress Echocardiography (DSE) before CABG. The degree of IMR decreased to mild or disappeared completely in some patients while it did not change or increased to severe degree in others. Several questions prompted based on these observations:

- Does DSE have a role in preoperative evaluation of IMR patients?
- Does DSE have a role in planning the surgical approach to address IMR?
- Does DSE have a role in predicting post-surgery outcome?

To investigate these questions, we hypothesized that Low Dose DSE may have a role that can sharpen the therapeutic approach of IMR.

Prospectively, thirty chronic moderate or moderate to severe IMR patients were studied. They were divided according to Low Dose Dobutamine Stress Test into 2 groups:

- Group A: in whom degree of IMR decreased during DSE.
- Group B: in whom degree of IMR did not change or increased during DSE.

We compared the results of both groups trying to find out answers to these questions.

Chapter 1

Mitral Valve Anatomy & Physiology

Under normal conditions, mitral valve competence is maintained by a complex interaction of the five components of mitral valve function: the ventricular wall, the fibrous annulus, the papillary muscles, the chordae tendineae, and the valve leaflets. Derangements in any single component can produce valve dysfunction, but in ischemic incompetence, the primary defect is infarction of the ventricular wall and papillary muscles. With increasing interest in valvular reconstruction in ischemic mitral regurgitation, a detailed knowledge of mitral valve anatomy has become essential [14].

Although more D-shaped than circular, the mitral annulus functions as a complete ring to which the leaflets are anchored. The flattened portion of the ring incorporates a fibrous region of continuity between the leaflets of the aortic and mitral valve. The two ends of this zone of fibrous continuity are thickened to form the fibrous trigones, which anchor the aortic-mitral unit across the roof of the left ventricle. The right trigone is somewhat larger and firmer than the left, with the propensity towards age-related calcification. [15]

Moreover, the point of unity of the right fibrous trigone with the membranous septum marks the so-called central fibrous body of the heart, which is pierced by the atrioventricular conduction axis. The remainder of the annulus continues around the parietal part of the left atrioventricular junction, where it forms a flexible rather than a rigid ring. In places, the annulus takes the form of a collagenous rod that supports the mural leaflet of the valve, but in other areas, the annulus is more of a fibrous fold, or else is deficient [16]. Externally, the position of the mural annulus is delineated by the courses of the coronary sinus and the circumflex branch of the left coronary artery running in the atrioventricular groove (Figure 1 and 2). These are important points to remember during the placement of sutures when replacing the valve. The relationship to the coronary artery is more intimate when the circumflex artery is dominant, the chance of iatrogenic injury to the artery being less when the right coronary artery is dominant. [15]

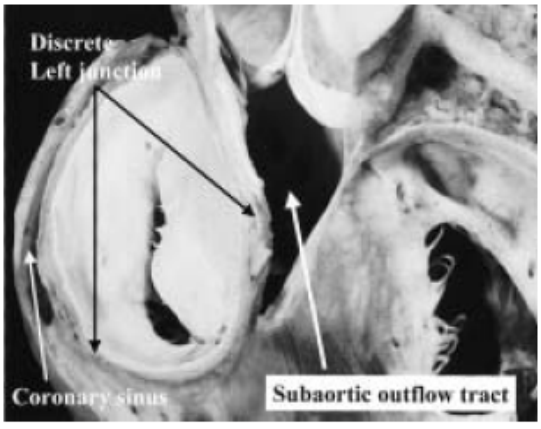

Figure 1: The relationships of the annulus of the mitral valve. [15]

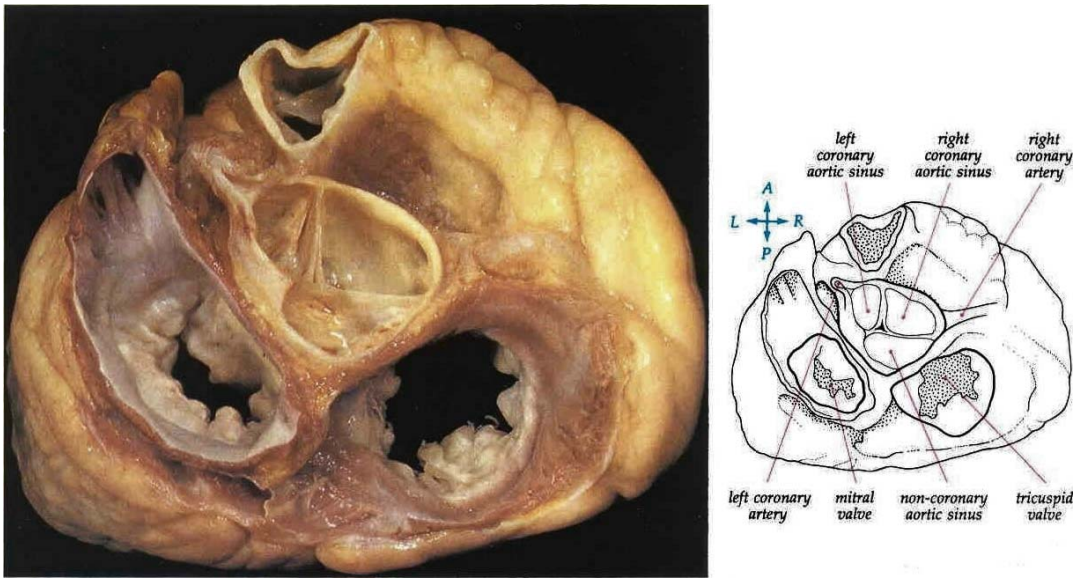

Figure 2: Anatomic interrelationships of the atrioventricular valves.[17]

Both leaflets have a trapezoidal shape and attach by thin fibrous chordae tendineae to both the anterior and posterior papillary muscles. Stated differently, the chordae from each papillary fan out and attach to nearly half of both cusp margins (figure 3). The commissures do not divide the leaflet tissue completely to the valve annulus (figure 4), and the basal aspects at the commissures are composed of continuous valvular tissue [18, 19].

The papillary muscles arise from the ventricular walls, at approximately two-thirds of the distance toward the apex. The anterolateral papillary muscle is single in 75% of patients, whereas its posteromedial counterpart usually has multiple heads arising directly from the ventricular wall [19]. The anterolateral muscle is supplied by branches of the proximal left anterior descending or circumflex coronary systems and is generally believed to have a more abundant blood supply. Posterlateral branches of the right coronary artery usually perfuse the posterior papillary muscle heads and are some distance from the orifices of the coronary arteries [19]. In case of left coronary dominance, posterlateral branches of the circumflex coronary artery supply the posterior papillary muscles. This more tenuous nature of posterior wall perfusion may be one explanation for the predominant involvement of the posterior coronary circulation in acute papillary-annular dysfunction.