# Anterior lateral minithoracotomy as a surgical approach for aortic valve transplantation due to endocarditis

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**Abstract**

**Introduction:** Infective endocarditis is a destructive disease that affects the endothelium and other cardiac structures. It has a high mortality rate due to its difficult diagnosis. Timely surgical intervention in patients with clinical criteria or who have complications arising from this infectious process can be performed via minimally invasive surgery.

**Clinical case:** A 66-year-old male patient with a history of arterial hypertension was transferred to the hospital with persistent fever during hospitalization for the management of a cerebrovascular event. Physical examination revealed a diastolic murmur in the aortic foci, and laboratory findings revealed leukocytosis. Echocardiogram and magnetic resonance revealed aortic regurgitation with a mobile vegetation on the non-coronary leaflet. He underwent antibiotic therapy and a right anterior minithoracotomy for valve replacement, with a favorable outcome.

**Conclusions:** Minimally invasive cardiac surgery for infective endocarditis maintains the quality, effectiveness and safety of the conventional method, with differences in favor of the former in less tissue damage, earlier functional recovery and lower risk of complications.

**Keywords:** endocarditis, aorta, mini-thoracotomy, case report.

## Introduction

Infective endocarditis (IE) is an inflammation of various heart structures. It has an annual incidence of 3 to 10 per 100,000 inhabitants and a 30-day mortality rate of up to 30%[1]. The pathognomonic lesion of IE is a vegetation, which develops as a result of the body's inflammatory response to a microorganism, leading to the aggregation of platelets, fibrin, and inflammatory cells. These vegetations are commonly found on different valves, with the aortic valve being the most frequently affected. This involvement causes valvular insufficiency and, subsequently, the development of heart failure—the most common and severe complication.

In addition, IE may present alongside other clinical conditions such as stroke, pulmonary embolism, meningitis, nephritis, collagen vascular disease, pneumonia, or urinary tract infections[2] [3].

Diagnosing IE is complex, as its clinical presentation can range from persistent fever alone to signs of left or right heart failure, depending on the valve involved, and may even appear with complications. Therefore, suspicion of IE is generally confirmed through blood cultures. Diagnosis primarily depends on both cardiac and non-cardiac risk factors, along with the modified Duke criteria, which have a sensitivity of 80%.

Currently, a multimodal imaging approach is recommended, with echocardiography as the gold standard, complemented by other modalities such as computed tomography and nuclear imaging[4].

Both medical treatment with an antibiotic regimen based on culture results and extensive debridement or removal of the infectious focus are key to achieving adequate recovery. Such intervention is required in up to 50% of acute endocarditis cases, 20% of subacute cases, and 40% of chronic cases. Advances in surgical techniques in cardiovascular surgery have significantly improved outcomes, safety, and early patient recovery through the implementation of minimally invasive surgery (MIS)[5].

We present the case of a patient with severe damage to the non-coronary cusp of the aortic valve, a large vegetation, and a complication involving a thrombotic event in the right middle cerebral artery, who underwent intervention using MIS.

**Case Presentation**

A 66-year-old male patient, born in Colombia and currently residing in Guayaquil. He is a retired business engineer with a diagnosis of arterial hypertension from two years ago. He reports no use of tobacco or alcohol and engages in moderate physical activity. His surgical history includes a right inguinal hernioplasty performed 10 years ago. Blood type: O Rh positive. Family history includes arterial hypertension in his father and siblings.

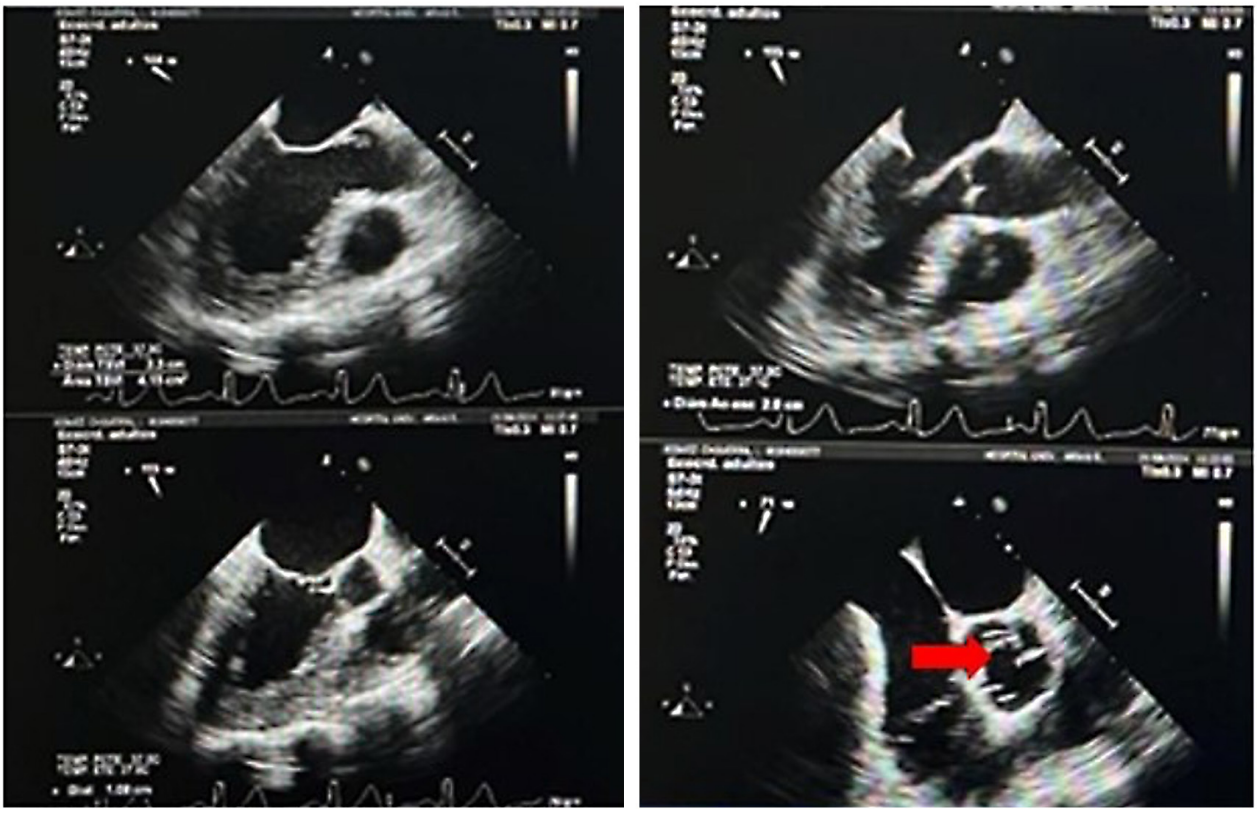
The clinical picture began with an intense holocranial headache that persisted for a month without responding to conventional analgesia. Subsequently, the patient experienced sudden disorientation in time and person, prompting emergency evaluation. On physical examination, dysarthria and left central facial paralysis with a clear deviation of the oral commissure were observed.

He was initially treated at a private clinic in Guayaquil, where a cranial CT scan revealed an ischemic cerebrovascular event in the right middle cerebral artery. He was prescribed acetylsalicylic acid, clopidogrel, and rosuvastatin. During hospitalization, the patient developed fever with poor response to antipyretics for four days, leading to his transfer to José Carrasco Arteaga Hospital in Cuenca, Ecuador.

Upon arrival, initial assessment showed a heart rate of 74 bpm, respiratory rate of 19 bpm, blood pressure of 96/44 mmHg, temperature of 37.5°C, and oxygen saturation of 94%. On physical examination, the patient was alert and oriented. Skin exhibited decreased turgor and elasticity. The chest showed reduced elasticity and expandability, with preserved vesicular breath sounds. Heart sounds were rhythmic and synchronous with the pulse; a 2/6 early diastolic murmur was auscultated at the aortic focus. No Osler nodes or Janeway lesions were found. Muscle strength and tone were preserved.

Blood tests revealed only a slight leukocytosis at 11,000/$mm^3$. A transesophageal echocardiogram and MRI were performed, revealing the following findings: left atrial dilation of 40 ml/$m^2$, a 12 mm vegetation, rupture of the non-coronary cusp of the aortic valve (AV), severe aortic regurgitation with a vena contracta of 6.3 mm, holodiastolic reverse flow in the descending aorta, prolonged mitral inflow relaxation pattern, mild left ventricular (LV) diastolic dysfunction, and a left ventricular ejection fraction (LVEF) of 67% (see Figure 1).

**Figure 1**. Echocardiogram: Tricuspid aortic valve, moderate regurgitation secondary to lack of cusp coaptation. The red arrow indicates a 12 mm thread-like, highly mobile mass adhered to the posterior or non-coronary semilunar cusp.



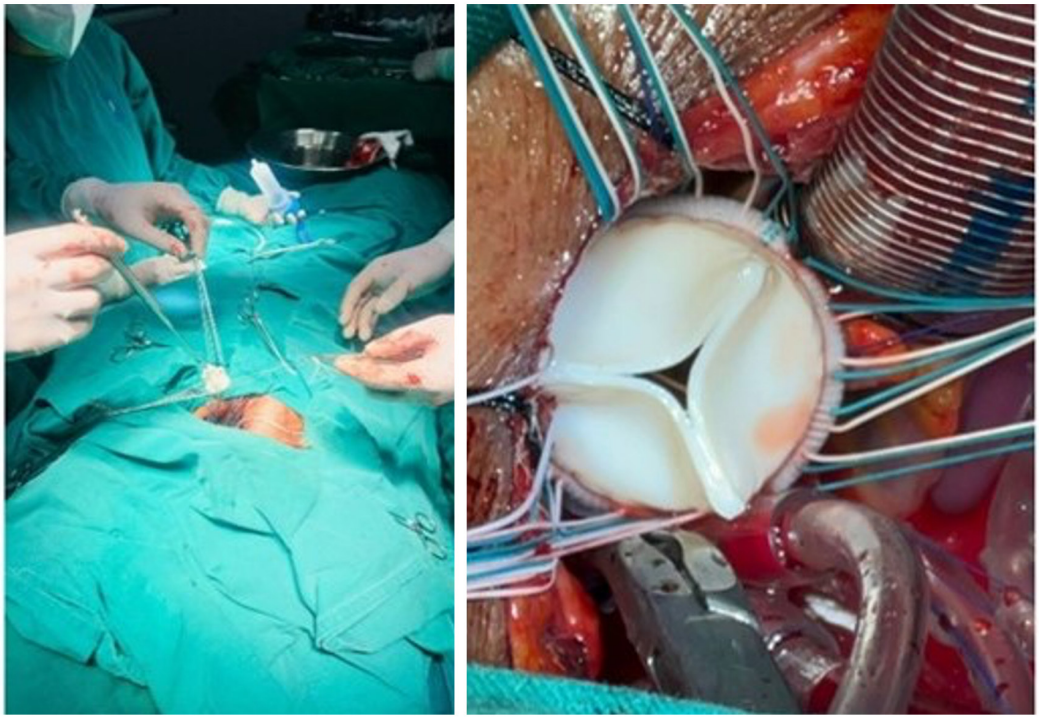
*Own Elaboration

After obtaining blood cultures, empirical antibiotic treatment with ampicillin was initiated, suspecting bacterial endocarditis. A few days later, the blood cultures tested positive for *Streptococcus gallolyticus*, which was sensitive to ceftriaxone. The antibiotic was then switched, and treatment was continued for 34 days with favorable clinical progression. The diagnosis of infectious endocarditis was confirmed based on positive Duke criteria, and minimally invasive surgery (MIS) was planned to remove the infectious focus via right anterior mini-thoracotomy (RAMT) for aortic valve replacement (AVR).

An anterior thoracotomy was performed with a 4 cm horizontal incision over the third rib, starting at the right parasternal region, followed by intercostal muscle dissection, pericardiotomy, and pericardial marsupialization. Heparin was administered to achieve an optimal activated clotting time. A 4-0 Prolene purse-string suture was placed on the left femoral artery for arterial cannulation and on the right atrium for venous cannulation. The

aorta and venae cavae were cannulated using a dual-stage cannula, secured with 4-0 Prolene purse-string sutures. Once cardioplegia was achieved at a temperature of 32°C and with the patient on cardiopulmonary bypass, an inverted U-shaped aortotomy was performed to expose the aorta and its valve, providing access to the coronary ostia. A size 21 biological prosthesis was then implanted, with polyester sutures and pledget reinforcement placed around it (see Figure 2).

**Figure 2.** Placement of a prosthetic valve through mini-thoracotomy.



*Own Elaboration

After implantation of the new valve, the aortic root was closed using 4-0 Prolene, and rewarming was initiated. A pacemaker lead was placed on the epicardium over the free wall of the ventricle, and its function was verified. The aortic clamp was then removed, and sinus rhythm was successfully restored. With the patient hemodynamically stable, cardiopulmonary bypass was discontinued, and decannulation of the femoral artery and right atrium was performed. Protamine was administered to reverse the effects of heparin, and a right chest tube was placed and secured with 2-0 polyester suture. Once adequate hemostasis in the thoracic cavity was confirmed, the fascia was closed with Vicryl and the skin with Monocryl (see Figure 3). Total cardiopulmonary bypass time was 1 hour and 46 minutes, with a cross-clamp time of 1 hour and 32 minutes. The surgery proceeded without complications.

**Figura 3.** Cierre de herida quirúrgica de aproximadamente 4 cm y tubo de tórax derecho.

*Own Elaboration

After the procedure, the patient was transferred to the intensive care unit for monitoring and recovery. He remained in sinus rhythm with patent drainage and was extubated without complications. The patient reported good tolerance to postoperative pain and expressed satisfaction with the perceived size of the scar.

A week later, a follow-up echocardiogram was performed, showing the following findings: prosthetic aortic valve with a maximum systolic gradient of 21 mmHg, no paravalvular leak, and no structural abnormalities in the mitral and tricuspid valves. Mild pericardial effusion, with no evidence of thrombi or vegetations. Left ventricular systolic function was preserved with an ejection fraction (LVEF) of 57%, and grade I diastolic dysfunction.

**Discussion**

The challenges of infective endocarditis (IE) are varied, but many are manageable. The value of early diagnostic strategies and surgical treatment plays an increasingly important role, although there is currently a wide variation in outcomes[6]. Despite advances in transcatheter therapy, surgical aortic valve replacement remains the gold standard, especially in young and low-risk patients[7]. For this procedure, full median sternotomy (FMS) has been the approach of choice for several years, offering broad access to cardiac anatomy and extensive exposure to the great vessels. However, FMS carries serious complications, such as sternal disruption and mediastinal infection, which occur in 0.3–5% of cases, and these issues are associated with a mortality rate between 14% and 47%[8]. Pain is another complication that, in many cases, is disabling for a long period, and sometimes for life. Abnormal scar formation is a major source of morbidity after sternotomy, and the presence of this scar can cause disturbances in body image, self-esteem, and cosmetic outcomes[9–11].

Randomized prospective studies have shown advantages of the anterior right mini-thoracotomy (ARMT) approach in terms of reduced bleeding, pain, postoperative trauma, and shorter intensive care and hospital stays, resulting in cost savings[12,13]. However, ARMT can sometimes lengthen aortic cross-clamp and cardiopulmonary bypass times compared to conventional surgery[14]. Additionally, in some studies, femoral artery cannulation has been associated with an increased risk of postoperative stroke[15]. Nonetheless, several meta-analyses have found no significant differences in terms of postoperative mortality[14,16]. Although ARMT may have a steeper learning curve, as surgical experience increases, operative times progressively decrease[17].

North American and European experience has shown that the ARMT approach is safe for aortic valve replacement (AVR)[18]. However, experience in Latin America remains limited. Countries in the region such as Peru, Colombia, Uruguay, and Cuba have implemented this technique several years

earlier[19–21]. A case series of 54 patients published by Ríos-Ortega et al. in the neighbor country Peru reported a 0% mortality rate and a 3.7% incidence of major valve-related adverse events within 30 days after the procedure[19]. Similarly, the meta-analysis by Phan et al. suggested that AVR via ARMT is associated with reduced mortality, ICU stay, overall hospitalization time, renal failure, transfusions, and pain[14].

The main limitations of our study lie in the fact that, as one of the first documented cases of AVR via ARMT at the local level, we do not yet have enough information to comprehensively assess the advantages and disadvantages of this minimally invasive approach compared to the traditional surgical method. The lack of prior data limits our ability to draw firm conclusions regarding the benefits, risks, and potential complications associated with this technique in the context of minimally invasive cardiac surgery.

## Conclusion

In patients with clear surgical criteria due to infectious endocarditis, as in this case, the minimally invasive approach for aortic valve replacement proved to be a safe and effective alternative. It is worth highlighting the advantages of this technique: reduced tissue trauma and blood loss, shorter recovery time, decreased risk of complications, and improved postoperative pain tolerance as well as cosmetic satisfaction with the resulting scar.

## Bioethical Considerations

The case was conducted under bioethical principles and written informed consent was obtained from the patient.

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