Endoaortic Versus Transthoracic Clamp for Minimally- invasive Mitral Valve Surgery: A Systematic Review and Meta-Analysis

Thesis

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By

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Contents

List of Abbreviations

COPD : Chronic obstructive pulmonary disease

CPB : Cardiopulmonary bypass

EABO : Endo-aortic balloon occlusion

GHL : Global health library

LVEF : Left ventricular ejection fraction

MICS : Minimally invasive cardiac surgery

MIMVS : Minimally invasive mitral valve surgery

MIS : Minimally invasive surgery

MMO : Micro-mitral operation

NIH : National institute of health

RAP : Retrograde arterial perfusion

TEE : Transesophageal echocardiographic

TTC : Transthoracic aortic clamping

VHL : POPLINE, Virtual health library

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List of Figures

List of Tables

Abstract

Background

Minimally invasive surgery (MIS) is a rising trend in medicine, having been adopted into nearly every medical field. Rather than single approach, Minimally Invasive Mitral Valve Surgery (MIMVS) refers to a collection of techniques and operation-specific technologies such as modified perfusion and visualization techniques that are directed toward minimizing surgical access and trauma. The aortic occlusion has been extensively reviewed by two techniques in the literature; transthoracic clamp (TTC) and Endo-aortic balloon occlusion (EABO).

Methods

Nine electronic databases were screened for published observational studies comparing EndoAortic (EABO) versus Transthoracic (TTC) for aortic occlusion during MIMVS. Furthermore, the titles and abstracts of the studies resulted from the search were screened for the inclusion in the systematic review and the meta-analysis based on the inclusion and exclusion criteria. Subsequently, the intraoperative data including cross-clamp time, bypass time, conversion, dissection, were extracted. Moreover, the postoperative data including 30 days mortality rate, stroke occurrence, minor neurological events, re-exploration for bleeding, blood transfusion, post hospital ICU stay, post hospital stay, wound infection, recurrence of the mitral valve lesion, respiratory failure, renal failure, myocardial infarction, major vascular complication, and groin lymphocele.

Results

The current meta-analysis highlights the comparative safety of the two most commonly employed aortic clamping techniques for small thoracotomy Mitral Valve Surgeries, TTC, and Endo-aortic clamp. By inclusion of 23 studies with 8829 patients, it represents the largest database on the direct comparison of these two devices ever analyzed. EABO approach was associated with a trend toward longer cross-clamp, CPB time, postoperative hospital stay and a higher risk of intraoperative aortic dissection.

Conclusion

Our meta-analysis demonstrated that patients undergoing EABO may experience slightly more risk of occurrence of intraoperative aortic dissection, longer bypass time and cross clamp time and longer postoperative hospital stay.

Keywords: Endoaortic, Transthoracic Clamp, Minimally- invasive, Mitral Valve Surgery

Introduction

Minimally invasive surgery (MIS) is a rising trend in medicine, and has been adopted into nearly every surgical field. This growth in the type of MISs can largely be attributed to its numerous advantages, which include shorter recovery times, decreases in complication rates, and increases in the functional results of the procedures **(*Fuchs, 2002*).**

A minimally invasive surgical procedure should be defined as one that is safe and is associated with a lower postoperative patient morbidity compared with a conventional approach for the same operation.

The first procedure, which prevented a previous radical operation, was the use of a cystoscope to look into and treat lesions of the bladder. In 1931, Takagi of Tokyo redesigned the cystoscope and produced an arthroscope 3.5 mm in diameter. Marski Watanable, a pupil of Takagi, tenaciously pursued the development of the arthroscope, and in 1957, based on extensive experience in performing arthroscopy, he published an atlas of arthroscopy. This was the time when the minimally invasive surgery was born***(Jaffray, 2005).***

At the seat of success of minimally invasive surgery is the constant upgrading of surgical instruments, which have gone from crude, cumbersome gadgets to sophisticated, robotically controlled instruments.

In observing the rapid and successful implementation of these changes, one can only marvel at the accomplishments that lie ahead. Although improved instrumentation makes the procedure easier and more effective for the surgeon, the surgeon must learn to master the new technology. Thus, the procedure involves a learning curve with its risks.

The term minimally invasive surgery has gained widespread acceptance, and indeed it should if there is reduction of operative traumatic insult without compromise of therapeutic benefit. Practically every surgical subspecialty is using some form of minimal invasiveness. However, it appears that for some of those techniques to fulfill their greatest potential, one needs to apply a multidisciplinary approach, forming a coherent team of specialists from various disciplines working in cooperation rather than in separate disciplines***(Ochsner, 2000).***

Unfortunately, those performing the procedure need to develop the dexterity and skills for proper execution. In the final analysis, safe and efficient execution depends on the skill of the surgeon (***Ochsner, 2000)***.

Minimally invasive cardiac surgery (MICS) looks back into 20 years of development starting from increased efforts to perform coronary bypass grafting (CABG)on the beating heart to development of small access surgeries on both the coronary arteries and the heart valves and to application of advanced techniques which include video-scopy, robotic technology, and refined catheter-based interventions ***(Bonatti et al., 1998)***.

Throughout the modern era of cardiac surgery, most operations have been performed via median sternotomy with cardiopulmonary bypass. This paradigm is changing, however, as cardiovascular surgery is increasingly adopting minimally invasive techniques. Advances in patient evaluation, instrumentation, and operative technique have allowed surgeons to perform a wide variety of complex operations through smaller incisions ***(Langer & Argenziano, 2016).***

Along with the broader surgical community, cardiovascular surgery is in the midst of an ongoing evolution in technique. What began in the 1990s with the first reports of minimally invasive valve surgery has spread to influence nearly every type of cardiovascular operation performed today, and this evolution is being further spurred by recent developments in percutaneous valve technology. With increasing patient interest in minimally invasive procedures, it is more important than ever for surgeons to be current on the most common minimally invasive techniques in cardiac surgery ***(Langer & Argenziano, 2016)***.

Less invasive cardiac surgery has emerged as a new and substantially different approach to a variety of cardiovascular surgical procedures. However, the largest experience in this field is related to coronary artery bypass grafting ***(Weinschelbaum et al., 1998)***.

In contrast to general surgery, the goal in cardiac surgery should not necessarily be to minimize pain since extracorporeal circulation, not mediastinotomy, is probably the major cause of morbidity. Thus, we might consider minimally invasive cardiac surgery as largely off-pump surgery **(*Ochsner, 2000*).**