Ain Shams University
Faculty of Medicine

MITRAL VALVE REPLACEMENT IN CHILDREN

Thesis
Submitted in partial Fulfillment
for the M.D. Degree In
Cardio-Thoracic Surgery

by

MOHAMED ELSAID IBRAHIM IBRAHIM KOMBER
M.B.B.Ch.,M.S.

Supervisors

Prof. MOHAMED S.EL-Fiky
professor of Cardio-Thoracic Surgery
Ain Shams University

Prof. FOUAD ZAKI ABDALLA
professor of Cardio-Thoracic Surgery
El-Mansoura University

Prof. MOHAMED MOUNIR EL-SAEGH
Professor of Cardio-Thoracic Surgery
Ain Shams University

Dr. TAREK ZAGHLOUL SHALABY
Assistant Professor of Cardio-Thoracic surgery
Ain Shams University

1995

Ain Shams University
Faculty of Medicine

MITRAL VALVE REPLACEMENT IN CHILDREN

Thesis
Submitted in partial Fulfillment
for the M.D. Degree In
Cardio-Thoracic Surgery

by

MOHAMED ELSAID IBRAHIM IBRAHIM KOMBER
M.B.B.Ch.,M.S.

Supervisors

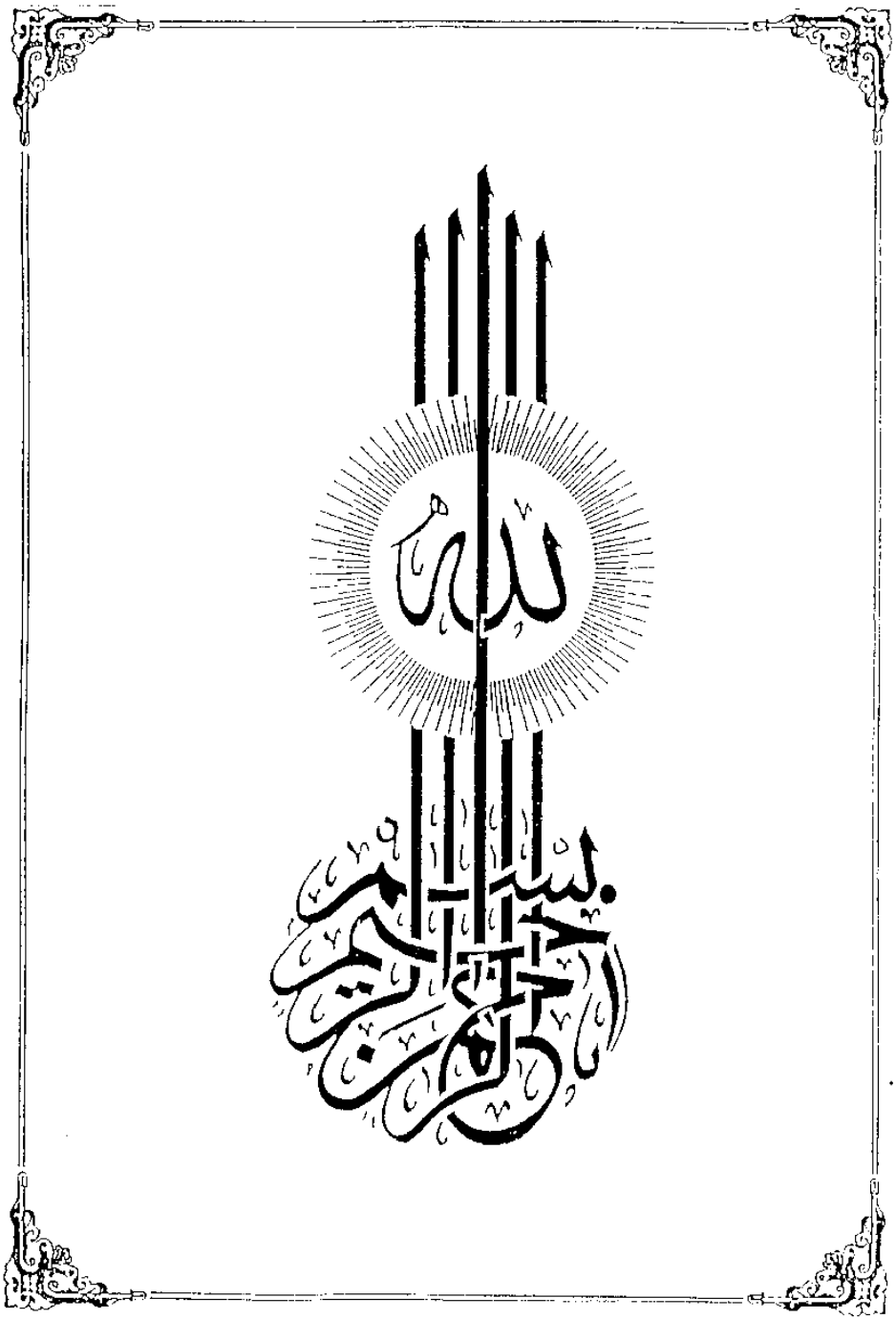
Prof. MOHAMED S.EL-Fiky
professor of Cardio-Thoracic Surgery
Ain Shams University

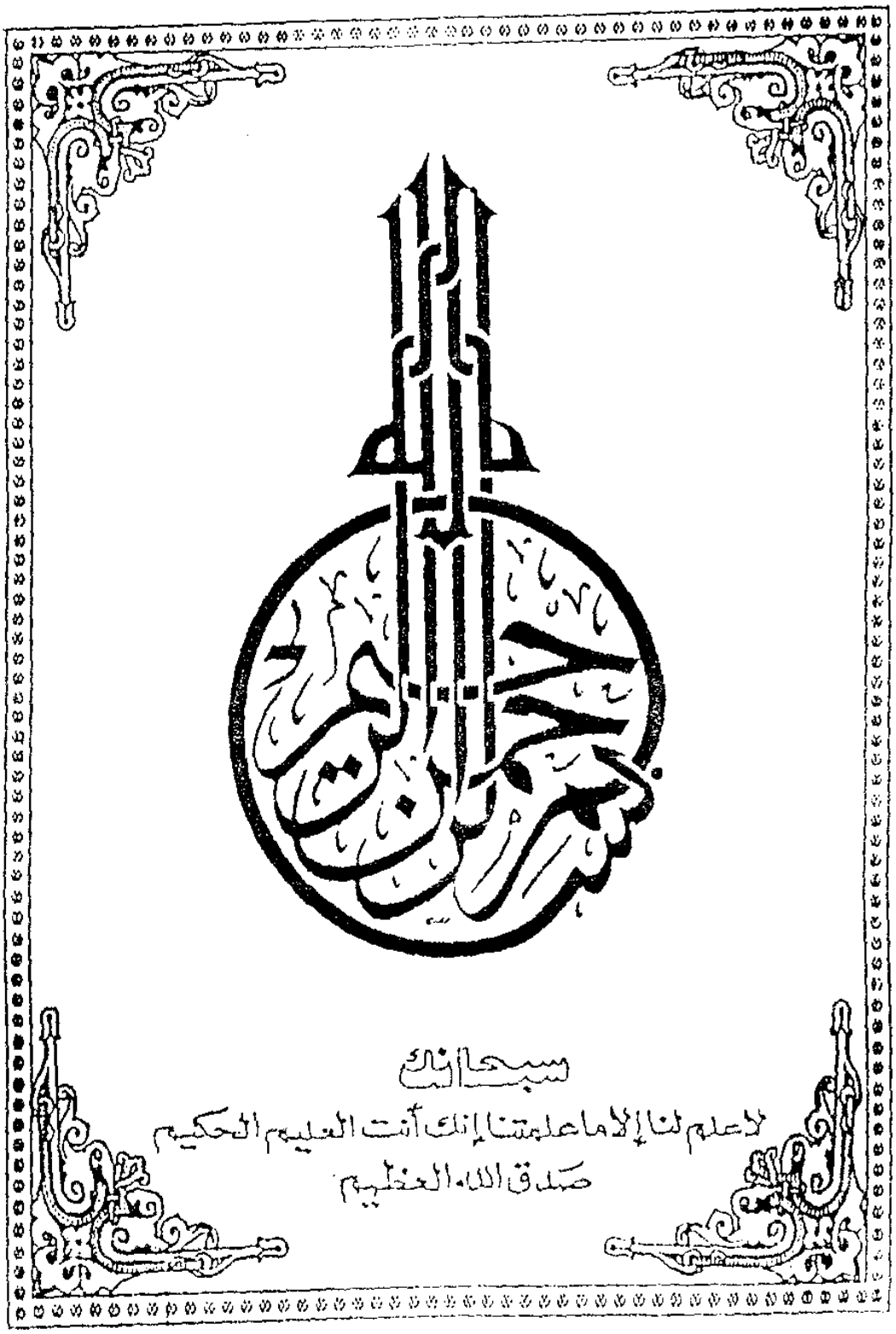
Prof. FOUAD ZAKI ABDALLA
professor of Cardio-Thoracic Surgery
El-Mansoura University

Prof. MOHAMED MOUNIR EL-SAEGH
Professor of Cardio-Thoracic Surgery
Ain Shams University

Dr. TAREK ZAGHLOUL SHALABY
Assistant Professor of Cardio-Thoracic surgery
Ain Shams University

1995





Acknowledgement

Praise be upon God of the Universe for the gift of mind, may the Almighty give use more of his gifts.

I would like to express my sincere thanks and deepest gratitude to *Prof. Mohamed EL-FIKY*, Professor of Cardiothoracic Surgery, Ain Shams University for his helpful guidance, encouragement and support.

I am so grateful to *Prof. Fouad Zaki Abdalla,* Professor of cardiothoracic Surgery, Mansoura university for his kind help and continuous advice.

I wish to acknowledge *Prof. Mohamed M. EL-Saegh*, Professor of cardiothoracic Surgery, Ain Shams University, for his fatherly guidance. I am indeed deeply indebted to his kindness and keeness as he dedicated much of his time and effort for me.

It is a pleasure to me to express my gratitude to *Dr. Tarek Zaghloul,* assistant professor of Cardiothoracic Surgery, Ain Shams University for his kind help and encouragement.

I wish also to express my thanks to *Prof. Ismail Sallam,* Professor and head of department of Cardiothoracic Surgery, Ain Shams University for his kind help as he allowed me to attend for more than four years and conduct my work there.

I am so grateful to all the staff memebers, Colleagues, and echo lab Staff, Cardiothoracic Surgery department , Ain Shams University.

Mohamed EL-SAID.

Contents

HISTORY AND INTRODUCTION

HISTORY AND INTRODUCTION

The first report of mitral valve replacement in an infant was recorded nearly thirty years ago. The valve of a ten month old female infant with congenital mitral stenosis was replaced by an experimental canine aortic prosthesis, as there were no commercially available valves at that time (Young and Robinson, 1964). Two years later, she needed mitral valve rereplacement because of outgrowth. At that time, a commercially available small Starr-Edward ball valve was used (Robinsom, 1974).

Whereas prosthetic cardiac valve replacement is considered to be successful method of treating adult patients, it is still regarded as a palliative procedure, at best, in children. It is true that the pediatric age group faces specific hazards 1) because of the long life expectancy, durability of the valve is of major concern, 2) anticoagulant treatment recommended for all bearers of mechanical valves, may be hazardous in children who are physically active, and require regular control not always easy to obtain in developing countries, 3) outgrowing of a valve is a concern when small-diameter prosthesis must be implanted. However, it seems that the current status of valve replacement in

children allows more encouragement than is widely believed (Milano et al., 1986 and El-Makhalouf et al., 1987).

Mitral valve diseases necessitating valve replacement vary in different countries. Congenital heart disease predominate in western countries whereas rheumatic heart disease is still predominating in developing countries (Elliott and de Leval, 1985).

Rheumatic fever and rheumatic heart disease, in third world countries, often invovle young subjects in whom the pattern follows a malignant and fulminant course resulting in pronounced disability and death. This often necessitate mitral valve surgery in childhood and adolescence to prevent deterioration of myocardial function (John et al., 1983).

Whereas mitral valve repair is possible in some cases, it is impossible in others because of marked destruction of valvular components, and mitral valve replacement becomes a must at that young age (Elliott and de Leval, 1985).

This study aims to review the current status of cardiac valve replacement in children and to assess the expected difficulties encountered in this special age group of patients and in particular,

to evaluate the clinical course of the surviving patients in terms of valve failure and valve related complications. The problem of when to do valve replacement in the course of the disease will be also discussed.

REVIEW OF LITERATURE

ANATOMY OF THE MITRAL VALVE

The mitral apparatus is a complex, finely coordinated mechanism that requires for its normal performance the functional integrity of anatomic elements working in delicate harmony. These elements are the mitral leaflets, the annulus, the chordae tendinae, and the papillary muscles (Perloff and Roberts, 1972).

The Mitral Leaflets:

The mitral valve forms a continuous veil attached to the circumference of the mitral annulus. The free edge of this veil hangs into the left ventricle and is split by indentations, two of which are constant and well delineated: the anterolateral and the posteromedial commissures (Rusted et al., 1952). They can be identified by the comissural chordae which arise from the tips of the papillary muscles and branch in a fanlike manner to be inserted into the free margin of the commissural regions (Lam et al., 1970). They permit division of the mitral veil into the anterior (aortic) and posterior (mural) leaflets. They present on their atrial side a distinct ridge that defines the line of leaflet closure and separates the leaflets into a rough zone distal to the ridge which reprsents the surface of coaptation, and a membranous (clear) zone proximal to the ridge (Rusted et al., 1952).

The anterior mitral leaflet is a semicircular or triangular structure. It has a common attachment to the cardiac skeleton with the left coronary cusp and half of the non-coronary cusp of the aortic valve. The gap between the aortic valve and the mitral valve is filled with an intervalvular septum where the fibrous mitral annulus is absent (Zimmerman and Baily, 1962).

The posterior mitral leaflet is quadrangular. It has a wider attachment to the annulus than does the anterior leaflet, its margin has two indentations, giving rise to a scalloped appearance. In addition to the rough and clear zones, there is a basal zone between the clear zone and the annulus (Ranganthan et al., 1970).

The Mitral Annulus:

The mitral annulus is a zone of junction which serves as the attachment of the muscular fibres of the atrium and the ventricle and as the attachment of the mitral valve. It is attached to the two fibrous trigones. Between them, the mitral valve is in continuity with the aortic wall and the fibrous mitral annulus does not exist in this region. The posterior portion of the annulus to which the posterior leaflet is attached has a variable thickness. The mitral annulus decreases its diameter during systolic contraction and as a consequence has a sphincterlike function (Ormiston et al., 1981).

There are four important structures related to the mitral valve annulus (Fig. 1). These should be avoided during insertion of the prosthetic valve (Perloff

and Roberts, 1972):

1) The intervalvular space: this space affords a certain margin of safety, but even so, carelessly placed sutures may transfix the bases of the left and non coronary aortic cusps and cause aortic insufficiency.

2) Coronary vessels: where the lateral commissure abouts against the left fibrous trigone, the great cardiac vein and the circumflex branch of the left coronary artery are endangered by deep sutures.

3) Bundle of His: where the medial commissure meets the right fibrous trigone, the atrioventricular bundle may be injured.

4) The coronary sinus: the opening of the coronary sinus into the right atrium is slightly behind the site of the atrioventricular bundle. Along the posterior two thirds of the mitral annulus, the coronary sinus and left coronary vein may be incorporated by careless sutures (Perloff and Roberts, 1972).

Chordae Tendinae:

The chordae tendinae are fibrous strings that originate from tiny nipples on the apical portion of the papillary muscles or directly from the ventricular wall (Carpentier et al., 1976b). On the base of careful investigation of the relationship of chordal morphology to the site of insertion of individual chordae, they are classified into commissural chordae, anterior and posterior leaflet chordae (Lam et al., 1970).

Commissural Chordae:

They arise as a main stem that branches radially like a fan to insert into the

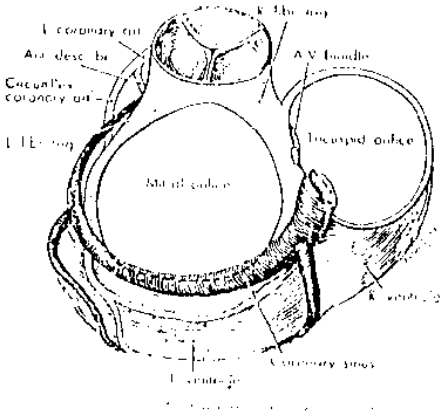


Fig. 1 : Diagram illustrating the structures related to the mitral valve annulus which must be avoided during insertion of the valve prosthesis. After perloff and Roberts(1972).