Journal of the Egyptian Society of Cardio-Thoracic Surgery 25 (2017) 311–315

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Journal of the Egyptian Society of Cardio-Thoracic Surgery

journal homepage: http://www.journals.elsevier.com/journal-of-the-egyptian-society-of-cardio-thoracic-surgery/

Early and midterm results of upper ministernotomy approach for aortic valve replacement

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ARTICLE INFO

Article history:
Received 5 September 2017
Received in revised form 19 October 2017
Accepted 2 November 2017
Available online 6 November 2017

Keywords:
Ministernotomy
Aortic valve
Minimally invasive surgery

ABSTRACT

Background: Aortic valve replacement (AVR) surgery today offers excellent results with low morbidity and mortality. However, the evolution of surgery encourages us to develop minimally invasive techniques. We report in this study our early experience of AVR by Upper Ministernotomy and describe the surgical technique, learning curve, complications and surgical follow-up.

Methods: Between March 2009 and March 2013, 50 patients underwent surgery for AVR at Zagazig university hospitals by inverted T Upper Ministernotomy (mean age 48 ± 11.2). The mean Euro-SCORE was 5.7% ± 4.1 and the ejection fraction was 60% ± 12. Six patients had an associated ascending aortic replacement. The cannulation was performed in femoro-femoral by the direct or percutaneous approach.

Results: Mean aortic clamping time for patients with isolated AVR was 91 ± 29 min and bypass time of 123 ± 56 min. One patient required conversion to sternotomy. The mean duration of mechanical ventilation was 10.3 ± 26.3 h, the average length of stay in intensive care units was 2.6 ± 2.2 days, and the mean hospital stay was 9.3 ± 5.8 days. Hospital mortality was 2 patients (4%).

Conclusions: The Upper mini-sternotomy for aortic valve surgery is an approach that offers many benefits. However, it is technically more complicated and requires a learning curve beyond which it can offer a lower complication rate with lower pain, blood loss and transfusion, and rapid return to normal activities.

1. Introduction

The development of minimally invasive techniques in cardiac surgery has grown considerably over the past two decades. First, it involved coronary surgery with thoracotomy beating bypass surgery, followed by upper ministernotomy for the aortic valve [1] and mitral surgery with right thoracotomy [2]. The right minithoracotomy was first described in 1999 [3] and has recently developed with several series in the literature [4–9]. The expected benefits of this approach are improved operative results (pain, blood loss, and transfusion), faster recovery (shorter hospital stay, earlier resumption of activities) and an aesthetic benefit. However, the implementation of a new technique requires a learning curve beyond which the technique

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Peer review under responsibility of The Egyptian Society of Cardio-thoracic Surgery.

https://doi.org/10.1016/j.jescts.2017.11.001

must bring to the patient the same results as conventional surgery while providing a functional and/or cosmetic benefit [15]. We report in this study our early experience of aortic valve replacement (AVR) by ministernotomy, surgical technique and complications.

2. Materials and methods

This is a retrospective study to review our results and experiences of AVR by inverted T upper ministernotomy from the first case in March 2009 to March 2013 at Zagazig university hospitals, Zagazig, Egypt. Fifty patients were operated during this period at cardiothoracic surgery department. All patients' data were collected according to the legal Customs and traditions with granted informed consent. Exclusion criteria for the use of this technique were: previous sternotomy (Redo-Surgery), aortic root dilatation, associated cardiac surgery (coronary bypass surgery, atrial fibrillation treatment), octogenarians, and significant comorbidities. The preoperative assessment included the classic assessment of AVR with an arterial and venous Doppler ultrasound for femoral cannulation and aortic calcifications (coronary angiography for patients older than 40 years ± aortic computerized tomography scan). Postoperative renal insufficiency is defined as an increase in serum creatinine of more than 50 μmol/l relative to the baseline value or postoperative dialysis.

All patients were subjected to follow up period during the 1st three months postoperative for early and short term results and during 12 months for mid-term results. The data were collected through the visit to our surgery clinic or the treating cardiologist. The post-operative pain was evaluated by a Score of visual analogue scale [16].

2.1. Surgical technique

2.1.1. Installation

The installation was carried out in supine position with a transverse block Jell pad under the shoulder as usual. The surgical field extended from the suprasternal notch to the second subcostal region, with exposure of the bilateral femoral areas. External defibrillation pads were placed on the posterior and anterolateral left sides of the thorax. The operation was performed under general intravenous anesthesia. When all necessary arterial and venous lines were fixed, the patient was anaesthetized by conventional method. A transesophageal echography (TEE) probe was set up to check the position of the cannulas.

2.1.2. Surgery

The patient was prepared with iodine solution, exposing the anterior and right lateral chest wall and both groin areas. An adhesive aseptic strip was fixed to the exposed areas. The skin incision was started 2 fingers breadth below the sternal notch and extended 5–7 cm inferiorly. An oscillating saw was used to perform inverted T-incision into the fourth intercostal space preserving the internal thoracic artery. Entering the third intercostal space resulted in adequate exposure of the aortic valve and right atrial appendage for venous cannulation by double staged venous cannula. If the atrial appendage could not be safely cannulated, percutaneous cannulation of the femoral vein was performed. Then the extracorporeal circulation was established through direct aortic cannulation by Easy Flow aortic cannula (Estech, San Ramon, CA) and percutaneous femoral vein cannulation guided (*Seldinger technique*) by guide wire and TEE for adequate bicaval insertion of double stage 22-22-Fr and 23–25-Fr venous cannula (Estech, San Ramon, CA). A standard Cardioplegia cannula was placed in the ascending aorta. Cardioplegia was delivered as an antegrade method of crystalloid solution or custodiol into the aortic root and the infusion and venting lines were connected as during usual procedure.

After dissection of thymic fat, the pericardium was open with a longitudinal incision along the ascending aorta and a transverse incision along the upper edge of the right atrium. The field was exposed with pericardial suspension sutures passed through the skin by a transcutaneous needle. The body temperature was dropped to 33° C. The aorta was clamped with a flexible Cygnet flexible aortic cross-clamp (Novare Surgical Systems, Inc., Cupertino, CA) and cardioplegia was performed by warm blood or Custodiol with perfusion pressure control. The aorta was open transversely. Valvular resection was performed with conventional instrumentation and technique. The valve was exposed according to the conventional local technique by 3 commissural pull points. A replacement of the ascending aorta was associated in some cases and aortic root enlargement in 3 case by modified Manouguian technique. The instruments used were classical instruments. The deairing of the cardiac cavities was performed conventionally by aspiration in the ascending aorta and in the left atrium under TEE control. The drain was inserted in the right side thoracic cavity where the pleura was opened. The wound was closed in usual manner.

2.2. Data analysis

Statistical analysis was done by Statistical Package for the Social Sciences software 19.0 (SPSS). Our data were expressed as mean and standard deviation (S.D.) for continuous variables. The other numerical or categorical data were presented as percentage in a frequency tables.