How-to-do-it

Portaclamp in video-assisted minimally invasive cardiac surgery: Surgical technique and preliminary clinical experience

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Abstract

Video-assisted minimally invasive cardiac surgery (VAMICS) is currently performed with various indications. However, despite the increasing evidence of its effectiveness, new approaches have to be defined to simplify this procedure, minimize its potential complications and limit its costs, for a wider use in the surgical community. The limited access to the aorta is a key point in VAMICS and mandates specific clamping modalities with their own limitations, costs and drawbacks. The Portaclamp (Cardio Life Research SA, Louvain la Neuve, Belgium), a new autoguided extravascular aortic cross-clamping system, has been recently proposed to facilitate VAMICS. Herein, we describe the Portaclamp approach and report our indications and preliminary clinical experience so to define its role in VAMICS.

Keywords: Less invasive surgery; Cardiac; Device; Adult

1. Introduction

Video-assisted minimally invasive cardiac surgery (VAMICS) is currently performed with various indications. However, despite the increasing evidence of its effectiveness [1], new approaches have to be defined to simplify this procedure, minimize its potential complications and limit its costs, for a wider use in the surgical community. The limited access to the aorta is a key point in VAMICS and mandates specific clamping modalities with their own limitations, costs and drawbacks. The Portaclamp (Cardio Life Research SA, Louvain la Neuve, Belgium) has been recently proposed for VAMICS [2]. Herein, we describe the Portaclamp approach and report our indications and preliminary clinical experience so to define its role in VAMICS.

2. Patients and methods

Fifty patients underwent VAMICS in our Institution with the use of the Portaclamp. Clinical data are reported in Table 1. Indications were: mitral valve surgery, tricuspid valve surgery, atrial fibrillation ablation associated to valve surgery, PFO/ASD closure, and excision of atrial masses. Contraindications to femoro-femoral cannulation for CPB and severe pericardial adhesions precluded the use of this approach.

3. Surgical technique

The Portaclamp consists of a guide-wire, two clamping jaws and a squeezing mandrel (Fig. 1a). The guide-wire is inserted through a port in the 2nd-3rd intercostal space (anterior axillary line) and then pushed into the transverse sinus through a small (2–3 cm) pericardiotomy to encircle the aorta and the pulmonary artery (Fig. 1b). The two clamping jaws are then inserted sequentially in front of and behind the aorta through the same port, as they present an axial lumen in which the two ends of the wire are introduced. Aortic cross-clamping is accomplished by a cylindrical squeezing tube on a mandrel locking system that is placed around the two clamping jaws and gently sleeved forward the aorta ensuring parallel cross-clamping (Fig. 1c). The guide-wire does not contribute to the clamping mechanism and it is not tighten-up to minimize compression on the pulmonary artery. Withdrawing the squeezing system performs unclamping.

The Portaclamp procedure includes an anterior minithoracotomy (right 4th intercostal space, 5–6 cm skin incision in the inframammary groove) and standard femoro-femoral CPB. Visualization is accomplished with an endoscope (Visera, Olympus Corporation) through a separate port (4th intercostal space, anterior axillary line). Antegrade cold crystalloid cardioplegia is delivered with a conventional catheter in the aortic root inserted through the mini-thoracotomy and secured by a pledgeted suture and
a tourniquet (Fig. 1d). A double lumen endotracheal tube is used to allow single lung ventilation.

4. Results

Various surgical procedures were performed with a prevalence of mitral valve repair, involving mainly the anulus and the posterior leaflet (Table 1). Two patients had more complex mitral repairs, in five AF ablation was associated and in two tricuspid repair. Four patients underwent PFO/ASD closure, one left atrial mixoma excision and two other procedures. Mean skin incision was $5.5 \pm 0.6$ cm.

Results are summarized in Table 1. Successful aortic cross-clamping with stable cardiac arrest was achieved in all cases. No patient required conversion to conventional approaches or reopening for bleeding. There was no perioperative mortality. Forty-four out of 50 patients had an ITU stay of less than 24 h. There were no postoperative TIA or CVA; we recorded one femoral vein thrombosis successfully treated conservatively.

5. Discussion

Endovascular balloons, as the EndoCPB system and the Endodirect system (Cardiovations-Ethicon, Cornelia, GA, USA), and external clamping devices, as the Chitwood clamp (Cardiovasive-Scanlan-International, St Paul, MN, USA), are currently available aortic clamping options for VAMICS.

Peripheral endovascular balloons require continuous monitoring of the positioning and pressure: because of the compliance of the aorta or a pressure drop in the endoclamp, they can migrate and occlude the brachiocephalic trunk or cause incomplete aortic clamping. Moreover, they rely on patient selection because of femoral cannulation, and contribute to increase operative costs [3–5].

Central endovascular clamping systems provide antegrade flow, offer a better position stability, minimize the risk of potential vascular complications, require no patient selection, but are still limited by costs [6].

The Chitwood clamp represents a simple, not disposable, readily available alternative to endoclamping systems [7]. However, it involves a remote and partially blind manoeuvre to cross clamp the aorta that can result into potential cardiac injury or incomplete aortic cross-clamping.

Compared to the Chitwood clamp, the Portaclamp, because of the guided feature, minimizes the risk of damaging any cardiovascular structure in contiguity with the clamping zone during positioning and allows a better reproducibility of complete aortic cross-clamping. Moreover, the Portaclamp is expected to be less traumatic as it distributes the clamping force on both jaws and on a broader surface.

Compared to the femoral EndoCPB system the Portaclamp provides a more stable aortic cross-clamping, avoiding the need for continuous monitoring of the position.
It also represents a less expensive alternative to either central and peripheral endovascular clamping systems. The Portaclamp approach resulted to be a feasible, safe and easy reproducible technique that can be promptly adopted to facilitate VAMICS. Limitations to Portaclamp approach are related to peripheral surgical femoral cannulation (additional skin incision, potential vascular complications and patient selection). Moreover, severe adhesions impeding the guide wire to encircle the aorta and the pulmonary artery preclude the use of this approach in the majority of redo cases.

References


