Transesophageal Two-Dimensional Echocardiography and Color Doppler Flow Velocity Mapping In The Evaluation of Mitral Valve Prostheses

Thesis

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By

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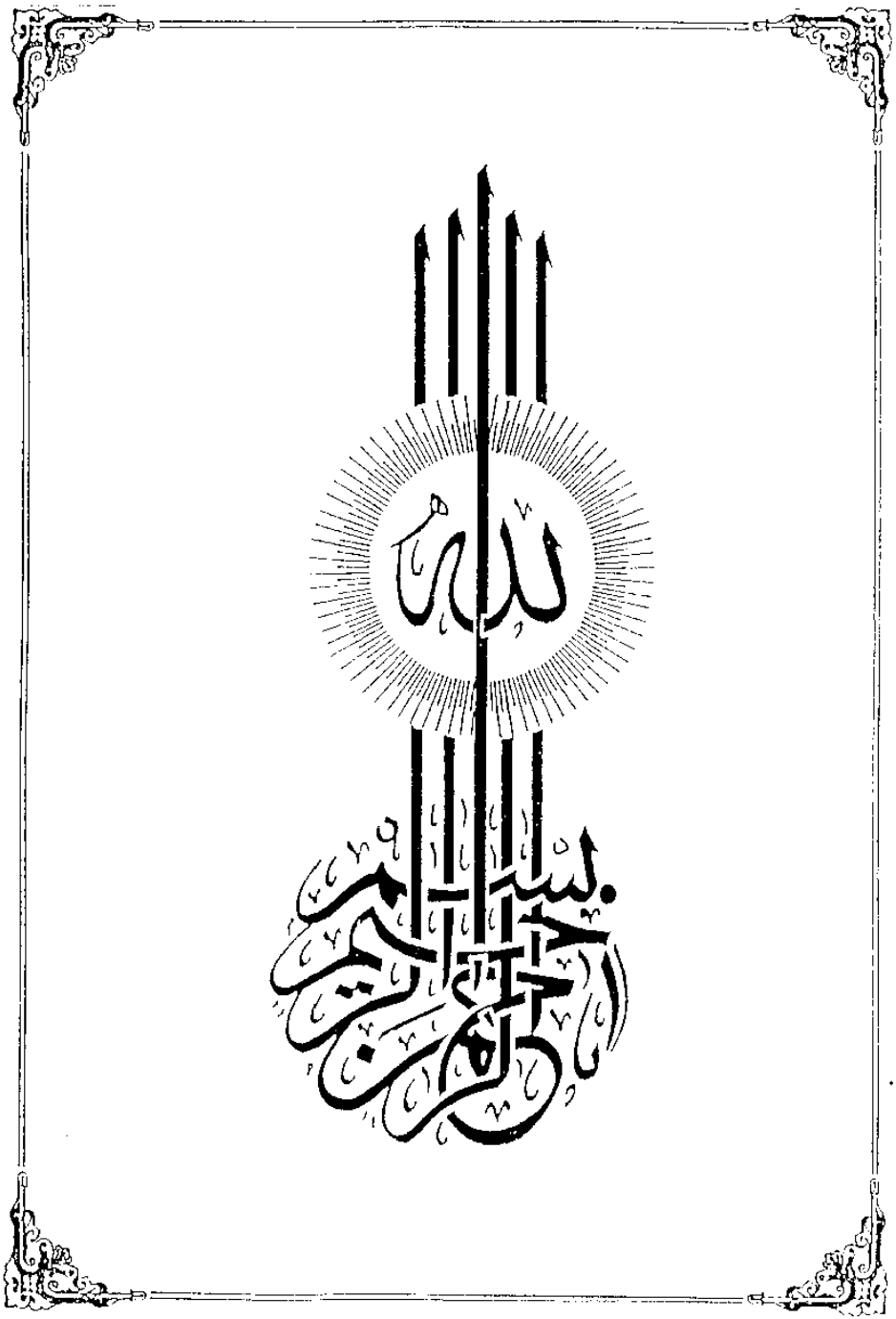

To

My Wife

&

Daughters

List of Abbreviations

2D	Two-dimensional
AF	Atrial fibrillation
BBB	Bundle branch block
CFM	Color flow mapping
CHF	Congestive heart failure
CPR	Cardiopulmonary resuscitation
CW	Continuous wave
ECG	Electrocardiography
EF	Ejection fraction
F	Female
LA	Left atrium
LAA	Left atrial appandage
LP	Longitudinal plane
LV	Left ventricle
LVEDD	Left ventricular end-diastolic diameter
LVESD	Left ventricular end-systolic diameter
LVOT	Left ventricular outflow tract
M	Male
MR	Mitral regurgitation
MV	Mitral valve
MVA	Mitral valve area
NMR	Nuclear magnetic resonance
PVC	Pulmonary venous congestion
PW	Pulsed wave
RA	Right atrium
RV	Right ventricle
SEC	Spontaneous echo contrast
SR	Sinus rhythm
SVT	Supraventricular tachycardia
TEE	Transesophageal echocardiography
TP	Transverse plane
TTE	Transthoracic echocardiography
VT	Ventricular tachycardia

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Introduction

Transesophageal echocardiography (TEE) is a newly advanced technique that allows ultrasonic imaging of the heart and the great vessels through the retrocardiac esophagus. During the last decade several indications for TEE have been established.

One of the most important indications of TEE is the evaluation of cardiac valve prostheses. This is because clinical as well as other non-invasive methods of assessment may be difficult. For example, tilting disc valves usually produce faint murmurs of incompetence ***(Burch and Giles, 1976)***, while in tissue valves, lack of mechanical clicks has made clinical evaluation more difficult and the presence of a diastolic rumble with these patients has not been found to correlate with calculated valve areas or diastolic gradients ***(Magilligan et al., 1980)***.

TEE is more advantageous than transthoracic echocardiography in this aspect as the ultrasound access to the heart from the esophagus is not restricted by lung tissue, and the proximity of the esophagus and the heart allows the use of high frequency transducers resulting in improved signal quality ***(Schluter et al., 1984)***. Also, accurate estimation of valvular regurgitation has been found in TEE because of the absence of ultrasound beam attenuation that occurs with the transthoracic approach ***(Nellssen et al., 1988)***.

Angiography is considered a hazardus and undesirable method of estimation of the degree of regurgitation as it is an invasive technique and has the risk of infective endocarditis.

Complications of TEE are minor and may occur with a very low (1-2%) frequency and include atrial and ventricular arrhythmias, vasovagal reactions, transient hypoxemia and minor bleeding ***(Lee and Schiller, 1989)***. The only reoprted major complication, transient recurrent laryngeal nerve paralysis, had occured in 2 patients in whom the probe was introduced intraoperatively in a sitting forward position with cervical neck flexion during neurosurgical procedures ***(Cucchiara et al., 1984)***.

Aim of The Work

The aim of this work is to assess this newly advanced technique, transesophageal 2-D echocardiography and Doppler color flow imaging, in the evaluation of the mitral valve prostheses in an attempt to overcome the limitations of the transthoracic approach.

Review Of Literature

Types of Prosthetic Cardiac Valves

The development of prosthetic cardiac valves has been a major advance in the management of patients with valvular heart disease. Since the first successful replacement of a diseased native cardiac valve 30 years ago, it is estimated that > 1,000,000 patients have received valvular prostheses ***(Dressler and Labovitz, 1992)***.

However, valve replacement is a palliative and not a curative procedure. Patients with artificial heart valve continue to face a substantial risk of death or serious complication during their cardiac surgery and continuously thereafter.

The ideal valve substitute, i.e., one having excellent haemodynamic performance, resistance to thrombogenesis and thromboemboli, good durability, and absence of degeneration throughout the human life span, is not available.

For the clinician to make an informed decision as to the timing of cardiac valve replacement and selection of prosthesis, it is important that he has an understanding of the types of valves, the functional and haemodynamic results of valve surgery, as well as the prognosis and complications of prosthetic valves.

Two major groups of artificial valves are currently available in models designed for both the atrioventricular and the aortic positions: mechanical prostheses and bioprostheses.

Mechanical Prostheses

There are three functional categories of mechanical prostheses: (1) caged ball, (2) caged disc, and (3) tilting disc prostheses.

(1) Caged ball prostheses: (Fig. 1)

This type of mechanical prostheses was the first to be used in the mitral position more than 30 years ago. It is still widely used in both the aortic and mitral position. The Starr-Edwards caged ball valve is the most famous one.

One of the most important advantages of this type of prostheses is the excellent record of durability up to 30 years ***(Braunwald, 1992)***. However, it has many disadvantages:

(a) Its bulky design makes it unsuitable in patients with a small left ventricular cavity in mitral position or a small aortic annulus in aortic position.

(b) It has a high incidence of thromboembolism even with chronic anticoagulation. ***Fuster et al. (1982)*** in their long term follow-up study reported that approximately 45% of the 10- to 15-year survivors of Starr-Edwards prostheses will have suffered a systemic embolus. In an attempt to reduce this high incidence of thromboembolism cloth-covered prostheses were developed to encourage the in-growth of neointima into the fabric.

(c) Because of the peripheral pattern of the flow passing across the valve, it appears to be intrinsically slightly more stenotic than the tilting disc valves ***(Braunwald, 1992)***.

(d) It is a noisy valve more than other prostheses.

(2) Caged disc prostheses: (Fig. 1)

This type of prostheses, for example, the ball disc valve, was developed because of concern about accommodation of the ball and cage of the caged ball prosthesis in the left ventricle as it has a much lower profile. ***Roberts et al. (1975)*** reported a high incidence of thrombo-embolism and haemodynamics similar to or worse than the caged ball prostheses, so they are not commonly used currently.

(3) Tilting disc prostheses: (Fig. 2)

A variation of the original disc valves was the evolution of the tilting-disc valve originally introduced as the Björk-Shiley valve and Lillehei-Kaster valves in the late 1960s. Today several types of tilting-disc valves are widely employed, these are less bulky and have a lower profile than the caged ball valve. In addition, the central flow design was proposed in an attempt to improve haemodynamics compared with the lateral flow of the ball-valve prostheses.

The initial model of the Björk-Shiley tilting-disc valve for mitral valve replacement, introduced in 1969, was equipped with a Derlin disc,