CASE REPORT
Vol. 11 No. 3 July-September 2026
doi: 10.35366/123487

Yang-Y in reoperation: a case report

Y de Yang en reoperación: reporte de un caso

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ABSTRACT

We present the case of a 27-year-old woman with cyanotic congenital heart disease due to a ventricular septal defect that was complicated by endocarditis in 2017. Following corrective surgery and aortic valve replacement, she developed prosthetic valve dysfunction in 2025, necessitating reintervention utilizing the Yang Y-incision technique. This approach enlarges the aortic annulus and mitral-aortic continuity, which makes it easier to place a larger prosthesis. This case underscores the successful surgical management of a young patient with a complex medical history and highlights the utility of this technique in complex reoperations.

Keywords: aortic valve, aortic root enlargement, cardiac surgical procedures, reoperation, surgical aortic valve replacement, Yang Y-incision technique.

RESUMEN

Presentamos el caso de una mujer de 27 años de edad con cardiopatía congénita cianótica secundaria a un defecto del tabique interventricular que se complicó con endocarditis en 2017. Tras una cirugía correctiva y un reemplazo valvular aórtico, desarrolló disfunción valvular protésica en 2025, lo que requirió una reintervención mediante la técnica de incisión en Y de Yang. Este abordaje amplía eficazmente el anillo aórtico y la continuidad mitroaórtica, facilitando así la colocación de una prótesis de mayor tamaño. Este caso destaca el éxito del tratamiento quirúrgico de una paciente joven con antecedentes médicos complejos y destaca la utilidad de esta técnica en reoperaciones complejas.

Palabras clave: *válvula aórtica, agrandamiento de la raíz aórtica, procedimientos quirúrgicos cardíacos, reoperación, reemplazo quirúrgico de la válvula aórtica, técnica de incisión en Y de Yang.*

A prosthetic valve dysfunction can lead to signs or symptoms compatible with heart failure due to the improper functioning of cardiac valves, which may be biological or mechanical. Despite the benefits provided by prosthetic valves, recipients may develop new pathologies; therefore, these mechanisms can be classified as intrinsic or extrinsic. Intrinsic prosthetic dysfunction, also known as primary structural failure of the prosthesis, is mainly related to the lifespan of the valve, associated with material wear or fracture in mechanical prostheses, and leaflet calcification in biological valves. Extrinsic dysfunction refers to any cause external to the valve itself that results in its disruption. It is generally associated with paravalvular leak, which is the most common, inappropriate prosthesis size relative to the recipient annulus, hemolytic anemia, pannus entrapment, or prosthetic thrombosis. When prosthetic dysfunction or secondary complications are suspected, a series of paraclinical tests must be performed to optimally evaluate

How to cite: Ramírez-Zedillo D, de Paz-Ocaña A, Alcalá-Gutiérrez DA, Peña-Quintero KV, Bustos-Romero M, Gómez-Manríquez J. Yang-Y in reoperation: a case report. Cir Card Mex. 2026; 11 (3): 118-121. https://dx.doi.org/10.35366/123487

Received: 11-02-2025. Accepted: 01-09-2026.

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the patient and subsequently determine the appropriate management.[1,2]

Aortic annulus enlargement with the Yang Y-incision was first described by Bo Yang in 2021. Initially named the "Y-incision/rectangular patch," it was later renamed in honor of its creator and is now known as the "Yang Y-incision." Typical indications include patients with a small aortic annulus and those undergoing surgical reintervention after prior valve replacement who present with dysfunction of the existing prosthesis, as in this clinical case report. This technique allows the implantation of a larger prosthesis without compromising adjacent structures, reducing the risk of patient-prosthesis mismatch and improving long-term hemodynamic performance. Timely decision-making and detailed planning are essential to avoid future complications.[3,4]

CASE DESCRIPTION

We report the case of a 27-year-old woman with a complex cardiovascular clinical history of acyanotic congenital heart disease, specifically a perimembranous ventricular septal defect, complicated by infective endocarditis involving the native aortic valve during pregnancy in 2017. This condition required emergency cesarean delivery followed by concomitant mechanical aortic valve replacement and patch closure of the ventricular septal defect. The patient remained under cardiology surveillance; however, during the year preceding the current admission, she developed progressive deterioration in functional capacity, manifested by worsening exertional dyspnea, marked reduction in exercise tolerance, and recurrent syncopal episodes, consistent with advanced prosthetic valve obstruction. Transthoracic echocardiography demonstrated severe dysfunction of the mechanical aortic valve secondary to extensive pannus formation, with elevated transprosthetic gradients and significant obstruction to left ventricular outflow, warranting surgical reintervention.

Surgical reintervention was performed under balanced general anesthesia with invasive arterial and central venous monitoring. Peripheral cardiopulmonary bypass was established via left inguinal exposure. After systemic heparinization, purse-string sutures of 4-0 Prolene were placed on the femoral artery and vein. Arterial inflow was achieved using a 19-Fr femoral arterial cannula, and venous drainage was obtained with a 21-Fr femoral venous cannula. Cardiopulmonary bypass was initiated, and the patient was cooled systemically. Myocardial protection was achieved using cardioplegic arrest following cross-clamping of the ascending aorta. A transverse aortotomy was performed approximately 1 cm above the sinotubular junction, providing optimal exposure of the aortic root and prosthetic valve.

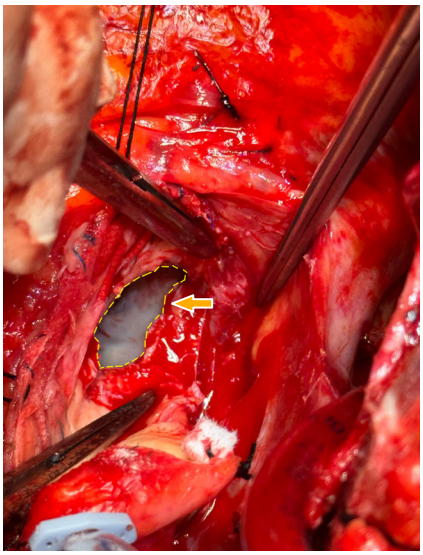

Figure 1:

Aortotomy and removal of mechanical aortic valve with pannus.

Intraoperative inspection revealed circumferential pannus overgrowth extending from the annulus into the subvalvular region, severely restricting leaflet motion. The mechanical prosthesis was carefully explanted, and complete resection of pannus tissue was performed using sharp dissection to restore native annular contours while avoiding injury to adjacent structures *(Fig. 1)*.

Given the markedly small aortic annulus and concern for postoperative patient-prosthesis mismatch, annular enlargement was considered mandatory. Yang Y-incision technique was selected due to its ability to provide substantial annular and root enlargement while preserving aortic root geometry. A Y-shaped incision was created, extending from the nadir of the non-coronary sinus and bifurcating toward the left coronary sinus, traversing the annulus and entering the fibrous trigones. This incision was subsequently reconstructed using a tailored Dacron patch, sutured meticulously to enlarge both the annulus and the adjacent sinuses, thereby increasing the effective annular diameter *(Fig. 2)*.

Following annular and root reconstruction, a 21-mm bioprosthetic aortic valve was implanted in the supra-annular position using interrupted, pledgeted 2-0 Prolene sutures placed evenly around the enlarged annulus to ensure uniform load distribution and optimal seating. Valve orientation was carefully adjusted to avoid coronary ostial obstruction and to ensure symmetric leaflet opening. Prior to aortic closure, the prosthesis was thoroughly inspected, confirming unrestricted leaflet mobility and absence of paravalvular gaps. The aortotomy was closed in a continuous fashion using 4-0 Prolene. After de-airing maneuvers, the aortic cross-clamp was removed, restoring coronary perfusion and spontaneous sinus rhythm.

Temporary epicardial atrial and ventricular pacing wires were placed prophylactically. The patient was successfully weaned from cardiopulmonary bypass on the first attempt, demonstrating stable hemodynamics without the need for inotropic or mechanical circulatory support. Transesophageal echocardiographic assessment confirmed appropriate prosthetic valve function, low transvalvular gradients, and no evidence of paravalvular leak.

Aortic root enlargement using Yang Y-incision technique is depicted in *Fig. 3*, illustrating the characteristic bifurcated extension through the non-coronary and left coronary sinuses with patch augmentation. This configuration allows for significant expansion of the aortic annulus and root, facilitating implantation of a larger prosthetic valve and effectively mitigating the risk of patient–prosthesis mismatch while maintaining physiologic aortic root geometry *(Fig. 3)*.

Following separation from cardiopulmonary bypass, decannulation was performed in a standard fashion with meticulous hemostasis. A left-sided chest tube was positioned toward the left pleural cavity, and an additional right pleural tube was placed for adequate bilateral pleural drainage. Mediastinal closure was performed in layers. The sternum, noted to be of poor bone quality, was approximated using two crossed stainless-steel wires and one simple wire to enhance stability. Intraoperative findings included dense and loose pericardial and epicardial adhesions, consistent with the patient's history of prior median sternotomy.

COMMENTARY

In patients with previous prosthetic valve replacement, reintervention represents a therapeutic challenge due to the need to preserve hemodynamic stability as much as possible in the setting of prosthetic dysfunction requiring aortic annulus enlargement, which is essential to prevent patient–prosthesis mismatch. Although classical techniques previously described have been viable therapeutic options, the Yang Y-incision technique offers an innovative alternative that allows annular enlargement without compromising adjacent structures. The case presented highlights the usefulness of this technique in a rare and highly complex clinical scenario.[1,5,6]

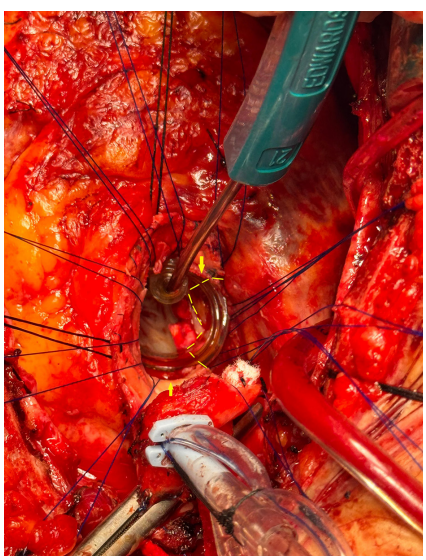

Figure 2:

Enlargement using the Yang Y-incision technique with Dacron patch.

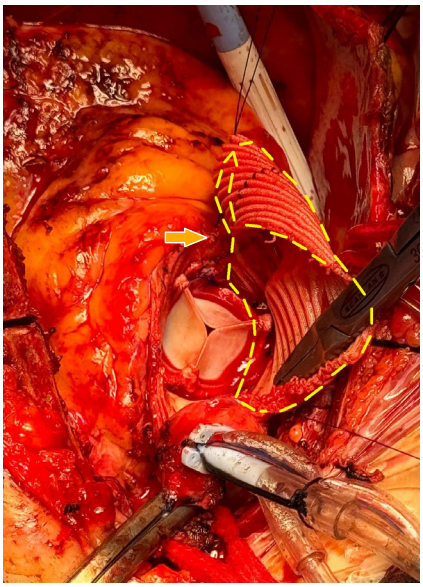

Figure 3:

Placement of biological prosthetic aortic valve replacement.

CONCLUSIONS

The Yang Y-incision technique has demonstrated safety and efficacy as an alternative in young patients with a small aortic root or the need for reintervention. This experience reinforces its value as a strategy for aortic annulus enlargement and for reducing complex clinical scenarios. Although the published experience is still limited and comes mainly from specialized centers,[2,7,8] the initial results support its inclusion as a valid option.

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Funding: none.

Disclosure: the authors have no conflict of interest to disclose.