Minimally Invasive Aortic Valve Surgery through Right Anterior Thoracotomy versus Conventional Approach through Median Sternotomy

(Retrospective Study)

Thesis

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List of Contents

List of Tables

List of Tables (Cont...)

List of Figures

List of Figures (Cont...)

List of Abbreviations

Abb.	Full term

ABG ..... *Arterial Blood Gases*
ACT ..... *Activated Clotting Time*
AR ..... *Aortic Regurge*
ARDS ..... *Acute Respiratory Distress Syndrome*
AS ..... *Aortic Stenosis*
AV ..... *Aortic Valve*
AV ..... *Atrio-Ventricular*
AVA ..... *Aortic Valve Area*
AVD ..... *Aortic Valve Disease*
AVR ..... *Aortic Valve Replacement*
AVS ..... *Aortic Valve Surgery*
BMI ..... *Body Mass Index*
CBC ..... *Complete Blood Count*
COPD ..... *Chronic Obstructive Pulmonary Disease*
CPAP ..... *Continuous Positive Airway Pressure*
CPB ..... *Cardiopulmonary Bypass*
DC ..... *Direct Current*
DVT ..... *Deep Venous Thrombosis*
ECG ..... *Electrocardiogram*
EF ..... *Ejection Fraction*
ESD ..... *End Systolic Dimension*
FEV ..... *Forced Expiratory Volume*
FEV1 ..... *Forced Expiratory Volume in one second*
FVC ..... *Forced Vital Capacity*
HS ..... *Highly Significant*
ICS ..... *Intercostal Space*
ICU ..... *Intensive Care Unit*

List of Abbreviations (Cont...)

Abb.	Full term

LA ..... *Left Atrium*
LUS ..... *Limited Upper Sternotomy*
LV ..... *Left Ventricle*
MIAVR ..... *Minimally Invasive Aortic Valve Replacement*
MIAVS ..... *Minimally Invasive Aortic Valve Surgery*
NS ..... *Not Significant*
NYHA ..... *New York Heart Association*
PS ..... *Pressure Support*
RFTs ..... *Respiratory Function Tests*
SD ..... *Standard Deviation*
SPSS ..... *Statistical Package for Social Science*
SVC ..... *Superior Vena Cava*
TOE ..... *Trans Oesophageal Echocardiography*
TTE ..... *Trans Thoracic Echocardiography*
VAS ..... *Visual Analog Scale*
VHD ..... *Valvular Heart Disease*

Abstract

BACKGROUND& OBJECTIVES: Minimally invasive aortic valve surgery has evolved into a well-tolerated, efficient surgical treatment option in experienced centers, providing greater patient satisfaction and lower complication rates. Potential advantages of minimally invasive aortic valve replacement (MIAVR) arise from the concept that patient morbidity and potential mortality could be reduced without compromising the excellent results of the conventional procedure which include improved cosmetic results, safer access in the case of re-operation, less post-operative bleeding, fewer blood transfusions, lower intensive care unit and in-hospital stays, as well as the absence of sternal wound infection. These results were achievable also in high-risk patients. Reduced pain and hospital length of stay, decreased time until return to full activity, and decreased blood product use have also been demonstrated.

METHODOLOGY*:* Eighty patients with aortic valve disease randomized into two equal groups; group "A" underwent aortic valve surgery through a minimally invasive right mini-thoracotomy. Group "B" underwent aortic valve surgery through a full median sternotomy. The Pain was evaluated on 2^{nd}, 3^{rd} day post-operatively and at the 3^{rd}, 6^{th} month after discharge. Echo-cardiographic data were performed pre-operatively and at the 3^{rd} month after discharge in all patients. Standard aortic and bicaval cannulation with antegrade blood cardioplegia was adopted in group"B", while in group "A" femoral arterial and venous cannulation was adopted with antegrade blood cardioplegia.

RESULTS*:* There was no statistical difference between the two groups pre-operatively regarding their age, sex, NYHA class, EF% and spirometric study. There was no operative mortality in both groups but few post-operative complications occurred in both groups. Total hospital stay, ICU stay, post-operative bleeding, inotropic requirement, ventilatory support, blood transfusion was less in group "A", with better cosmetic appearance, more cost effective.

CONCLUSIONS*:* right mini-thoracotomy minimally invasive technique for aortic valve replacement provides excellent exposure of the aortic valve and offers a better cosmetic scar. In addition, minimally invasive right mini-thoracotomy is as safe as full median sternotomy for aortic valve surgery, with fewer complications and post-operative pain, less ICU and hospital stay, fast recovery to work with limited movement restriction after surgery. It can be used safely as an approach for aortic valve surgery.

KEY WORDS: Minimally Invasive - Right Mini-Thoracotomy - Median Sternotomy - Aortic Valve Surgery.

INTRODUCTION

Successful cardiac surgeons know that a standardized routine for cardiac operations is essential. An established routine makes every operation more efficient and, in the case of an emergency, allows one to proceed with speed and accuracy. a midsternal incision is made for nearly all cardiac Operations. The midsternal incision begins below the sternal notch over the sternal manubrium and extends to the xiphoid process the incision is taken through the periosteum of the anterior table of the sternum using electrocautery dissection. Ventilation of the patient is stopped momentarily to allow the lungs to deflate and retract away from the anterior chest wall as the sternum is divided with the sternal saw ***(Doty and Doty, 2012).***

Sternotomy has been the gold standard in cardiac surgery and generally provides an unobstructed view of the heart. This is the currently used method in which all surgeons are trained and perform cardiac surgery across the world. However, expertise in this traditional method may no longer suffice for the professional survival of cardiac surgeons. Owing to mounting evidence of fast recovery and cosmetic appeal, percutaneous approaches mostly spear- headed by cardiologists, including transcatheter aortic valve replacement and MitraClip, are replacing traditional methods. This transition may threaten the role of surgeons in treating diseases of the heart. To remain relevant, we must acknowledge patient demand for less

invasive procedures and proactively learn and adopt new effective technologies into our practices. In addition to percutaneous procedures, minimally invasive valve surgery is the much-needed paradigm shift for our continued central role in patient care ***(Joseph and Tom, 2015).***

The quest to reduce patient morbidity from cardiac operations led surgeons to develop approaches to avoid a complete sternotomy in performing aortic valve surgery. Various surgical incisions have been proposed, including an inverted (T) partial upper sternotomy, (J) upper partial sternotomy, (T) sternotomy performed between the second and fifth intercostal spaces, midline lower-half sternotomy, and a (C) mini-sternotomy, leaving the upper and lower ends of the sternum intact. Right parasternal approaches have also been described, with or without resection of costal cartilages. All of these approaches permit central cannulation and good exposure of the left ventricular outflow track, aortic valve, and ascending aorta. Continuous carbon dioxide is infused into the mediastinum to minimize the risk of air embolization after aortic unclamping. Following the initiation of Cardiopulmonary bypass, the aortic valve operation is conducted using standard techniques ***(Svensson, 1997).***

Right anterior thoracotomy avoids division of the sternum, but it must be located precisely for adequate exposure. The right third interspace is used for aortic valve operations. Adequate exposure of the heart and intracardiac structures is

facilitated by retraction systems. Soft tissue retractors open the intercostal space and keep the tissues out of the visual field. Rib resection may be done to facilitate exposure. Flexible aortic cross-clamp can be inserted through separate stab wounds to prevent cluttering of the operative field ***(Doty and Doty, 2012).***

The Society of Thoracic Surgeons (STS) database defines minimally-invasive cardiac surgery as "any procedure not performed with a full sternotomy and Cardio-pulmonary bypass support." Minimally-invasive valve surgery should not be defined in terms of a specific procedure, but rather a "philosophy" that requires an operation-specific strategy. Each minimally-invasive strategy introduces alternatives for Cardio-pulmonary bypass cannulation (central or peripheral), aortic occlusion (endovascular or transthoracic), and cardioplegia delivery (antegrade, atrial retrograde, or trans jugular retro-retrograde) ***(STS National Database. Spring 2003).***

Various locations on the ascending aorta and aortic arch are most often used as sites for insertion of the arterial cannula because of the simplicity and maintenance of antegrade blood flow. Multiple other locations can be good alternatives, including the common femoral, axillary, and innominate arteries; descending thoracic aorta; and rarely the left ventricular (LV) apex. To cannulate the ascending aorta, most surgeons place two purse-string sutures with or without pledgets partially through the aortic wall Next, with a systolic blood pressure preferably less than 100 mm Hg, a 4- to 5-mm

full-thickness stab wound is made, occasionally dilated, and then controlled under finger or forceps pressure. The cannula is then inserted under the finger or forceps approximately 1 to 2 mm into the lumen of the aorta. The common femoral artery is probably the second most common location for Cardio-pulmonary bypass cannulation. Exposure of the femoral artery is through a small oblique incision just below the inguinal ligament. Only the anterior surface of the vessel needs to be exposed. After placement of a 5-0 monofilament purse-string suture, the common femoral artery is punctured and a guidewire is passed to the aorta. Transesophageal echocardiography (TEE) guidance can be used to confirm the location of the wire. A long, thin-walled cannula is t hen passed over the wire into the distal aorta ***(Edward and John, 2012).***

Three basic approaches for central venous cannulation are used: bicaval, single atrial, or cavoatrial ("two stages"). Single venous cannulation is adequate for most aortic valve and coronary artery surgery; however, usually a cavoatrial cannula ("two-stages") is employed. Placement of a single venous cannula is most easily accomplished through the right atrial appendage. After application of a vascular clamp, the right atrial appendage is excised, or it may be opened longitudinally when the appendage is small. A purse-string suture is then placed just below the free edges, which are controlled with forceps. After release of the clamp, the cannula is inserted toward the Inferior vena cava. At times, venous cannulation is