Title: ~ Outcome of preservation of mitral valve apparatus during mitral valve

replacement for rheumatic versus valve lesions with myocardial ischemia“.

ID: 2796# Outcome of Preserved Mitral Valve Apparatus During Mitral Valve Replacement

The visual abstract:

Are there differences in outcome of mitral valve replacement with preservation of mitral apparatus among rheumatic and/or ischemic mitral lesions?

There are some differences between the two groups that actually didn`t affect the one year- survival or reoperation rates.

Mitral valve replacement with preservation of leaflets, and added revascularization, when indicated, is a feasible and reproducible procedure.

Thoracoscopic or minimally invasive techniques can be developed on these bases

Abstract

Objectives: The aim is to compare outcome of modified preservation of mitral valve apparatus during prosthetic mitral replacement for rheumatic versus myocardial ischemia &mitral valve disease.

Methods ;This prospective cross-sectional comparative study will include 50 patients with isolated rheumatic mitral valve disease (group A) and 50 patients with mitral disease and myocardial ischemia (group B), will be started in 2017 and expected to be terminated in 2020 at one center. All patients will have modified preservation of mitral apparatus during prosthetic mitral replacement. Additionally, group B patients had bypass grafts to left anterior descending and/or posterior descending / right coronary artery. Data were collected and analyzed.

Results: Pre-operative clinical data didn`t show significant differences between groups ($p>0.05$.) except smoking index was much higher in group B. Results will be reported and analyzed to get the conclusions

Key wards: Preservation of mitral apparatus during mitral replacement,

Intra-operative TEE during mitral replacement

Mitral replacement with preservation of mitral apparatus for rheumatic mitral disease,

Mitral replacement with preservation of mitral apparatus for ischemic mitral disease

Introduction

Rheumatic heart disease led to an estimation of 275100 deaths worldwide in 2013 [1]. Mitral valve disease comprises diverse etiologies e.g., rheumatic, degenerative or left ventricular ischemia.[2]. Rheumatic heart disease remains by far the most common manifestation of valve heart disease worldwide and affects approximately 41 million people.

Deaths due to coronary artery disease peaked in the mid -1960s and then, deaths decreased however, it still is the leading cause of death worldwide [3, 4].

Early mortality after mitral valve replacement without preservation of the valve apparatus was 10.4 % [3].

Mitral valve apparatus: The apparatus consists of the two leaflets, the annulus and the sub-valvular apparatus. The latter includes the left ventricular free wall, the two papillary muscles that give off the chordae tendineae. Carpentier, in 2010 reported that proper valve function is dependent on integrity and harmonious interplay of the components and disturbed integrity and harmony will produce valve incompetence and/or stenosis-dysfunction [5]. Functionally the apparatus is producing " annulo-ventricular continuity".

The papillary muscles:

These small myocardial structures originate from the free wall of the left ventricle. They are attached to the trabecular carnea and covered by the endocardium:

1- They contract to prevent inversion or prolapse of the leaflets,

2- Hold the valve in place while the ventricle is pumping blood,

3- Draw the mitral ring toward the apex causing further shorting of the long axis of the contracting left ventricle thus, contributing to ejection of left ventricular blood through the aortic valve. They contract just before left ventricular wall contraction [5].

The posteromedial papillary muscle is supplied via the dominant right coronary artery or the circumflex (only one source) and the anterolateral is supplied by the LAD, Diagonal or marginal branch of circumflex artery (dual blood supply).

Papillary muscle dysfunction (PMD) can be due to ischemia. This dysfunction syndrome can be evaluated with tissue Doppler strain imaging. Dysfunction is not an independent determinant of mitral regurgitation. Papillary muscle tethering distance is the final determinant of MR and PMD is one of the determinants of the tethering distance along with LV remodeling. As the papillary muscles contract during the isometric phase, the closed mitral valve is brought down into the left ventricle leading to a reduction of the longitudinal axis and increasing the short axis producing increased myocardial fiber stretch, greater wall tension, contraction and stroke volume. If the left ventricle dilates; wall tension increases as by Laplace`s law producing increased systolic wall stress that can be assessed with the echocardiogram. Interruption of the papillary –annular complex causes impairment of the normal left ventricular stress-strain patterns

Revascularization of the viable adjacent left ventricular wall is expected to improve mitral apparatus `functions. Lillehei and others, in 1965 reported the continuity between mitral annulus and the papillary muscles, subsequently; they started preservation of the posterior leaflet [4].

David and his colleagues in 1984, described mitral valve replacement with preservation of both leaflets Modifications were added to: prevent preserved tissues from affecting prosthetic valve function and adequate size of the prosthesis; also to prevent LV outflow tact obstruction [4-7]

Functional ischemic mitral regurgitation is a complex disorder with a poor prognosis., it is known that post-infarction left ventricular remodeling is the most significant factor in the development of this mitral valve lesion. Echocardiography and magnetic resonance imaging have made significant contributions to clarifying the many mechanisms that progressively worsen mitral regurgitation [8]

Left ventricular remodeling owing to severe myocardial infarction plays an important role in mitral valve lesion-development, although local involvement of the papillary muscles is also a factor. Annular dilation is not the direct cause of regurgitation, but the consequence of the different mechanisms leading to a lack of valve coaptation [9]

The ischemic origin of the severe ischemic mitral regurgitation is evident when the posterior papillary muscle appears to be elongated and presents a partial rupture.(12-15). Functional ischemic mitral regurgitation is currently one of the most widely investigated medical conditions at the international level [10-12].

In patients with non-ischemic mitral regurgitation, the abnormal valve structure leads to functional deterioration of the left ventricle because of dilation and, eventually, to ventricular dysfunction. In contrast, the ventricular dysfunction in coronary artery disease generates a series of changes in left ventricular geometry and in the various components of the mitral valve resulting in the functional anatomy of non-ischemic mitral regurgitation [13] The progressive increase in mitral regurgitation results in an increase in ventricular dilation and wall stress, thus establishing a vicious circle, with progressive deterioration of ventricular function [14-15]. There is still controversy about the best surgical approach, particularly with regard to whether to replace or repair the valve, the type and size of prosthesis to be used in mitral replacement for severe rheumatic and / or severe ischemic mitral valve disease [16].

Objectives: The aim is to compare outcome of modified preservation of mitral valve apparatus during prosthetic mitral replacement for rheumatic versus myocardial ischemia &mitral valve disease.

Patients and Methods:

This prospective cross-sectional comparative study included 50 patients with isolated rheumatic mitral valve disease (group A) and 50 patients with ischemic mitral disease (group B).

The Institutional Review Board (IRB) or Ethics Committee (EC) and consent of each patient were obtained

Criteria for inclusion of patients for mitral valve replacement according to the guide lines:

For mitral stenosis: Mitral valve replacement is an option for treatment only if there is no other option and the patient has severe limiting symptoms [11]. Because the natural history of rheumatic MS is one of slow progression over decades, surgery should be delayed until the patient has severe limiting symptoms (NYHA class III or IV)-[17–20]. Patients who increase their trans-mitral gradients to >15 mm Hg with exercise have been shown to improve symptomatically after intervention. Intervention should be delayed until symptoms are severely limiting and cannot be managed with diuresis and heart rate control [.21].

For mitral regurgitation: most patients with acute severe MR require surgical correction for reestablishment of normal hemodynamics and for relief of symptoms [22].

Chronic primary MR include infective endocarditis, connective tissue disorders, rheumatic heart disease, cleft mitral valve, and radiation heart disease Correction of the MR before irreversible changes occur can be curative. For mixed MS and MR: mitral valve replacement may be necessary if therapy with diuretics do not relieve symptoms, but it should be performed only in patients who have severe limiting symptoms.

The selected surgical technique:

The left atrial approach: mitral valve inspection: we incise any fused commissures towards the valve annulus, fused or thickened chordae were mobilized. Anterior leaflet was incised from its middle; the incision continued to the annulus, the middle was selected for incision as it is devoid of chordal attachment. TiCron sutures 2/0 with pledgets (non-absorbable, polyester braided sutures) were bitten from annulus thence; those were passed from the bottom to the tip of the leaflet. Lastly, each suture was anchored to the bi-leaflet mitral prostheses (St. Jude bi-leaflet –low profile prostheses were used in all patients but, with different sizes (mostly 27-sized prosthesis). The posterior leaflet was preserved by

leaflet plicating sutures. The prosthetic mechanical valve was placed perpendicularly to the original mitral valve orifice. Modifications were done to prevent the preserved tissue from interfering with prosthetic valve function, to implant an adequate size of valve and to prevent left ventricle outflow tract obstruction.

For myocardial ischemia with valve lesions, arterial bypass grafts will have the priority above the venous grafts.

Sample size

The sample has been calculated according to the following formula (Shujuikuo et al., 2 018):

N= (Z/D)^2p(1-p)

N=is the sample size

Z=is the standard normal deviate = 1.96 at confidence interval 90%

D=is the desired confidence level (90% that the population proportion falls within 10% of the sample proportion)

P=is the sample proportion =0.7

Calculated number of patients= 46 patients. We will add 4 patients for possible incomplete study of 4 or less patients. Finally patients to be studied= 100 patients

Ethical considerations:

The study protocol will be approved by the research ethics committee of the faculty of medicine, Suez Canal University and The Tumor- Hospital in Ismailia.

An informed consent for carrying out special investigations will be taken from patients undergoing this study.

This consent is attached to protocol and contains:

1. Explanation of aim, procedure, and potential benefits of the study in a simple way easy to understand.

2. No harmful maneuver will be used, potential risks will be minimized by performing the procedure under supervision of a qualified trained cardiologist.

3. All data will be considered confidential and will not be used outside this study without patient approval.

4. Researcher phone number and all communicating methods will be identified to patient .

5. Patients will be announced by results of study .

6. Patient has the right to withdraw from this study at any time without affecting their routine medical care.

7. Signature or finger prints of patients.

Data management and statistical analysis:

Data collected will be coded, entered, and analyzed using Microsoft excel program software.

Statistical package for social science (SPSS) will be used for data analysis.

The independent data of study will be conducted and analyzed to identify rate of post-infusion Cardiovascular events and its relation to pre-infusion status , post-infusion status.

The proper statistical tests will be used.

Statistical analysis :

Coefficient is positive, if one variable tends to increase as the other decreases.
Coefficient is negative, if one variable tends to decrease as the other increases.

We will do test for normalization of data, like Kolmogorov- Simirnove or Shapiro test because normally distributed data will be analyzed by non-parametric tests.

Parameters at baseline and the end of every cycle of chemotherapy will be analyzed by linear mixed effects. COX regression analysis is needed to compare between patients affected by cardio-toxicity and non-affected patients.

P. value is considered as significant when: $P < 0.05$.

Value of P less than or equal to 0.05 will be considered statistically significant.

Time Table:

	August 2016 to September2016	October 2016 to November 2018	Dec. 2018 to Jan. 2019	Feb. 2019 to October 2020
Preparatory period and protocol approval				
Data collection and field work				
Data management				

Finishing and printing				

Budget:

Preparing protocol	500 L.E
Collecting data including Transplantation fees	4000 L.E
Echocardiographic assessment	9200 L.E
Statistical analysis	2000 L.E
Printing and finishing	1000 L.E
Preparing thesis	300 L.E
Total	17000L.E

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Arabic Summary