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Case Report

Cardiocentro ERNESTO CHE GUEVARA SANTA CLARA CUBA

Minimally invasive aortic valve replacement surgery. First cases performed in Cuba

Antonio de Arazoza Hernández[a]✉, MD, MSc; Elizabeth Rodríguez Rosales[b], MD; Fausto L. Rodríguez Salgueiro[c], MD; Miguel A. Carrasco Molina[d], MD; and Dania Valera Pérez[e], MD

[a] Department of Anesthesiology and Resuscitation. Cardiovascular Surgery Service. Cardiology Hospital at the Center for Medical and Surgical Research (CIMEQ). Havana, Cuba.
[b] Coronary Care Unit. Joaquín Albarrán Hospital. Havana, Cuba.
[c] Department of Anesthesiology and Resuscitation. Cardiovascular Surgery Service. Cardiology and Cardiovascular Surgery Institute. Havana, Cuba.
[d] Cardiovascular Surgery Service. CIMEQ Cardiology Hospital. Havana, Cuba.
[e] Cardiology Department. Dr. Salvador Allende Hospital. Havana, Cuba.

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✉ *A de Arazoza Hernández. CIMEQ. Calle 216 y 11B. Rpto Siboney Playa, CP 12100. La Habana, Cuba. E-mail address: dearazoza@infomed.sld.cu*

ABSTRACT
Aortic valve diseases, primarily of rheumatic cause in the past, are now mostly degenerative. The arrival of new therapeutic strategies, technological developments and increased life expectancy have led to an increase in the incidence of this disease and also to the fact that the patients we treat are increasingly of older ages. Thus minimally invasive cardiac surgery has been developed and aims to provide a new possibility of surgical treatment for the increasingly growing number of patients. A report of the first 2 aortic valve replacements performed in Cuba using this minimally invasive surgery is presented in this article. This technique has been successful in reducing the risk of infection and bleeding, need of transfusions, postoperative pain and postoperative intubation and mechanical ventilation times, as well as hospital stay and total cost of surgery.
Key words: Aortic valve replacement, Aortic valve, Minimally invasive cardiothoracic surgery, Heart surgery

Sustitución valvular aórtica mínimamente invasiva. Primeros casos realizados en Cuba

RESUMEN
Las enfermedades de la válvula aórtica que antes eran principalmente de causa reumática, ahora son, en su mayoría, degenerativas. El advenimiento de nuevas estrategias terapéuticas, el desarrollo tecnológico y el aumento de la esperanza de vida, han favorecido el aumento de la incidencia de esta enfermedad y que los pacientes que tratamos sean, cada vez, de edades más avanzadas. Por ello se ha desarrollado la técnica de cirugía cardiovascular por mínimo acceso que pretende brindar una nueva posibilidad de tratamiento quirúrgico para el cada vez más creciente número de

pacientes. En el presente artículo se presenta un informe de las 2 primeras sustituciones valvulares aórticas por vía mínimamente invasiva realizadas en Cuba, con lo cual se ha logrado reducir el riesgo de infección y sangrado, la necesidad de transfusiones, el dolor posoperatorio y los tiempos de intubación y de ventilación mecánica posoperatorios; además, la estadía intrahospitalaria y el costo total de la intervención quirúrgica.

Palabras clave: Sustitución valvular aórtica, Válvula aórtica, Cirugía cardiotorácica mínimamente invasiva, Cirugía cardíaca

INTRODUCTION

The aortic valve diseases we see today are not the same treated 40 years ago when the first valve prostheses began to be implanted. The leading cause of these diseases has changed from rheumatic to degenerative[1], after the advent and widespread use of antibiotics (to treat streptococcal pharyngitis), the development of new technologies and increased life expectancy, which also leads to the fact that the patients coming to our operating rooms today are much older.

Therefore, the surgery done today is not the same as the one done before, but over the years techniques and processes that make it safer and with better results have been developed and refined: improved cardiopulmonary bypass (CPB) techniques and b) myocardial protection techniques, c) refinement of valve prostheses (mechanical and biological), d) the introduction of interventional techniques to repair valvular lesions, and e) use of transesophageal echocardiography for intraoperative assessment of valve repair quality[1,2].

Aortic valve diseases that require surgery are mainly chronic, progressive, irreversible diseases which reach a stage in which only surgical treatment can be of benefit. Cardiac surgery is normally performed through a median sternotomy, with cannulation of the great vessels of the chest, but in the last 16 years new techniques of minimal access cardiovascular surgery known by the acronym MICS (Minimally Invasive Cardiac Surgery) have been developed[3].

Although there is no formal consensus regarding the techniques it includes, all thoseperformed through different incisions to full median sternotomy, such as: high or low partial sternotomy, lateral minithoracotomies, subxiphoid access, and subdiaphragmatic access or endoscopic access or PACS (Port-Access Cardiac Surgery)[3-5].

These techniques aim to provide a new possibility of surgical treatment for the increasingly growing number of patients that enlarge waiting lists of cardiovascular surgery. In this paper we present a report of the first minimally invasive aortic valve replacement performed in Cuba.

CASES REPORT

Between May and October 2012, 2 minimally invasive aortic valve replacement surgeries were performed at CIMEQ Cardiology Hospital, in Havana, Cuba. All patients were analyzed by the surgical team, based on the protocol for anesthetic, surgical and CPB strategies.

The day before surgery, patients were prepared according to the hospital standards. Patients were bathed with Hibiscrub twice, their chests and pelvis were shaved (forfemoro-femoral cannulation), evacuating enema was applied and they were previously medicated with benzodiazepines and Benadryl.

Once in the operating room, patients' left forearm vein and radial artery on the same side were cannulated. Anesthesia was induced with midazolam (0.2 mg/kg), fentanyl (10 mcg/kg) and atracurium (0.6 mg/kg). Unlike mitral valve replacements performed by

this surgical team, no double-lumen endotracheal tube was placed, but a conventional probe throughout the surgical procedure was used.

Two deep venous approaches, one in the left internal jugular vein where a 8F introducer with a three-way catheter was placed and the second from the right, where a 5F introducer was used, through which the surgeon subsequently placed a percutaneous cannula from superior vena cava for vacuum assisted venous drainage to the heart-lung machine. Monitoring used was that established for conventional cardiac surgery. Cefazoline was used as antibiotic prophylaxis (1 g intravenous every 8 hours) and for fibrinolysis, tranexamic acid (10 mg/kg, intravenous) prior to surgical stimulus and the same dose after the conclusion of CPB (before administering protamine sulfate) was repeated.

Prior to the patient's anticoagulation a transesophageal echocardiography probe was placed, in order to check the position of all cannulas and the removal of air from the left chambers at the end of such cannulas. The dose of heparin and its reversal followed the same criteria of theservice the conventional aortic valve replacement surgery: heparin at 4 mg/kg to maintain the activated clotting time greater than 500 seconds and protamine sulfate from 1.2 to 1.5 times the dose of administered heparin.

The ventilatory strategy used during the right lung collapse to prevent oxygen desaturation of hemoglobin was the one usually employed in thoracic surgery because lung collapse time is greatly reduced with the replacement of pulmonary ventilation by use of the CPB machine. Patients were ventilated in control volume mode setting with adjustment of respiratory rate to maintain the partial pressure of carbon dioxide around 40 mmHg and intrapulmonary pressures lower than 35 mmHg.

During intraoperative, continuous infusion of fentanyl (0.05 µg/kg/min) was maintained and supplemental doses of atracurium (0.05 mg/kg), midazolam (0.07 mg/kg) and inhaled isoflurane were administered as a supplement of balanced general anesthesia. Patient comfort was sought in the lateral decubitus position and during position changes.

All infusions were placed in the same deep vein lineand analgesia was deepened before maneuvers of maximum pain (skin opening, costotomy, pericardium opening). During CPB the temperature was lowered at 34 Celsius degrees and before finishing it was reheated at 36. Aortic Endoclamp® to occlude the aorta was not used in these valvular substitutions, but a clip of the instrumental of minimally invasive cardiac surgery designed for that purpose. Intermittent, warm, antegrade and hematic cardioplegia was applied.

For the CPB use, left femoro-femoral cannulation plus venous drainage of the right internal jugular vein through Carpentier percutaneous cannula was performed. In all cases prosthetic aortic valve was placed via right anterior minithoracotomy of 6 cm in an average time of 65 minutes. Due to the proximity of the aortic valve to the skin (few centimeters) it was not necessary to use instrumental of minimal access to place the prosthesis (**Figure**).

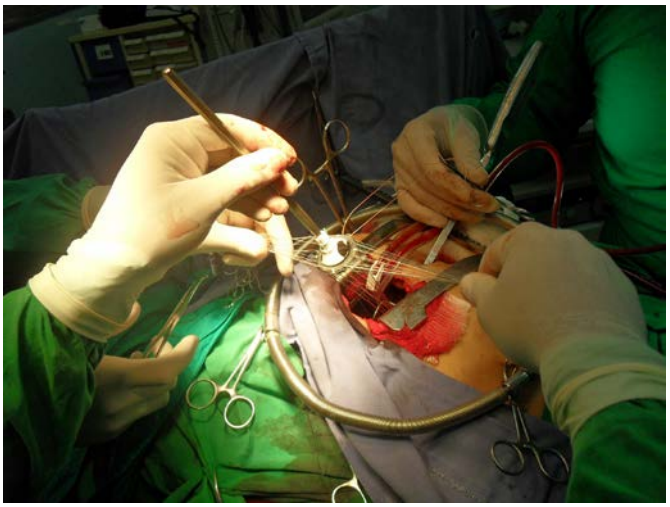

Figure. Aortic valve placement.

Hemogasometry and blood glucose were monitored throughout the perioperative period and any alteration of any of their values, was corrected imme-

diately. The level of heparinization was guided by activated coagulation times that were performed every hour, until its reversion. Before surgery ended a drainage with watermark was placed.

The 2 cases had, on average, an anesthetic time of 5.25 hours, 4.35 hours of operating time, 107 minutes of CPB and 65 minutes of aortic clamping. None of the 2 patients were transfused in the intraoperative and average final hematocrit was 0.27 %.

In the postoperative period encouraging results were also found. Patients were extubated at 5 hours on average, the average stay in the ICU was 20 hours and the average stay in the ward was seven days, with ambulatory monitoring of anticoagulation.

Postoperative pain was prevented in all cases with intraoperative intravenous administration of 100 mg tramadol and 75 mg diclofenac, with intercostal blockade also intraoperative, with absolute alcohol. Conventional analgesics followed. Ambulation was started at 24 hours.

DISCUSSION

The minimally invasive aortic valve replacement is a safe procedure and feasible to perform with the anesthetic technique described and is used in our Cardiology Hospital. Its main advantages are: it is less invasive, reduction of infection and bleedingrisk, of transfusion requirements, postoperative pain and time of intubation and of postoperative mechanical ventilation, in addition, it offers better healing and cosmetic surgical scar. There is little possibility of developing mediastinitis because mediastinal opening is minimal and there is no risk of sternal dehiscence since no sternotomy is performed. Furthermore, as the recovery is faster and has fewer complications, there is a decrease in hospital stay and total cost of surgery.

Difficulties to perform and implement minimally invasive procedures are not only due to the surgical technique, but mainly to the anesthetic technique[7,8]. Three years ago, a project of anesthetic conduction was designed and implemented at CIMEQ Cardiology Hospital[9] which allowed to perform first “simple" and short duration techniques such as the video-assisted placement of epicardial electrodes and transthoracic pericardial windows and afterwards myocardial revascularization and later, with the addition of CPB, mitral valve replacements[6], and more recently, aortic valve replacements. These myocardial revascularizations and valve replacements were performed, using this technique, for the first time in Cuba.

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