COMPARISON BETWEEN REPAIR OF MITRAL VALVE REGURGITATION USING SURGICAL METHOD AND USING PERCUTANEOUS CATHETERIZATION

Essay

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M.B.B.ch

In partial fulfillment of master degree in cardiothoracic surgery

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2015

المقارنة بين إصلاح ارتجاع الصمام الميترالي عن طريق استخدام الجراحة وإصلاحه عن طريق استخدام طريقة التدبيس باستخدام القسطرة عن طريق الجلد

رسالة مقدمة من

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بكالوريوس الطب والجراحة – جامعة المنوفية

توطئة للحصول على درجة الماجستير في جراحة القلب والصدر

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2015

بسم الله الرحمن الرحيم

قَالُوا سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

سورة البقرة آية (32)

Acknowledgement

I would like to express my deepest gratitude to all those who helped achieve this work.

*First, I always like to thank **ALLAH**, the great and the merciful, who helps us to know and learn.*

*I would like to express my profound gratitude and appreciation to my **Prof. Dr. Mohsen Mohammed Abdelkarim Fadala**, Prof. of cardiothoracic surgery, Ain shams university who honored me by his kind supervision and continuous help in all stages of this work.*

*I am very grateful to **Prof. Dr. Ahmed Samy Taha Desoky**, Prof. of cardiothoracic surgery, Ain Shams University, for his direction, and fatherly advice through this work.*

*No word can fulfill the feeling of gratitude and respect I carry for **Dr. Ahmed Helmy Aly Omar**, Lecturer of Cardiothoracic Surgery, Ain shams university, for his excellent comments, continuous encouragement, and advice.*

Lastly and not the least, I would like to thank my wife, family and friends, who had suffered during accomplishing this essay, and everybody encouraged it.

Ehab Algohary

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List of Abbreviations	
ACC/AHA	American college of cardiology/American heart association
CDS	Clip Delivery System
CHF	Congestive heart failure
DMR	Degenerative Mitral Regurgitation
EVEREST	Endovascular Valve Edge-to-Edge Repair Study
ESS	End-systolic stress
ESC	European Society of Cardiology
EACTS	European Society of Cardiothoracic surgeons
FDA	Food and drugs administration
FS	Fractional shortening
FMR	Functional mitral regurgitation
INR	International normalized ratio
IMR	Ischemic Mitral regurgitation
LV	Left ventricle
LVEDP	Left ventricular end-diastolic pressure
LVEDV	Left ventricular end-diastolic volume

LVESV	Left ventricular end-systolic volume
LVESVI	Left ventricular end-systolic volume index
MRSA	Methicillin resistant Staphylococcus aureus
MVP	Mitral valve prolapse
MR	Mitral regurgitation
NYHA	New-York heart association
PTCA	Percutaneous transluminal coronary angioplasty
PTFE	Polytetrafluoroethylene
ACCESS EU	Prospective, observational, multicenter, MitraClip post-approval study in Europe
ROA	Regurgitant orifice area
STS	Society for Thoracic Surgeon
SGC	Steerable Guide Catheter
SAM	Systolic anterior motion
TEE	Transoesophageal echocardiography
TTE	Transthoracic echocardiography

Introduction

Mitral valve regurgitation (MR) is among the most common valve diseases in developed countries and represents nearly one-third of acquired left-sided valve pathology. (Borger MA,.et al.2006)

MR can be broadly classified into two major categories as follows: primary and secondary MR. In primary MR, i.e. organic MR, the valvular incompetence is caused by compromised or structurally disrupted components of the valve apparatus. Examples include degeneration from rheumatic disease, myxomatous degeneration, endocarditis, chordae tendineae rupture, and papillary muscle rupture. In secondary MR, the valve is structurally normal with the regurgitation resulting from failure of coaptation of the mitral valve leaflets without coexisting structural changes of the valve itself. Examples include ischemic, dilated cardiomyopathy and hypertrophic cardiomyopathy. This form of MR is often referred to as functional MR. (Borger MA,.et al.2006)

Surgery is curative of mitral valve regurgitation. There are two surgical options for the treatment of MR: mitral valve replacement and mitral valve repair. (Al-Radi OO,et al.2005).

According to patient and type of MR, mitral valve repair is preferred to mitral valve replacement where a repair is feasible as bioprosthetic replacement valves have a limited lifespan of 10 to 15 years, whereas metallic replacement valves require ongoing use of blood anticoagulants to reduce the risk of valvular thrombosis which can develop gradually or abruptly and complicated by cerebral or peripheral embolic events. (Bishay ES, et al.2000).

There are many categories of mitral valve repair according to type of MR, for pure annular dilatation causing mitral regurgitation an annuloplasty reducing the orifice size alone may sufficient, Annuloplasty may be used in conjunction with other repair maneuvers to support the reconstruction and reinforce the annulus as well as prevent future annular dilatation.
(Alfieri O, et al.2001).

Quadrangular resection the most common situation seen in mitral regurgitation secondary to myxomatous degeneration is prolapse of the middle scallop of the posterior leaflet. This may result from chordal rupture or chordal elongation. (Alfieri O, et al.2001).

Triangular Resection of the anterior leaflet may be used for torn chordae tendinae on the anterior leaflet, generally of the central scallop. With a redundant anterior leaflet, this technique may also be helpful. (Alfieri O, et al.2001).

Polytetrafluoroethylene (Gore-Tex) sutures can be used to create chordae tendinae in circumstances of elongated or broken chords or when additional chords are required to support the free edge of a leaflet after repair techniques are employed. In particular, when removing a large segment of the posterior leaflet, the remaining chordae form acute angles after sliding annuloplasty, Gore-Tex suture is used to create new chords at the central portion of the posterior leaflet. (Digiammarco G,et al.2007).

In some cases, the "double orifice" (or 'Alfieri') technique for mitral valve repair, the opening of the mitral valve is sewn closed in the middle, leaving the two ends still able to open. (Digiammarco G,et al.2007).

In general, mitral valve surgery requires "open-heart" surgery in which the heart is arrested and the patient is placed on a heart-lung machine (cardiopulmonary bypass). (Digiammarco G,et al.2007).

Due to the physiological stress associated with open-heart surgery, elderly and very sick patients may be subject to increased risk, and may not be candidates for this type of surgery. As a consequence, there are attempts to identify means of correcting MR on a beating heart. The Alfieri technique for instance, has been replicated using a percutaneous catheter technique,(i.e. Mitra Clip) which installs a clip to hold the middle of the mitral valve closed. (Garg P, Walton AS, 2008).

The MitraClip Device is percutaneously implanted. The MitraClip System is used to implant the device and is comprised of the Clip Delivery System (CDS) and Steerable Guide Catheter (SGC). (Feldman M.D.,et al.2011).

Aim of work

The aim of this essay is to through some light on repair of mitral valve regurgitation by using surgical method and to show the differences between this method and percutaneous catheterization (mitraclip).

Anatomy of the Mitral valve

General anatomy:

The valvar complex comprises the annulus, the leaflets, the tendinous cords, and the papillary muscles. Also important for its function is the left atrial wall and the myocardium to which the papillary muscles are inserted. The valve is obliquely located in the heart and has a close relation to the aortic valve (Fig. 1-A). Unlike the tricuspid valve which is separated by muscle from its counterpart, the pulmonary valve; the mitral valve is immediately adjacent to the aortic valve (Fig. 1-B). (Siew,2002).

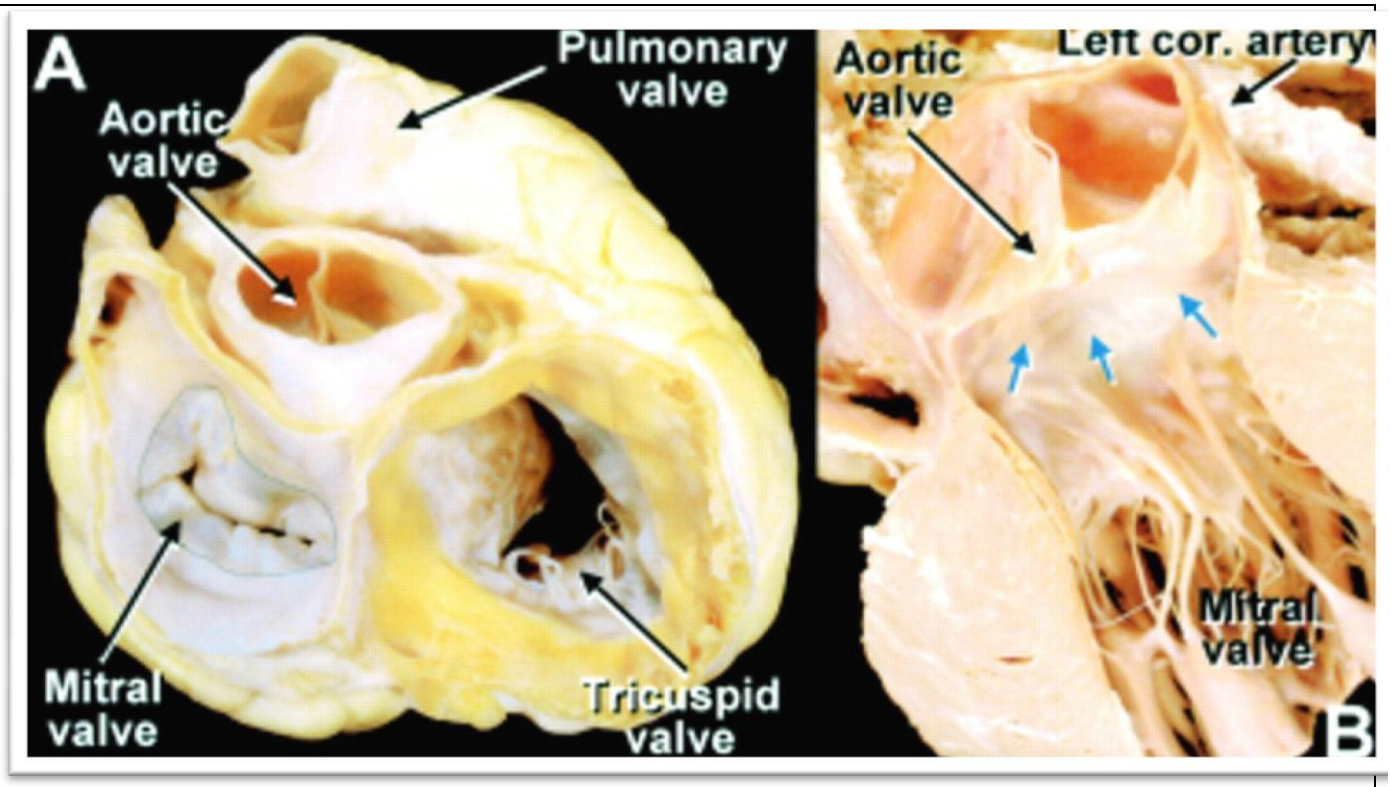

Fig. 1: (A) View of the base of the heart in anatomical orientation shows the spatial relations of the four cardiac valves. The left heart valves are close together whereas the right heart valves are separated by myocardium. Dotted line marks the limit of atrial myocardium around the mitral orifice. (B) This dissection of the heart viewed from the anterior aspect shows the close relation between aortic and mitral valves in situ. Fibrous continuity between the valves (blue arrows) is related to the non- and left coronary sinuses of the aorta (Siew, 2002).

The Left Atrial Wall:

Although generally not appreciated as part of the mitral apparatus, Perloff and Roberts emphasised the important role of the atrial wall since left atrial enlargement can contribute to mitral regurgitation (Siew, 2002).

The continuity of the atrial myocardium over the atrial surface of the mural ("posterior") leaflet makes this leaflet vulnerable to being displaced when the atrial chamber enlarges, but this

hypothesis remains to be proven. Normally, extensions of atrial muscle mark the so-called ring when the valve is viewed from the atrium the degree of muscular extension varies from heart to heart and from area to area within the same heart. When the parietal atrioventricular junction is cut in profile, the variability of insertion of the hinge, or fulcrum, of the mural leaflet relative to atrial myocardium can be seen. At the aortic ("anterior") leaflet of the valve, the distal edge of atrial myocardium marks the hinge (Siew, 2002).

Mitral Annulus:

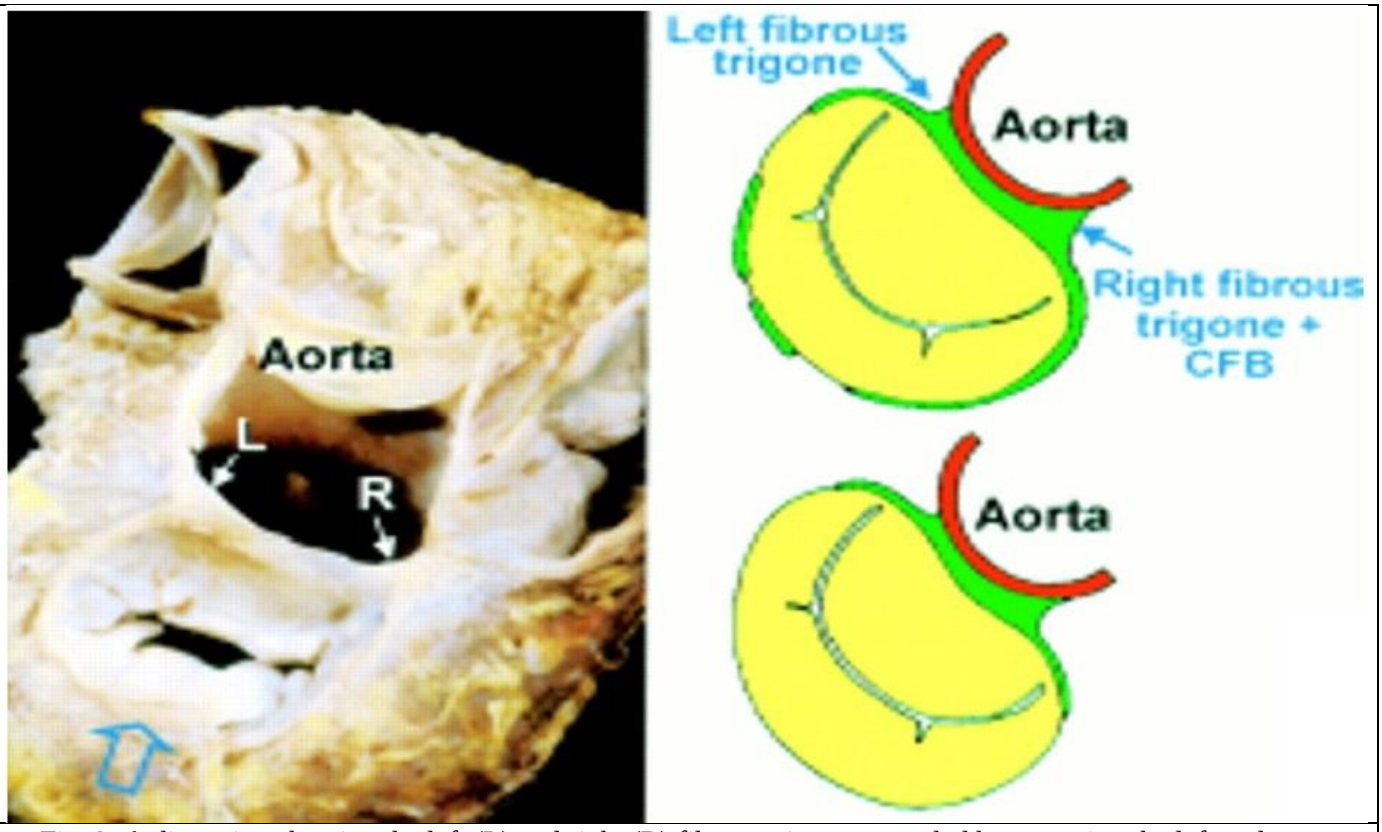

Fig. 2: A dissection showing the left (L) and right (R) fibrous trigones revealed by removing the left and non-coronary aortic sinuses. The trigones are expansions of fibrous tissue at either end of the area of aortic–mitral valvar continuity. The right fibrous trigone together with the membranous septum forms the central fibrous body. The diagrams represent two of the cases reported in the work by Angelini and colleagues. They show the variation in completeness of the so-called valvar annulus (green areas)
(Siew, 2002).

The mitral annulus is a pliable junctional zone of fibrous and muscular tissue joining the left atrium and ventricle and anchoring the base of the anterior and posterior mitral leaflets. The annulus has two major collagenous structures: (1) the right fibrous trigone, which is part of the central fibrous body and is located at the intersection of the atrioventricular membranous septum, the mitral and tricuspid valves, and the aortic root, and (2) the left fibrous trigone .The annulus marking the hinge line of the valvar leaflets is more D shaped than the circular shape portrayed by prosthetic valves. The straight border accommodates the aortic valve allowing the latter to be