ISSN 2954-3320

CIRUGÍA CARDIACA *EN* MÉXICO

Volume 10 - Issue 3 - July - September 2025

Official Journal of the
Sociedad Mexicana de Cirugía Cardiaca, A.C.
Colegio Mexicano de Cirugía Cardiovascular y Torácica, A.C.

SOCIEDAD MEXICANA DE CIRUGÍA CARDIACA A 1990 LABOR OMNIA VINCIT

COLEGIO MEXICANO DE CIRUGÍA CARDIOVASCULAR Y TORÁCICA, A.C.

AUTORIZADO Y AVALADO POR
LA DIRECCIÓN GENERAL DE PROFESIONES,
CON EL FOLIO F-455

CIRUGÍA CARDIACA *EN* MÉXICO

Official Journal of the Sociedad Mexicana de Cirugía Cardiaca, A.C.
and the Colegio Mexicano de Cirugía Cardiovascular y Torácica, A.C.

Contents

Cirugía Cardiaca en Mexico, Year 10, Vol. 10, Number 3, July-September 2025, is the Official Organ of the Sociedad Mexicana de Cirugía Cardiaca, A.C., and the Colegio Mexicano de Cirugía Cardiovascular y Torácica, A.C. is a quarterly publication edited by the Sociedad Mexicana de Cirugía Cardiaca, A.C. Administrative Offices: Juan Badiano No 1, Pabellón Santiago Galas Primer Piso, Colonia Sección XVI, Alcaldía Tlalpan, C.P. 14080, Mexico City, Mexico. Tel. 55 1315-0376. https://www.circardmex.org. E-mail: revmexcircard@gmail.com. Editor in charge: Dr. Ovidio A. García Villarreal. Número de Certifcado de Reservas de Derechos al Uso Exclusivo: 04-2019-041218174700-203. ISSN: 2954-3320, both granted by the Instituto Nacional del Derecho de Autor. Licitud de Título y Contenido: 16700, granted by the Comisión Calificadora de Publicaciones y Revistas Ilustradas de la Secretaría de Gobernación. Art, design, typesetting, prepress and printing by Graphimedic, S.A. de C.V., Coquimbo 936. Col. Lindavista, Alcaldía Gustavo A. Madero. Mexico City, Mexico. C.P. 07300. Tel. 5585898527 to 32. E-mail: graphimedic@medigraphic.com
Date of last modification: 30 of June of 2025.

Contents

Contenido / Contents

Volume 10 • Issue 3 • July-September 2025

EDITORIAL
Vol. 10 No. 3 July-September 2025
doi: 10.35366/120486

The evolving paradigm of Heart Team: challenges and opportunities

El paradigma en evolución del Heart Team: desafíos y oportunidades

Ovidio A. García-Villarreal* and Moisés C. Calderón-Abbo‡

* Mexican College of Cardiovascular and Thoracic Surgery. Mexico City, Mexico.
‡ Department of Cardiothoracic Surgery, Hospital Ángeles Lomas. Huixquilucan, Estado de Mexico, Mexico.

Keywords: cardiac surgery, Heart Team, interventional cardiology, structural heart disease, surgical aortic valve replacement, transcatheter aortic valve implantation.

Palabras clave: *cirugía cardíaca, Heart Team, cardiología intervencionista, enfermedad cardíaca estructural, reemplazo valvular aórtico quirúrgico, implante valvular aórtico transcatéter.*

A paradigmatic shift in cardiovascular care has been observed in recent years, driven by the advent of novel technologies, techniques, and therapies. The introduction of these innovations has yielded significant improvements in the quality of life and survival rates of patients with cardiovascular diseases.

Nevertheless, despite these advancements, decision-making in cardiovascular care remains a complex and multifaceted issue, often characterized by a lack of transparency and effective communication among healthcare professionals, patients, and their families. This can lead to suboptimal decision-making and, in some cases, adverse outcomes.

In response to these challenges, the concept of the Heart Team has emerged as a multidisciplinary approach aimed at enhancing coordination and communication among healthcare professionals to inform personalized decision-making for each patient.

This editorial will provide an in-depth examination of the Heart Team concept and its significance in contemporary cardiovascular care, highlighting the benefits and challenges of this approach and exploring strategies for improving transparency and communication in decision-making in cardiovascular care.

The Heart Team concept emerged in response to the need for a multidisciplinary approach in the SYNTAX trial, which evaluated patients with complex multivessel coronary artery disease who were potential candidates for both complete revascularization via percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG).[1] In the context of aortic valve disease, the Heart Team initially focused on assessing whether inoperable or high-risk surgical patients were suitable candidates for transcatheter aortic valve replacement (TAVR), considering vascular access safety and valvular anatomy suitability. Notably, the strategy has shifted from a balanced approach between PCI and CABG to a paradigm that prioritizes TAVR over surgical aortic valve replacement (SAVR), except in cases where TAVR is not viable or safe.[2,3]

According to the 2021 ESC/EACTS European guidelines for valvular heart disease (VHD), all interventions for cardiac valvulopathies should be performed in a Heart Valve Center. A Heart Valve Center is a center of excellence that must provide optimal care for treating cardiac valvulopathies. To achieve this, it must have departments of cardiology and cardiac surgery with 24/7 service and an experienced Heart Team comprising cardiologists, surgeons, imaging specialists, and

How to cite: García-Villarreal OA, Calderón-Abbo MC. The evolving paradigm of Heart Team: challenges and opportunities. Cir Card Mex. 2025; 10 (3): 77-78. https://dx.doi.org/10.35366/120486

Correspondence: Dr. Ovidio A. García-Villarreal. E-mail: ovidiocardiotor@gmail.com

anesthesiologists. Notably, while the European guidelines emphasize the importance of the Heart Team in treating cardiac valvulopathies, they do not specify a class of recommendation for its participation as such.[2] In 2020 ACC/AHA American guidelines for VHD, the class of recommendation is I, level of evidence C.[3] In contrast, the current recommendation for Heart Team participation in the context of coronary artery disease (CAD) is class I, level of evidence B-NR.[4]

Therefore, although the conceptualization of the Heart Team has been well-established, the effective implementation of the Heart Team remains the responsibility of each individual institution. However, this autonomy can lead to significant variability in the way the Heart Team is implemented, potentially impacting the quality and efficacy of care provided. Indeed, the composition of the Heart Team has undergone modifications. Initially, evaluation for TAVR required the participation of two cardiac surgeons, in addition to the cardiovascular surgeon. Nevertheless, over time, this requirement was relaxed, allowing for only one surgeon to be involved in the evaluation.[5]

Notwithstanding the aforementioned advancements, a critical limitation has been the inherent subjectivity and referral-physician dependency in determining clinical equipoise, which constitutes a profound obstacle to evidence-based decision-making.[6]

In this issue, Calderón et al.[7] present a case that illustrates the importance of adhering to evidence-based principles in clinical decision-making. Nevertheless, the optimal exercise of medical judgment necessitates the integration of current guidelines and best practices, facilitated by the collaborative participation of a seasoned and multidisciplinary Heart Team, thereby ensuring the most informed and effective decision-making outcomes, such as demonstrated by Calderón et al.[7]

The greatest challenge lies in ensuring that the Heart Team is a genuine multidisciplinary ensemble of specialists, boasting extensive experience in the realm of valvular heart disease, encompassing both surgical and clinical expertise, as well as imaging proficiency. To mitigate the risks of bias and malpractice, it is imperative to establish a mechanism for external auditing of these Heart Teams, which should be implemented on a routine basis. This would help prevent off-label use of cutting-edge technologies, thereby safeguarding patient outcomes and upholding the highest standards of clinical excellence.

REFERENCES

1. Head SJ, Davierwala PM, Serruys PW, et al. Coronary artery bypass grafting vs. percutaneous coronary intervention for patients with three-vessel disease: final five-year follow-up of the SYNTAX trial. Eur Heart J. 2014;35(40):2821-2830. doi: 10.1093/eurheartj/ehu213.
2. Vahanian A, Beyersdorf F, Praz F, et al; ESC/EACTS Scientific Document Group. 2021 ESC/EACTS Guidelines for the management of valvular heart disease. Eur Heart J. 2022;43(7):561-632. doi: 10.1093/eurheartj/ehab395.
3. Otto CM, Nishimura RA, Bonow RO, et al. 2020 ACC/AHA guideline for the management of patients with valvular heart disease: executive summary: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation. 2021;143(5):e35-e71. doi: 10.1161/CIR.0000000000000932.
4. Lawton JS, Tamis-Holland JE, Bangalore S, et al. 2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation. 2022;145(3):e18-e114. doi: 10.1161/CIR.0000000000001038.
5. Pavlidis AN, Perera D, Karamasis GV, et al. Implementation and consistency of Heart Team decision-making in complex coronary revascularisation. Int J Cardiol. 2016;206:37-41. doi: 10.1016/j.ijcard.2016.01.041.
6. Patterson T, McConkey HZR, Ahmed-Jushuf F, et al. Long-Term outcomes following heart team revascularization recommendations in complex coronary artery disease. J Am Heart Assoc. 2019;8(8):e011279. doi: 10.1161/JAHA.118.011279.
7. Calderón-Abbo MC, Carrillo-Cornejo M, Lara L, Arias-Rivera SA. Practical guidelines for aortic valve surgery and the current role of the Heart Team. Case report. Cir Card Mex. 2025;10(3):92-94.

Funding: none.

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

ORIGINAL ARTICLE

Vol. 10 No. 3 July-September 2025

doi: 10.35366/120487

Ventricular septal defect as a post-acute myocardial infarction complication, management in the acute phase

Comunicación interventricular como complicación de infarto agudo al miocardio, su manejo en fase aguda

Jaime G. López-Taylor, Carlos A. Jiménez-Fernández, David Ramírez-Cedillo, Italo Masini-Aguilera, Miguel A. Medina-Andrade and Alejandra Peña-Juárez

Thoracic and Cardiovascular Surgery Service. Hospital Civil de Guadalajara Fray Antonio Alcalde. Guadalajara, Jalisco, Mexico.

ABSTRACT

Introduction: post-acute myocardial infarction (AMI) ventricular septal defect (VSD) is a rare complication with high mortality. Its timely diagnosis is key to reducing mortality and surgery continues to be the treatment of choice. The objective of this study is to present the results of a series of cases of post-AMI VSD managed in the acute phase at our institution. **Material:** retrospective study, case series type where a total of six patients were evaluated during the period from 2020 to 2024. **Results:** the female gender predominated with 66.6% (n = 4), the average age in years was 70, the main risk factors were type 2 diabetes and accompanied by hypertension in 33.3%, respectively, subsequent heart attack was the main one (66.6%) as well as the apical VSD. There have been no reinterventions or mortality to date, only one patient has a residual defect. **Conclusions:** post-AMI VSD is a rare complication; surgery remains the treatment of choice with good results.

Keywords: acute myocardial infarction, ventricular septal defect, cardiac surgery.

RESUMEN

Introducción: *la comunicación interventricular (CIV) postinfarto es una complicación rara y con alta mortalidad. Su diagnóstico oportuno es clave para disminuir la mortalidad y la cirugía sigue siendo el tratamiento de elección. El objetivo de este estudio es presentar los resultados de una serie de casos de CIV postinfarto manejado en la fase aguda en nuestra institución.* ***Material:*** *estudio retrospectivo, tipo serie de casos, donde se valoraron un total de seis pacientes durante el periodo de 2020 al 2024.* ***Resultados:*** *el género femenino predominó con el 66.6% (n = 4), la media de edad en años fue de 70, los principales factores de riesgo fueron diabetes tipo 2 y acompañada de hipertensión en 33.3%, respectivamente, el infarto posterior fue el principal (66.6%) al igual que la CIV apical. No se presentaron reintervenciones ni mortalidad hasta el momento, solo un paciente presenta defecto residual.* ***Conclusiones:*** *la CIV postinfarto es una complicación rara y la cirugía sigue siendo el tratamiento de elección con buenos resultados.*

Palabras clave: *infarto agudo al miocardio, comunicación interventricular, cirugía cardíaca.*

How to cite: López-Taylor JG, Jiménez-Fernández CA, Ramírez-Cedillo D, Masini-Aguilera I, Medina-Andrade MA, Peña-Juárez A. Ventricular septal defect as a post-acute myocardial infarction complication, management in the acute phase. Cir Card Mex. 2025; 10 (3): 79-81. https://dx.doi.org/10.35366/120487

Received: 08-11-2024. Accepted: 04-21-2025.

Correspondence: Dra. Rocio Alejandra Peña Juárez. E-mail: alepejz@gmail.com

Abbreviations:
AMI = Acute Myocardial Infarction
CABG = Coronary Artery Bypass Grafting
VSD = Ventricular Septal Defect

Ventricular septal defect (VSD) after acute myocardial infarction (AMI) is a rare pathology with an approximate incidence of 1-2%, being associated with a mortality of almost 80% without surgical treatment. Surgery is recommended as a management with high morbidity and high risk of residual defect.[1]

As acute reperfusion strategies for AMI have evolved, post-AMI VSD is increasingly rare and is identified earlier in the course after AMI. However, despite current management strategies for AMI, the prognosis of VSD as a complication of AMI remains poor.[2]

We present a series of cases of post-heart attack VSD over a period of four years treated at our institution.

MATERIAL

This study is a descriptive, retrospective case series that was previously approved by the institutional ethics committee. Categorical variables were analyzed using percentages, while numerical variables were described in terms of their range as minimum and maximum values. The study included patients with a diagnosis of post-AMI VSD, confirmed by color Doppler echocardiography, who were presented at a medical-surgical meeting and accepted for surgical management between 2020 and 2024.

RESULTS

A total of six patients with post-AMI VSD were treated at our institution. The demographic and clinical characteristics of the patients are summarized as follows: the mean age was 70 years, with a female predominance (66.6%). The average interval between AMI and surgical intervention was eight days. Echocardiography was used to diagnose the septal defect in 66% of patients, while angiography was used in the remaining cases. Multiple coronary artery disease was present in 66% of patients, with diabetes mellitus type 2 and systemic arterial hypertension being the most common risk factors (33.3% each). Posterior myocardial infarction was the most common type (66.6%), and 50% of patients presented with cardiogenic shock at the time of intervention. The estimated risk by EuroSCORE was 41 ± 24 *(Table 1)*.

Table 1: Demographic variables (N = 6).

Variable	n (%)
Gender	
Female	4 (66.6)
Male	2 (33.3)
Age (years)	
Mean	70
Minimum	62
Maximum	75
Risk factors	
Diabetes mellitus 2	2 (33.3)
Diabetes mellitus and arterial hypertension	2 (33.3)
Smoking	1 (16.6)
Arterial hypertension	1 (16.6)
Location of the infarction	
Posterior wall	4 (66.6)
Anterior wall	2 (33.3)

Table 2: Surgical and post-surgical variables.

Variable	Frequency Range (Mean)
CPB time (minutes)	111-176 (150)
Aortic clamping (minutes)	90-123 (89)
Surgical time (hours)	5-8 (6)
Ventilation time (hours)	5-9 (6)
Time spent in therapy (days)	3-9 (4)
Mortality	0
Reintervention	0

CPB = cardiopulmonary bypass.

Surgical treatment involved median sternotomy with moderate hypothermia and cardiopulmonary bypass in all cases. Anterograde cardioplegia with crystalloid solution was administered, and closure of the VSD was performed with a double patch technique in all patients. The VSD was approached through the infarcted area of the left ventricle in 17% of patients and through the right atrium in 83%. Concomitant coronary artery bypass grafting (CABG) was performed in 66.6% of patients, using the left internal mammary artery and saphenous vein grafts in all cases. The mean cardiopulmonary bypass time was 150 minutes, the mean aortic clamping time was 89 minutes, and the mean surgical time was 6 hours. All patients underwent postoperative echocardiography evaluation *(Table 2)*.

Postoperative management included a mean ventilation time of six hours and a mean hospital stay of five days. Patients were divided into groups based on ventilation time (< 6 hours or > 6 hours) and hospital stay (< 5 days or > 5 days). The majority of patients (66.6%) required ventilation for more than 6 hours, and a similar proportion had a hospital stay longer than five days. These patients were more likely to have undergone concomitant CABG and VSD closure after AMI. Only two patients had residual shunt, and no patient required reintervention. There was no surgical mortality, and the mean follow-up period was two years, with only one patient requiring rehospitalization for a non-cardiac cause *(Table 2)*.

DISCUSSION

The incidence of VSD following AMI has decreased significantly with the advent of modern revascularization strategies. According to recent reports, the incidence of VSD after AMI is approximately 1-2%.[2] Furthermore, hospitalizations for this condition have declined substantially, with a reported decrease of 41.6% between 1999 and 2014, attributed to advancements in reperfusion techniques.[3]

The mortality rate for VSD post-AMI remains high, approximately 80%, if left untreated. Surgical intervention is generally considered the management of choice,[4] although percutaneous management has been reported to yield good results in select cases.[1] Nevertheless, surgery continues to be the preferred treatment option.[3] Several independent risk factors have been identified for developing VSD as a complication of AMI, including advanced age, female sex, previous ischemic injury, and chronic kidney disease.[2]

In most studies, female predominance is observed, consistent with our series. The underlying cause of this phenomenon remains uncertain; however, it is hypothesized that factors such as advanced age, atypical symptoms, and delayed management may contribute to the higher incidence in women.[5] Additionally, anatomical differences, such as a thinner septum in women compared to men, may also play a role.[6]

The American College of Cardiology Foundation/American Heart Association guidelines recommend immediate surgical intervention for patients with post-AMI VSD to improve hemodynamic status, classifying it as a surgical emergency.[7] However, some studies suggest that delaying surgery for 21 days after AMI may be associated with lower mortality rates.[5] Nevertheless, advances in surgical techniques and myocardial preservation have been shown to improve outcomes in most patients with post-AMI VSD.[6] Given the low incidence of this condition, we believe that the optimal timing of surgery should be determined on a case-by-case basis, considering the individual patient's morbidities and the center's expertise.

Another topic of ongoing debate is the role of CABG and VSD closure. While the issue remains controversial, several studies have found no significant association between CABG and perioperative mortality,[2] which is consistent with our series, where over 50% of cases underwent concomitant CABG without an increase in mortality. However, our series did reveal that these patients had longer ventilation times and hospital stays, likely due to more extensive cardiac damage and greater left ventricular dysfunction.

The main limitations of this study are the small sample size and single-center design. Nevertheless, we believe that our results can provide valuable insights and serve as a reference point for further statistical discussion and analysis.

CONCLUSION

Despite a decline in incidence over recent decades, VSD as a complication of AMI continues to be associated with significant morbidity. Surgical repair remains the primary management strategy for this condition.

REFERENCES

1. Rodés-Cabau J, Figueras J, Peña C, Barrabés J, Anívarro I, Soler-Soler J. Comunicación interventricular postinfarto de miocardio tratada en fase aguda mediante cierre percutáneo con el dispositivo Amplatzer. Rev Esp Cardiol. 2003;56(6):623-625.
2. Jones BM, Kapadia SR, Smedira NG, Robich M, Tuzcu EM, Menon V, Krishnaswamy A. Ventricular septal rupture complicating acute myocardial infarction: a contemporary review. Eur Heart J. 2014;35(31):2060-2068. doi: 10.1093/eurheartj/ehu248
3. Topaz O, Taylor AL. Interventricular septal rupture complicating acute myocardial infarction: from pathophysiologic features to the role of invasive and noninvasive diagnostic modalities in current management. Am J Med. 1992;93(6):683-688. doi: 10.1016/0002-9343(92)90203-n
4. Lang RM, Badano LP, Mor-Avi V, Afilalo J, Armstrong A, Ernande L, et al. Recommendations for cardiac chamber quantification by echocardiography in adults: an update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. J Am Soc Echocardiogr. 2015;28(1):1-39.e14. doi: 10.1016/j.echo.2014.10.003
5. Arnaoutakis GJ, Zhao Y, George TJ, Sciortino CM, McCarthy PM, Conte JV. Surgical repair of ventricular septal defect after myocardial infarction: outcomes from the Society of Thoracic Surgeons National Database. Ann Thorac Surg. 2012;94(2):436-443. doi: 10.1016/j.athoracsur.2012.04.020
6. Koh AS, Loh YJ, Lim YP, Le Tan J. Ventricular septal rupture following acute myocardial infarction. Acta Cardiol. 2011;66(2):225-230. doi: 10.1080/ac.66.2.2071255
7. Ma D, Zhang Z, Zhang S, Wang Z, Zhang G, Wang C, et al. Treatment strategies for ventricular septal rupture after myocardial infarction: a single-center experience. Front Cardiovasc Med. 2022;9:843625. doi: 10.3389/fcvm.2022.843625

Funding: none.

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

CASE REPORT
Vol. 10 No. 3 July-September 2025
doi: 10.35366/120488

Coronary artery bypass grafting as a treatment strategy for ALCAPA syndrome: case report

Cirugía de revascularización coronaria como estrategia de tratamiento para el síndrome de ALCAPA: reporte de caso

Emmanuel E. Coyote-Armenia, Samantha Toledo-García, Daniel A. Alcalá-Gutiérrez, Felipe DJ. Torres-Perales, Armando González-Enríquez, Axel de Paz-Ocaña and Oscar E. Villaseñor-Esquivel

Department of Cardiac Surgery, Centro Médico Nacional de Occidente, Instituto Mexicano del Seguro Social. Guadalajara, Jalisco. Mexico.

ABSTRACT

Coronary artery anomalies include several congenital conditions characterized by abnormal origin or course of any of the three main epicardial coronary arteries. Anomalous origin of a coronary artery from the pulmonary artery is a rare congenital cardiac anomaly. Out of them, anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA) is the most common. We report the case of a patient with ALCAPA syndrome treated with coronary artery bypass grafting.

Keywords: anomalous left coronary artery from the pulmonary artery (ALCAPA), coronary artery anomalies, coronary artery bypass grafting, pulmonary artery.

RESUMEN

Las anomalías de las arterias coronarias incluyen varias afecciones congénitas caracterizadas por un origen o curso anormal de cualquiera de las tres arterias coronarias epicárdicas principales. El origen anómalo de una arteria coronaria a partir de la arteria pulmonar es una anomalía cardíaca congénita poco común. De éstas, el origen anómalo de la arteria coronaria izquierda a partir de la arteria pulmonar (ALCAPA, por sus siglas en inglés) es el más común. Presentamos el caso de una paciente con síndrome de ALCAPA tratado mediante revascularización coronaria.

Palabras clave: *arteria coronaria izquierda anómala procedente de la arteria pulmonar (ALCAPA), anomalías de las arterias coronarias, injerto de derivación de la arteria coronaria, arteria pulmonar.*

Abbreviations:
ALCAPA = Anomalous origin of the Left Coronary Artery from the Pulmonary Artery
ALCARPA = Anomalous origin of the Left Coronary Artery from the junction of the main and the Right Pulmonary Artery
AOCAPA = Anomalous Origin of the Coronary Artery from the Pulmonary Artery
ARCAPA = Anomalous origin of the RCA from the Pulmonary Artery
CABG = Coronary Artery Bypass Grafting
CCTA = Coronary Computed Tomography Angiography
CMR = Cardiac Magnetic Resonance
ICA = Invasive Coronary Angiography
LIMA = Left Internal Mammary Artery
LMCA = Left Main Coronary Artery
TTE = Transthoracic Echocardiogram

Anomalous origin of the coronary artery from the pulmonary artery (AOCAPA) is a rare congenital cardiac anomaly, with an incidence of 0.01% in

How to cite: Coyote-Armenia EE, Toledo-García S, Alcalá-Gutiérrez DA, Torres-Perales FDJ, González-Enríquez A, de Paz-Ocaña A, et al. Coronary artery bypass grafting as a treatment strategy for ALCAPA syndrome: case report. Cir Card Mex. 2025; 10 (3): 82-86. https://dx.doi.org/10.35366/120488

Received: 03-17-2025. Accepted: 04-02-2025.

Correspondence: Emmanuel Enrique Coyote-Armenia. E-mail: dremmanuelcoyote@gmail.com

the general population. There are three forms of AOCAPA; namely, anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA) is the most common one, accounting for 1 in 300,000 live births; anomalous origin of the RCA from the pulmonary artery (ARCAPA), and anomalous origin of the left coronary artery from the junction of the main and the right pulmonary artery (ALCARPA).[1]

Adults with ALCAPA are characterized by extensive and dilated coronary collateral arteries, cardiomegaly, mitral valve regurgitation, and/or reduced left ventricular ejection fraction. Adults with ALCAPA may be discovered at any point in adulthood and is often an incidental finding when symptoms such as angina pectoris prompt an investigation. Common symptoms of adult ALCAPA, when present, include palpitations from dysrhythmias, syncope, dyspnea, chest pain, and fatigue. ALCAPA is a well-known and important cause of sudden cardiac death in adult patients and should be considered in the differential diagnosis of cardiac arrest.[2]

Various diagnostic techniques can be used to investigate coronary anatomy and to assess the presence of high-risk features. Coronary computed tomography angiography (CCTA) is currently considered the gold standard.

Current guidelines recommend surgery for all ALCAPA patients regardless of age and symptoms due to lifelong risk of ischemia, ventricular dysrhythmias, and sudden cardiac death.[3,4] The aim of surgery is to restore a dual coronary system through the reimplantation of the anomalous vessel in the ascending aorta. Several techniques have been designed for this purpose: 1) direct translocation of the anomalous artery (coronary button transfer), which is the technique of choice; 2) the Takeuchi procedure can be performed by creating an intrapulmonary tunnel by means of a parietal flap from the pulmonary artery connecting the anomalous ostium to the aorta (when the anomalous ostium is too distant from the aorta); 3) the anomalous coronary artery can be detached from the pulmonary artery and prolonged to reach the aorta through either a tube created joining flaps from the aorta and the pulmonary artery or oblique coronary prolongation techniques; and finally, 4) coronary artery bypass grafting (CABG) may be an alternative.[5]

Early mortality within 30 days is around 10%, and survival at 20 years following ALCAPA repair has been reported in 86 ± 4%.[6]

We present herein the case of a patient with ALCAPA syndrome treated with ligation of the proximal left main coronary artery (LMCA) and CABG to the distal LMCA using left internal mammary artery.

CLINICAL CASE

A 31-year-old female with a history of dyspnea on exertion and edema in both legs was admitted to the hospital. The physical examination only revealed edema +/+++ in the lower limbs. Laboratory studies and chest X-ray did not show any alterations. An echocardiogram was performed revealing reverse flow in the proximal portion of the pulmonary artery, and coronary fistula was suspected. CCTA concluded an anomalous origin of the left main coronary artery from the pulmonary artery associated with an extensive network of collaterals between the right and left coronary circulation, and ectasia of all coronary arteries *(Figure 1)*. The heart team decided to take the patient for surgical correction of the congenital coronary anomaly.

Surgical procedure

The cardiac approach was performed through a median sternotomy. The pericardium was opened. ALCAPA was corroborated. Left internal mammary artery (LIMA) was harvested. Central cannulation on the ascending aorta and right atrium was used for cardiopulmonary bypass. Aortic and pulmonary cross clamps were used, and cardiac arrest was achieved using anterograde cardioplegia through the ascending aorta and proximal pulmonary artery. Ligation of the left main coronary artery at its origin on the pulmonary artery was made using a "U" stitch with 4-0 polypropylene suture reinforced with teflon pledget. An anastomosis was performed between LIMA and the distal portion of the left main coronary artery (just before its bifurcation into the

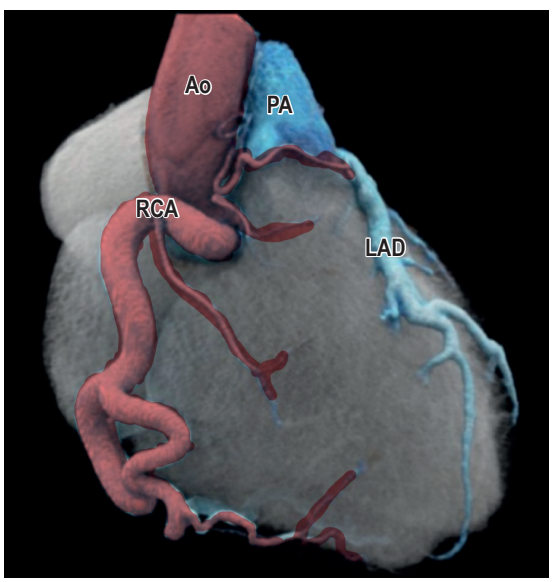


Figure 1: Coronary CT reconstruction showing the right coronary artery with its usual origin from the aorta and the left anterior descending artery with its anomalous origin from the pulmonary artery.
Ao = aorta. LAD = left anterior descending. PA = pulmonary artery. RCA = right coronary artery.

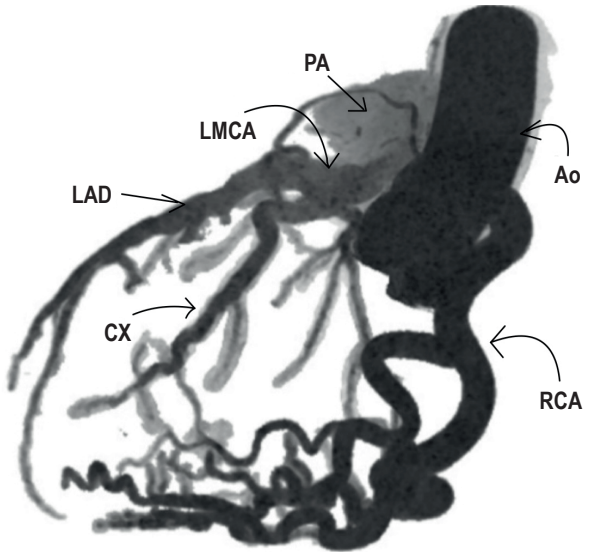


Figure 2: Coronary CT reconstruction showing the right coronary artery with its usual origin from the aorta and the left main coronary artery with an anomalous origin from the pulmonary artery.
Ao = aorta. CX = circumflex. LAD = left anterior descending. LMCA = left main coronary artery. PA = pulmonary artery. RCA = right coronary artery.

left anterior descending and circumflex arteries) using 7-0 polypropylene suture with a parachute technique *(Figures 2 and 3)*. Cardiopulmonary bypass was weaned off as per protocol. Cross-clamping and cardiopulmonary bypass time were 93 and 138 minutes, respectively. The patient had a satisfactory postoperative evolution, being extubated within the first six postoperative hours, and discharged from the hospital on the 4th day after surgery. The control electrocardiogram showed no evidence of ischemia. At two months of follow-up, the patient denied angina and improved to New York Heart Association functional class I.

COMMENT

AOCAPA is a rare congenital cardiac anomaly, with an incidence of 0.01% in the general population. As previously mentioned above, three forms of AOCAPA exist: ALCAPA, ARCAPA and ALCAPRA.[1] ALCAPA is the most common type, and was first clinically described in 1933 by Edward Bland, Paul Dudley White, and Joseph Garland, ALCAPA is, therefore, also known as Bland-White-Garland syndrome.[7]

The pathophysiological explanation of ischemia in patients with ALCAPA is as follows: after birth, pulmonary vascular resistance drops, resulting in retrograde flow from the left coronary artery to the pulmonary artery (left to right shunt); this, in turn, leads to reduced coronary perfusion, myocardial ischemia, and resultant ventricular dysfunction as well as other complications including dysrhythmias, mitral regurgitation, and sudden cardiac death. However, adequate collateral circulatory development can provide adequate coronary perfusion, resulting in a relatively asymptomatic clinical course in a select few, allowing for a late onset presentation, including during adulthood.[8,9]

ALCAPA is classified into two subtypes by age: those who present in infancy (85%) and, more uncommonly, those who present as older children, teens, or adults (15%), i.e., the so-called adult subtype.[2] Adult ALCAPA is characterized by extensive and dilated coronary collateral arteries, cardiomegaly, mitral regurgitation, and/or reduced left ventricular ejection fraction. Adult ALCAPA may be discovered at any point in adulthood and is often an incidental finding when symptoms such as angina pectoris prompt an investigation. Common symptoms of adult ALCAPA, when present, include palpitations from dysrhythmias, syncope, dyspnea, chest pain, and fatigue. ALCAPA is a well-known and important cause of sudden cardiac death in adult patients and should be considered in the differential diagnosis of cardiac arrest.[2] The symptoms reported by our patient, and for which the diagnostic approach was initiated, were dyspnea and edema. There was no angina, palpitations, or syncope. The physical examination only revealed edema +/+++ in the lower limbs.

Various diagnostic techniques can be used to investigate coronary anatomy and to assess the presence of high-risk features. CCTA is currently considered the gold standard.[5] Electrocardiographic findings suggestive of ALCAPA are abnormal deep or wide Q waves, inverted T waves, and poor R wave progression in leads I, aVL, and precordial lead V4 to V6. Our patient had poor R wave progression on these leads. Transthoracic echocardiogram (TTE) with

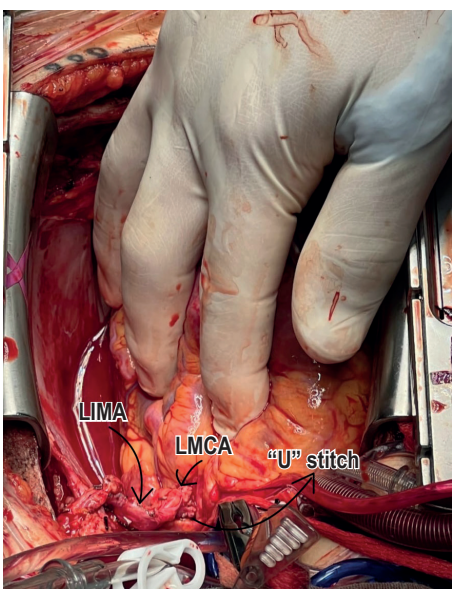


Figure 3:
Left internal mammary artery graft anastomosed to the distal left main coronary artery. A "U" suture was used to close the proximal portion of the left main coronary artery.
LIMA = left internal mammary artery. LMCA = left main coronary artery.

color Doppler is a safe, readily available, inexpensive, and portable noninvasive method for initial investigation used in all patients. Echocardiographic findings indicative of ALCAPA include visualization of the left coronary artery originating from the pulmonary artery, retrograde flow from the left coronary artery to the pulmonary artery, dilated and tortuous right coronary artery, lack of the left coronary artery at aortic origin, significant and dilated collateral coronary arteries, mitral regurgitation, left ventricular dysfunction with regional wall motion abnormalities, and enhanced echogenicity of papillary muscles. In our patient, an abnormal reverse flow could be observed in the pulmonary artery just above the pulmonary valve, which was initially misdiagnosed as a probable coronary fistula.[2] Invasive coronary angiography (ICA) was considered the most important and definite tool to identify and classify CAAs. However, because of its invasiveness, relatively low spatial resolution, and lack of 3-dimensional images, it has been progressively replaced by CCTA.[5] Typical findings on ICA include a dilated and tortuous right coronary artery with multiple collaterals to the left coronary system; anomalous flow into the pulmonary artery can also be seen. In our patient, ICA was not performed. Some features that can be seen on the CCTA are direct visualization of the left coronary artery originating from the pulmonary artery, a dilated right coronary artery with extensive coronary collateral arteries, abnormal left ventricular wall movement, and dilated bronchial arteries. In infants, the right and left coronary arteries may appear normal. However, the coronary arteries are dilated and tortuous in adults, with dilated intercoronary collateral arteries coursing along the epicardial surface of the heart or within the interventricular septum. In our patient, CCTA allowed us to make the appropriate diagnosis by observing the origin of the left main coronary artery from the pulmonary artery. In addition, there was an important collateral network between the right and left coronary circulation, as well as significant ectasia of the right coronary artery. Cardiac magnetic resonance (CMR) has emerged as an alternative to CCTA in patients with CAAs. In CMR, left ventricular hypertrophy secondary to chronic myocardial hypoperfusion, mitral insufficiency or prolapse, myocardial ischemia, left ventricular wall motion abnormalities, and delayed subendocardial enhancement imply ALCAPA. The retrograde flow from the left coronary artery to the main pulmonary artery, which represents the coronary steal phenomenon can be depicted on CMR.[2] In our patient, CMR was not performed.

Natural history studies of anomalous coronary artery from the PA (particularly anomalous left coronary artery from the PA) suggest poor outcome in untreated patients.[3] Myocardial ischemia is considered the primary cause of life-threatening events in patients with CAAs. Pulmonary origin of coronary arteries is invariably associated with severe impairment of myocardial perfusion. Although patients with anomalous pulmonary origin of the right coronary artery may be asymptomatic or complain of mild angina or dyspnea, some cases of severe symptoms and even SCD have been reported. On the contrary, anomalous pulmonary origin of the left coronary artery may be rapidly lethal in > 90% of cases, defining the so-called infant type. Notably, a later diagnosis, or adult type, should not be univocally associated with a good prognosis.[5]

Current guidelines recommend surgery for all ALCAPA patients regardless of age and symptoms due to lifelong risk of ischemia, ventricular dysrhythmias, and sudden cardiac death.[3,4] The aim of surgery is to restore a dual coronary system through the reimplantation of the anomalous vessel in the ascending aorta: direct translocation of the anomalous artery (coronary button transfer) is the technique of choice. When the anomalous ostium is too distant from the aorta, the Takeuchi procedure can be performed by creating an intrapulmonary tunnel by means of a parietal flap from the pulmonary artery connecting the anomalous ostium to the aorta. The anomalous coronary artery can be detached from the pulmonary artery and prolonged to reach the aorta through either a tube created joining flaps from the aorta and the pulmonary artery or oblique coronary prolongation techniques. Finally, coronary artery bypass graft surgery may be an alternative, especially in adults, in whom translocation can be difficult.[5] Our decision to proceed with revascularization surgery employing the left internal thoracic artery was based on two primary considerations. Firstly, the anatomical configuration of the left main coronary artery, which originated from the non-facing sinus, rendered translocation a technically demanding task. Secondly, our institutional experience with translocation techniques was limited.

Results after surgical repair are excellent. On a single center experience, a total of 78 patients underwent ALCAPA repair. Following repair, systolic LV and MV function improved significantly. Early mortality (within 30 days) was 10% (n = 8). No 30-day mortality was reported in the past 20 years. Survival at 20 years following ALCAPA repair was 86 ± 4%.[6]

CONCLUSION

ALCAPA is the most common form of AOCAPA. In adults (15% of all ALCAPA syndromes) is often an incidental finding when symptoms such as angina pectoris prompt an investigation. CCTA is considered the gold standard diagnostic technique. Current guidelines recommend surgery for all ALCAPA patients regardless of age and symptoms due to lifelong risk of ischemia, ventricular dysrhythmias, and sudden cardiac death. Direct translocation of the anomalous artery (coronary button transfer) is the technique of choice,

but it can be difficult to perform in adult patients, in whom CABG (preferably with an internal thoracic artery graft) is an excellent alternative. To our knowledge, there are no studies that analyze the long-term outcome of adult patients in whom ALCAPA was treated with CABG. We hope that our report contributes to the literature on patients with ALCAPA treated with CABG.

REFERENCES

1. Mishra A. Surgical management of anomalous origin of coronary artery from pulmonary artery. Indian J Thorac Cardiovasc Surg. 2021;37(Suppl 1):131-143. doi: 10.1007/s12055-021-01147-8.
2. Blickenstaff EA, Smith SD, Cetta F, Connolly HM, Majdalany DS. Anomalous left coronary artery from the pulmonary artery: how to diagnose and treat. J Pers Med. 2023;13(11):1561. doi: 10.3390/jpm13111561.
3. Stout KK, Daniels CJ, Aboulhosn JA, et al. 2018 AHA/ACC guideline for the management of adults with congenital heart disease: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol. 2019;73(12):1494-1563. doi: 10.1016/j.jacc.2018.08.1028.
4. Baumgartner H, De Backer J, Babu-Narayan SV, et al; ESC Scientific Document Group. 2020 ESC Guidelines for the management of adult congenital heart disease. Eur Heart J. 2021;42(6):563-645. doi: 10.1093/eurheartj/ehaa554.
5. Gentile F, Castiglione V, De Caterina R. Coronary artery anomalies. Circulation. 2021;144(12):983-996. doi: 10.1161/CIRCULATIONAHA.121.055347.
6. Lange R, Cleuziou J, Krane M, Ewert P, Pabst von Ohain J, Beran E, et al. Long-term outcome after anomalous left coronary artery from the pulmonary artery repair: a 40-year single-centre experience. Eur J Cardiothorac Surg. 2018;53(4):732-739. doi: 10.1093/ejcts/ezx407.
7. Bland EF, White PD, Garland WJ. Congenital anomalies of the coronary arteries: report of an unusual case associated with cardiac hypertrophy. Am Heart J. 1933;8:787-801.
8. Dodge-Khatami A, Mavroudis C, Backer CL. Anomalous origin of the left coronary artery from the pulmonary artery: collective review of surgical therapy. Ann Thorac Surg. 2002;74(3):946-955. doi: 10.1016/s0003-4975(02)03633-0.
9. Lin CT, Raman SP, Fishman EK. An algorithmic approach to CT of pulmonary arterial disorders. Clin Imaging. 2016;40(6):1226-1236. doi: 10.1016/j.clinimag.2016.08.015.

Funding: none.

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

CASE REPORT

Vol. 10 No. 3 July-September 2025

doi: 10.35366/120489

Interrupted aortic arch. A hybrid management: surgical-endovascular

Interrupción del arco aórtico. Un manejo híbrido: quirúrgico-endovascular

José J. Parra-Salazar* and Elizabeth Vera-Domínguez‡

* Department of Surgery. Hospital General de Puebla "Dr. Eduardo Vázquez Navarro". Puebla, Mexico.

‡ Department of Health Sciences. Universidad de las Américas Puebla. Puebla, Mexico.

ABSTRACT

Complex heart diseases represent a challenge for the cardiothoracic surgeon. Interruption of the aortic arch in adults is usually rare. The coexistence of arch interruption with other heart diseases that occur at this age is even rarer. The case presented here allowed surgical management by means of the interposition of a dacron graft, total correction of the common truncus arteriosus and placement of an endoprosthesis using endovascular therapy.

Keywords: aortic aneurysm, common arterial truncus, congenital heart disease, endovascular therapy, interruption of the aortic arch.

RESUMEN

Las cardiopatías complejas representan un reto para el cirujano cardiotorácico. La interrupción del arco aórtico en el adulto suele ser infrecuente. La coexistencia de interrupción del arco con otras cardiopatías que se presentan en esta edad es aún más raro. El caso aquí presentado permitió un manejo quirúrgico mediante la interposición de un injerto de dacrón, corrección total de tronco arterioso común y colocación de endoprótesis mediante la terapia endovascular.

Palabras clave: *aneurisma aórtico, tronco arterioso común, cardiopatía congénita, terapia endovascular, interrupción del arco aórtico.*

Interrupted aortic arch (IAA) is a rare heart disease, occurring approximately three times per million births.[1] It is the lack of continuity between the ascending and descending aorta. Rarely a condition that manifests in isolation. It is common to find AAI in association with other cardiac defects, for example: patent ductus arteriosus, ventricular septal defect mainly ventricular septal defect, left ventricular outflow tract obstruction, aorto-pulmonary window, aberrant innominate arteries.[2]

According to the classification of Celoria and Patton described in 1959, it is classified into three types: A, B and C. Type A is a discontinuity of the distal arch to the left subclavian artery at the level of the aortic isthmus, type B is a discontinuity between the left common carotid artery and the left subclavian artery, and type C refers to a discontinuity that occurs between the innominate artery and the common carotid artery. Type A is the most commonly reported in adult cases at 79%, while type B is the most commonly detected in the neonate at 53%.[3]

Common truncus arteriosus, truncus arteriosus from its Latin name, is a rare cyanotic congenital heart disease.[4] It has an estimated incidence of 1 in 10,000 births. It is described as a single arterial trunk arising from the heart through a

How to cite: Parra-Salazar JJ, Vera-Domínguez E. Interrupted aortic arch. A hybrid management: surgical-endovascular. Cir Card Mex. 2025; 10 (3): 87-91. https://dx.doi.org/10.35366/120489

Received: 10-15-2024. Accepted: 02-21-2025.

Correspondence: Dr. José Juan Parra-Salazar. E-mail: josejuanparrasalazar@gmail.com

single arterial valve. This artery is responsible for pulmonary, systemic and coronary circulation.[5] Different classifications of the defect have been described. The first known classification was elaborated by Collett and Edwards in 1949, based on the disposition of the origin of the pulmonary arteries from the common trunk.[6] Type I truncus arteriosus: there is a single pulmonary trunk connecting the right and left pulmonary arteries, this is the most common type. Type II: each main pulmonary artery has its own common origin in the trunk. Type III: each main pulmonary artery originates separately on the lateral side of the common trunk. Type IV: no pulmonary branch arises from the trunk, the pulmonary supply arises from collateral systemic arteries.[7] As for the Van Praagh classification, specifies the presence or absence of ventricular septal defect. The classification involves in the nomenclature the letter A for presence and B for absence. Type I and type II are similar to that described by Collett and Edwards. Type III: describes a branch of the pulmonary artery that originates in the trunk and the rest of the lung irrigation through collaterals or branches arising from the aortic arch. IV: corresponds to a hypoplastic aortic arch, interrupted or with a patent ductus arteriosus.[8]

CASE DESCRIPTION

We present the case of a 37-year-old female patient whose personal pathologic history includes the detection of a murmur during infancy, and who required hospitalization during birth. Without further information provided by the patient, the complete cardiologic history is unknown. Her current condition began with dyspnea on medium exertion, chest tightness, palpitations, nausea, headache with intensity 9/10 of oppressive type, tinnitus and lipotimia for 15 consecutive days. She went to a local hospital in her city of origin where she was hospitalized due to the symptoms described above. During her hospitalization she developed syncope and diaphoresis. Cardiogenic shock and atrial fibrillation of medium ventricular response was detected, being managed by pharmacological cardioversion with amiodarone, later requiring norepinephrine and dobutamine to maintain perfusory mean arterial pressure. She was sent to the hospital unit where she was asymptomatic and hemodynamically stable after transfer.

A first transthoracic echocardiogram was performed with generalized dilatation in the four chambers, decreased contractile dynamics, vena cava with diameters of 21 mm, distensibility of 33%. Subsequently, upon admission to our hospital unit in charge of cardiology, a second transthoracic echocardiogram was performed. Cardiomyopathy in dilated phase of undetermined origin, left ventricular systolic dysfunction with left ventricular ejection fraction of 43%, with abnormal global and segmental contractility due to global hypokinesia. Severe dilatation of the right chambers. Moderate mitral and tricuspid insufficiency, mild aortic insufficiency and severe pulmonary insufficiency. Severe pulmonary arterial hypertension due to pulmonary artery systolic pressure of 100 mmHg. Diagnostic cardiac catheterization was performed by interventional cardiology with the results of severe pulmonary arterial hypertension unresponsive to oxygen challenge, and an aortogram with anatomy compatible with common arterial trunk type I was performed *(Figure 1)*. Angiotomography with reconstruction of large vessels was performed, where the interruption distal to the subclavian artery and an aneurysmal dilatation were identified *(Figure 2)*. It was decided to evaluate the patient by the cardiac surgery service.

For surgical resolution the sternotomy approach was performed. A 7 mm dacron graft anastomosis is performed at the right subclavian level. Arterial cannula of 19 mm is placed. Sternotomy is performed, finding multiple collateral vessels, subsequent opening of the pericardium, supra-aortic trunks are surrounded. Bicaval venous cannulation is performed. Heparinization and initiation of cardiopulmonary bypass. Temperature decreases to 28 °C, emptying (continuous retrograde

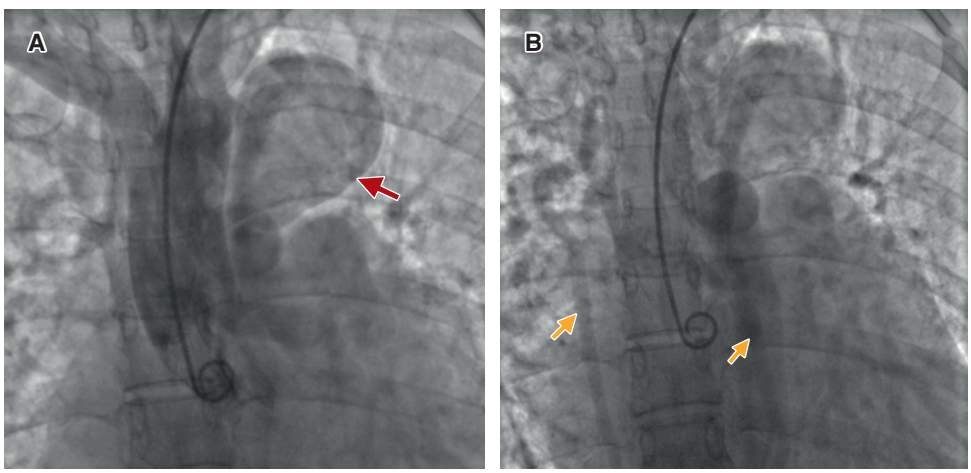


Figure 1:

A) Evidence of aneurysm in catheterization. **B)** Collateral vessels evidenced during catheterization.

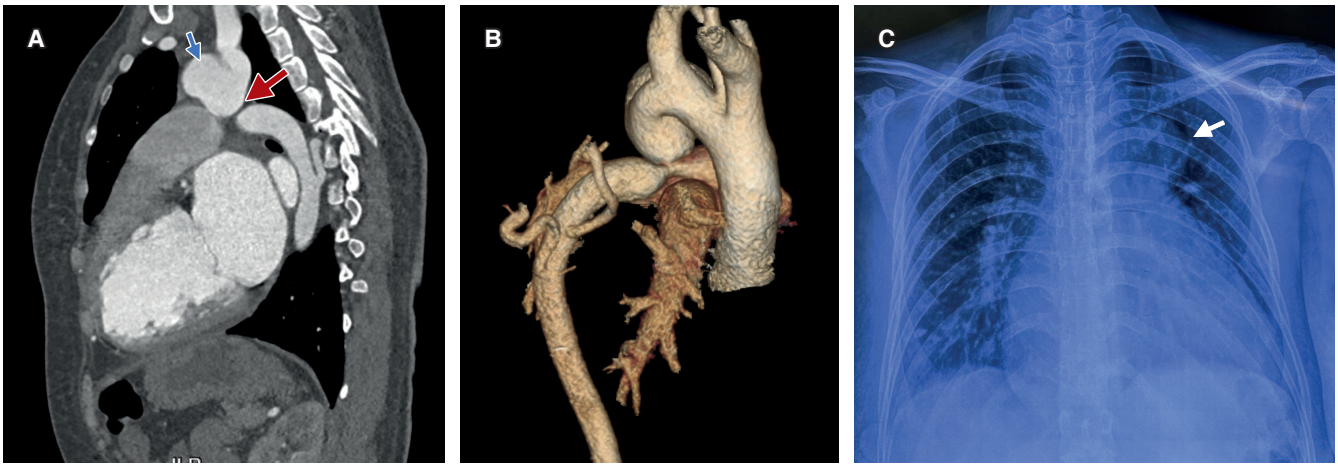


Figure 2: A) Sagittal CT scan showing aneurysm (blue arrow) and interruption of the aortic arch (red arrow). **B)** Reconstruction of great vessels. **C)** Preoperative chest X-ray showing a huge mass (white arrow).

perfusion through the brachiocephalic trunk). Aortic clamping and initiation of cardioplegia. Supra-aortic trunks and aortic isthmus are dissected up to their most distal portion. Aneurysm with fistula to the pulmonary artery trunk is identified. Aneurysm dissection of distal end of interruption of the aortic arch is performed, as well as pulmonary artery trunk identifying conduit. The aneurysm is resected, the pulmonary trunk is opened, the duct is sectioned and the descending aorta is identified. A 20 mm dacron graft is placed after placing the bigoteral in the distal end of the aortic mouth performing anastomosis with prolene 3-0 surgete, proximal anastomosis same technique *(Figure 3)*. After clamping, bleeding occurred at the distal site of the anastomosis, so a 26 × 10 mm zenith endoprosthesis was positioned under fluoroscopy. Hemostasis was corroborated, epicardial cables, drains and sternal closure were placed. The findings were aneurysm in proximal end of 5 × 8 cm, interruption of the aortic arch type A and type I truncus arteriosus without ventricular septal defect. The pump time was 3 hours and 28 minutes and the aortic clamping time was 2 hours and 2 minutes. After surgery, the patient was admitted to the intensive care unit *(Figure 4)*. He died fourteen days after surgery due to septic shock.

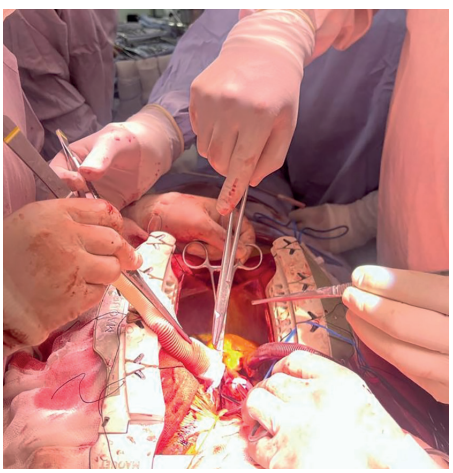


Figure 3: Dacron graft interposition.

COMMENT

A complex congenital heart disease represents an operative challenge. The arteriosocomun trunk is a complex cardiopathy that represents a low percentage of congenital cardiopathies, less than 1%, other references determine that.[9] Meanwhile, AAI represents a low incidence of 3 in 1'000,000 live births.[10] We present here the case of a patient in the fourth decade of life, who presents a complex heart disease, involving interruption of the aortic arch, common truncus arteriosus and patent ductus arteriosus. In addition to the findings, an aneurysm developed at the proximal level of the interruption. The occurrence of aneurysms in coexistence with congenital heart disease is extremely rare.

In the literature have been recently described two cases that have some similarity to the case presented here. One of the cases reported in the literature reported a male patient in the sixth decade of life, with a diagnosis of type A thoracic arch interruption and post-interruption thoracic aortic aneurysm. In this patient no ductal finding was described. The clinical presentation in this patient was characteristic of dyspnea and wheezing, as well as a history of arterial hypertension. Surgical resolution was by sternotomy, with interposition of a termino-terminal dacron graft.[11]

Another case found in the literature corresponds to a woman in her sixth decade of life with a diagnosis of

interrupted aortic arch with post-interruption aneurysm and bicuspid aortic valve. As in the previous case, there was a history of hypertension previously. The clinic involved decreased exercise tolerance, as well as claudication in the lower extremities. In this case, the patient did not receive any medical-pharmacological or medical-surgical care.[12] A case found which does not correspond to a rupture with aneurysm, is the one published by Ture, et al,[13] where the 5-month-old patient, who presented the diagnosis of common truncus arteriosus in coexistence with ruptured aortic arch type B and crossed pulmonary artery. The resolution was surgical, the aortic interruption was repaired, the Lecompte maneuver was performed, where the anterior pulmonary artery was brought to the aorta. It represents a rare case. In the presentation of our case, in comparison with the cases found in the literature, we can find that our patient did not present with the classic clinic in patients with interruption in adulthood. Patients who prevail into adulthood with this malformation usually present with hypertension, claudication, cardiac insufficiency.[7] Open repair of the interruption allows the interposition of a graft in the interruption, in the specific case of our case involving an aneurysm proximal to the interruption, allowing correction of this defect.

In our case, an endoprosthesis was placed after graft interposition. Initially, endovascular management had been planned. Due to the conditions and the complexity of the cardiopathy, it was decided to use sternotomy, with hybrid management of the endoprosthesis placement. The type of endovascular prosthesis used in this case was the Cook Medical Zenith Alpha Thoracic® (Cook Medical, Bloomington, Indiana). This device is a modular and tubular endovascular grafting system. It allows its adaptability to tortuous anatomies and tortuous access vessels. It can be used as an auxiliary component to increase the length by overlapping or extending the coverage of a graft and is adaptable to the curvature of the aortic arch.[14] This last proposed use is the one attributed to it during our surgical procedure. As it is a device that allows overlapping, it allows bleeding to be controlled and provides support to the distal portion of the graft. The preparation of cardiothoracic surgeons in training to achieve mastery of the new techniques is fundamental. The management of endovascular techniques is fundamental in preparation. Not only does it involve preparation and knowledge of devices, but skill acquisition is critical. Often, this acquisition of these skills is implemented in descending order of hierarchy. A great example of the preparation of cardiothoracic surgeons is the Canadian system, where it has allowed flexibility to the contemporary surgical environment.[15] A fundamental part of the program involves familiarization with endovascular surgery, as well as rotations that allow for the development of skills in transcatheter aortic valve replacement.

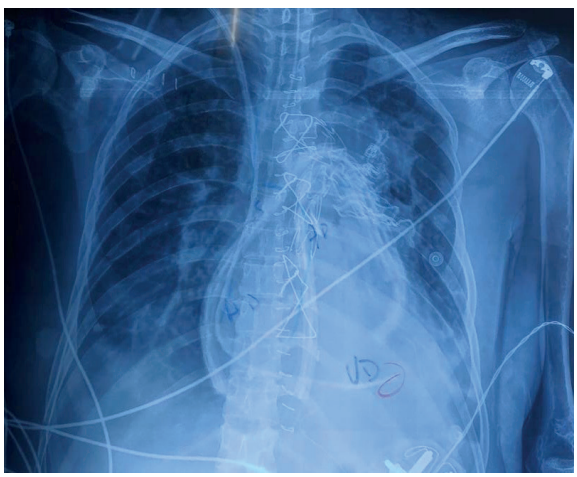


Figure 4: Postoperative radiography in intensive care.

CONCLUSIONS

Few cases have been described of over interruption of the aortic arch and the development of aneurysms. The case presented here, allowed surgical management by interposition of a dacron graft, total correction of common truncus arteriosus and stenting by endovascular therapy. This allows a hybrid management of the pathology. As innovations develop, the cardiac surgeon has more similarities with vascular surgeons. This advancement is a constant challenge to the cardiac surgeon's skill development.

ACKNOWLEDGMENTS

We thank the imaging service for their support.

REFERENCES

1. Ponte M, Dias A, Dias Ferreira N, Fonseca C, Mota JC, Gama V. Interrupted aortic arch: A misdiagnosed cause of hypertension. Rev Port Cardiol. 2014;33(6):389.e1-5. doi: 10.1016/j.repc.2014.01.014.
2. Chikkabyrappa S, Mahadevaiah G, Buddhe S, Alsaied T, Tretter J. Common arterial trunk: physiology, imaging, and management. Semin Cardiothorac Vasc Anesth. 2019;23(2):225-236. doi: 10.1177/1089253218821382.
3. Chatila S, Houyel L, Hily M, Bonnet D. Common arterial trunk associated with functionally univentricular heart: anatomical study and review of the literature. J Cardiovasc Dev Dis. 2021;8(12):175. doi: 10.3390/jcdd8120175.
4. Peirone AR, Benson LN, Freedom RM. Clinical findings in common arterial trunk. Prog Pediatr Cardiol. 2002;15(1):23-31. doi: 10.1016/S1058-9813(02)00005-X.
5. Stark JF, de Leval MR, Tsang VT, editors. Surgery for congenital heart defects. Chichester, UK: John Wiley & Sons, Ltd; 2006. doi: 10.1002/0470093188.
6. Verma AK, Rawat A, Mishra S, Dikshit NA. Type A4 truncus arteriosus: series of 3 cases focused on dual source multidetector

CT angiogram findings. Int J Res Med Sci. 2021;10(1):257-260. doi: 10.18203/2320-6012.ijrms20215062.
7. Gordon EA, Person T, Kavarana M, Ikonomidis JS. Interrupted aortic arch in the adult. J Card Surg. 2011;26(4):405-409. doi: 10.1111/j.1540-8191.2011.01273.x.
8. Dong SW, Di DD, Cheng GX. Isolated interrupted aortic arch in an adult: a case report. World J Clin Cases. 2021;9(4):992-998. doi: 10.12998/wjcc.v9.i4.992.
9. Firouzi A, Sadeghipour P, Pouraliakbar H, et al. Paradigm shift in the management of isolated interrupted aortic arch in adulthood. Curr Probl Cardiol. 2021;46(3):100717. doi: 10.1016/j.cpcardiol.2020.100717.
10. Bohuta L, Hussein A, Fricke TA, et al. Surgical repair of truncus arteriosus associated with interrupted aortic arch: long-term outcomes. Ann Thorac Surg. 2011;91(5):1473-1477. doi: 10.1016/j.athoracsur.2010.12.046.
11. Davis JA, Gilani R, Al-Najjar R, Tsai PI, Wall MJ Jr. Operative challenges in management of concurrent interrupted aortic arch and descending thoracic aortic aneurysm. J Vasc Surg. 2013;57(6):1661-1663. doi: 10.1016/j.jvs.2012.10.067.
12. Patel DM, Maldjian PD, Lovoulos C. Interrupted aortic arch with post-interruption aneurysm and bicuspid aortic valve in an adult: a case report and literature review. Radiol Case Rep. 2015;10(3):5-8. doi: 10.1016/j.radcr.2015.06.001.
13. Ture M, Oncel G, Tanidir IC, Tuzun B. Common arterial trunk, interrupted aortic arch, and crossing pulmonary artery coexistence: case report of a rare anomaly. Turk Arch Pediatr. 2022;57(5):563-565. doi: 10.5152/TurkArchPediatr.2022.22071.
14. Illig KA, Ohki T, Hughes GC, et al. One-year outcomes from the international multicenter study of the Zenith Alpha Thoracic Endovascular Graft for thoracic endovascular repair. J Vasc Surg. 2015;62(6):1485-94.e2. doi: 10.1016/j.jvs.2015.05.007.
15. Ouzounian M, Herman C. Down to the wire: acquiring endovascular skills in cardiac surgery. J Thorac Cardiovasc Surg. 2015;149(3)678. doi: 10.1016/j.jtcvs.2015.01.028.

Funding: none.

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

CASE REPORT

Vol. 10 No. 3 July-September 2025

doi: 10.35366/120490

Practical guidelines for aortic valve surgery and the current role of the Heart Team. Case report

Guía práctica para la cirugía de la válvula aórtica y el papel actual del Equipo Cardíaco. Informe de caso

Moisés C. Calderón-Abbo,* Manuel Carrillo-Cornejo,‡ Ledu Lara* and Simón A. Arias-Rivera*

* Department of Cardiothoracic Surgery, Hospital Ángeles de las Lomas. Huixquilucan, Estado de México, Mexico.

‡ Department of Cardiology; Hospital Ángeles de las Lomas. Huixquilucan, Estado de México, Mexico.

ABSTRACT

Aortic valve replacement is the second most common cardiac surgery in adults, primarily due to aortic stenosis. While both surgical aortic valve replacement (SAVR) and transcatheter aortic valve replacement (TAVR) have well-defined indications, the increasing availability of TAVR has led to its use in cases that may not meet clinical guidelines criteria. This article discusses practical indications by guidelines for aortic valve surgery and the critical role of a multidisciplinary Heart Team in decision-making. A case report of a 63-year-old asymptomatic male with a bicuspid aortic valve and mild-to-moderate aortic insufficiency is presented. Initially recommended as a candidate for TAVR without clear clinical indications, the patient sought a second opinion, leading to a comprehensive evaluation by a Heart Team. Stress echocardiography and guideline-based assessment determined that conservative management was the most appropriate course of action, preventing an unnecessary procedure. This case highlights the risks associated with the overuse of TAVR in "off-label" scenarios and emphasizes the importance of structured decision-making through a heart team approach. Additionally, it underscores the value of insurance-mandated second opinions in safeguarding patients from unwarranted interventions. To ensure appropriate patient selection and adherence to best practices, there is an urgent need for broader advocacy for multidisciplinary Heart Teams within accredited surgical organizations.

RESUMEN

El reemplazo valvular aórtico es la segunda cirugía cardíaca más común en adultos, principalmente debido a la estenosis aórtica. Si bien tanto el reemplazo valvular aórtico quirúrgico como el reemplazo valvular aórtico transcatéter tienen indicaciones bien definidas, la creciente disponibilidad del reemplazo valvular aórtico transcatéter ha llevado a su uso en casos que pueden no cumplir con las pautas clínicas. Este artículo analiza las indicaciones prácticas para la cirugía valvular aórtica y el papel fundamental de un equipo cardíaco multidisciplinario en la toma de decisiones. Se presenta el reporte de caso de un hombre asintomático de 63 años con una válvula aórtica bicúspide e insuficiencia aórtica leve a moderada. Inicialmente se le recomendó reemplazo valvular aórtico transcatéter sin indicaciones clínicas claras, pero el paciente buscó una segunda opinión, lo que llevó a una evaluación integral por parte de un Equipo Cardíaco. La ecocardiografía de estrés y la evaluación basada en las directrices clínicas oficiales determinaron que el tratamiento conservador era el curso de acción más adecuado, lo que evitó un procedimiento innecesario. Este caso destaca los riesgos asociados con el uso excesivo de reemplazo valvular aórtico transcatéter en escenarios "fuera de etiqueta" y enfatiza la importancia de la toma de decisiones estructurada a través de un enfoque de Equipo Cardíaco. Además, subraya el valor de las segundas opiniones exigidas por las compañías de seguros para proteger a los pacientes de intervenciones injustificadas. Para

How to cite: Calderón-Abbo MC, Carrillo-Cornejo M, Lara L, Arias-Rivera SA. Practical guidelines for aortic valve surgery and the current role of the Heart Team. Case report. Cir Card Mex. 2025; 10 (3): 92-94. https://dx.doi.org/10.35366/120490

Received: 03-05-2025. Accepted: 03-13-2025.

Correspondence: Dr. Moisés C. Calderón-Abbo. E-mail: drmoisescalderon@gmail.com

garantizar la selección adecuada de los pacientes y el cumplimiento de las mejores prácticas, existe una necesidad apremiante de una defensa más amplia de los Equipos Cardíacos multidisciplinarios dentro de las organizaciones quirúrgicas acreditadas.

Keywords: aortic valve replacement, cardiac surgery, transcatheter aortic valve replacement, Heart Team, aortic heart valve.

Palabras clave: *reemplazo valvular aórtico, cirugía cardíaca, reemplazo valvular aórtico transcatéter, Equipo Cardíaco, válvula aórtica.*

Abbreviations:
AI = Aortic Insufficiency
AS = Aortic Stenosis
CAD = Coronary Artery Disease
LVEF = Left Ventricular Ejection Fraction
LVESD = Left Ventricular End-Systolic Dimension
LVH = Left Ventricular Hypertrophy
NYHA = New York Heart Association
SAVR = Surgical Aortic Valve Replacement
TAVR = Transcatheter Aortic Valve Replacement
VHD = Valvular Heart Disease

Aortic valve replacement is the second most common cardiac operation in the adult population in the Western world, primarily due to aortic stenosis. From a practical standpoint, the common indications for aortic valve surgery are as follows:

Below is a summarized overview of the surgical indications for aortic valve replacement (SAVR) in cases of aortic insufficiency and aortic stenosis, based on recent clinical practice guidelines.[1,2]

Aortic insufficiency

The surgical indications for aortic valve replacement in cases of aortic insufficiency (AI) include:

1. Symptoms: patients with worsening symptoms such as dyspnea, angina, or syncope should be considered for surgery, especially if they are classified as NYHA (New York Heart Association) functional class II or higher.
2. Left ventricular dilation or dysfunction:
a. Surgery is recommended if the left ventricular ejection fraction (LVEF) falls below 60%.
b. A left ventricular end-systolic dimension (LVESD) greater than 50 mm indicates the need for intervention.
3. Acute aortic insufficiency: immediate surgical intervention is indicated in cases of acute severe AI due to conditions such as aortic dissection or infective endocarditis.
4. Other factors: consideration should also be given to patients with progressive aortic regurgitation, significant worsening of symptoms, or a rapid decline in left ventricular function.

Aortic stenosis

The surgical indications for aortic valve replacement in cases of aortic stenosis (AS) include:

1. Symptoms: patients who exhibit symptoms related to aortic stenosis (e.g., exertional dyspnea, angina, or syncope) should undergo valve replacement, typically when classified as NYHA functional class II or higher.
2. Severe aortic stenosis: surgical intervention is indicated in patients with a valve area of less than 1.0 cm^2, particularly if they are symptomatic.
3. Asymptomatic patients: surgery may also be required in asymptomatic patients if:
   a. The LVEF is less than 50%.
   b. The peak aortic jet velocity is greater than 4.0 m/s.
   c. Persistent left ventricular hypertrophy (LVH) is observed.
3. Other indications: patients undergoing other cardiac surgery (e.g., coronary artery bypass grafting) should have the aortic valve replaced if significant stenosis is present.

CASE DESCRIPTION

We present this case report because the patient had already been scheduled to undergo a transcatheter aortic valve replacement (TAVR) without any clear indication for a valve procedure.

The patient was a 63-year-old asymptomatic male with a cardiovascular condition. He was evaluated after the discovery of a heart murmur during a routine medical check up in 2023. He was diagnosed with a bicuspid aortic valve with minimal insufficiency. One year later, in July 2024, after undergoing multiple follow-up studies, he was informed that the insufficiency had rapidly progressed to a moderate degree but had not yet caused ventricular dysfunction. He was advised that this was an ideal time to undergo TAVR, particularly because it is a minimally invasive procedure with immediate recovery. The patient was surprised by the diagnosis but did not question the recommendation.

The insurance company's policy required a second opinion for conditions that involved major medical expenses. The patient visited the private hospital, consulted the medical directory, selected a cardiologist's name, and scheduled an appointment with a physician from our multidisciplinary team.

He underwent a stress echocardiogram with a cycle ergometer, which revealed the following findings: the test was stopped due to fatigue at 15 minutes after reaching 85% of the maximum heart rate for his age, with 143 watts of

resistance and 60 RPM. At peak heart rate, there were no signs of segmental contractility alterations suggestive of ischemia or myocardial injury, nor were there electrocardiographic abnormalities. Pulmonary artery pressure during peak exertion was estimated at 40 mmHg, with an oxygen saturation of 98%, and he exhibited a hypertensive response that resolved after the test. The aortic valve was bicuspid with a mild double aortic lesion, predominantly insufficiency, with an AVA of 1.8 cm^2, a mean gradient of 8 mmHg, and a Vmax of 1.9.

The case was presented at a Heart Team session, where three surgeons qualified for transcatheter implantation evaluated the patient. He was started on antihypertensive therapy and advised to continue his normal life. Appropriate preventive measures were recommended to reduce the risk of infections due to the valve's morphology, and he was scheduled for clinical surveillance and follow-up in one year.

COMMENT

As demonstrated earlier, the patient presents a typical case of bicuspid aortic valve with a double lesion characterized by predominant insufficiency. Notably, the patient remains asymptomatic and does not meet any criteria for intervention. In the introduction to this document, we outlined the surgical indications for aortic valve surgery, encompassing the criteria for transcatheter valve replacement.[1,2] Indeed, the incidental detection of a moderate, asymptomatic, bicuspid aortic valve with predominant regurgitation in a patient does not align with established indications for TAVR.

Had this patient initially been presented to a "Heart Team", he probably would not have been scheduled for transcatheter implantation or any other procedure. In most academic settings, patients are only presented at "Heart Team case presentations" or "medical-surgical sessions" when the natural history of the disease progresses to such a state where an intervention is considered; which is not the present case. However, due to the growing number of "off label" cases that we are observing, we considered it quite pertinent to write and discuss this case report. Similarly, if the insurance company had not required a second opinion (as is the case with most companies), the patient would have already undergone an unnecessary procedure. It is a fact that the statement: *"We do not need to perform an open heart operation anymore, now we can fix your heart valve with a single stick in your groin and you will be discharged home the next morning",* has moved patients with SAVR/TAVR borderline indications to decide towards TAVR; even in an "off label" setting.

The Heart Team plays a pivotal role in the management of valvular heart disease (VHD) in centers with access to both conventional surgical and percutaneous interventions. Current guidelines emphasize the importance of Heart Team participation, with a class I recommendation, level of evidence B-NR, in the context of coronary artery disease (CAD),[3] and a class I recommendation, level of evidence C, in the 2020 ACC/AHA American guidelines for VHD.[1]

Probably, this case could not be an isolated incident, and many readers may have encountered similar scenarios. However, authors strongly advocate that, as a collective professional body, we should promote the development of multidisciplinary teams that foster collaborative decision-making. This should involve partnerships with medical directors from insurance companies, as well as accreditation from recognized Mexican surgical organizations.

CONCLUSIONS

The increasing availability and minimally invasive nature of TAVR have led to its use in borderline and even inappropriate cases. This case highlights the need for structured decision-making involving a Heart Team to ensure guideline-based management and avoid unnecessary procedures. It also suggests the role of medical insurance policies in encouraging second opinions, which may protect patients from inappropriate interventions. Greater advocacy for multidisciplinary Heart Teams within accredited surgical organizations is essential to uphold best practices in valvular heart disease management.

REFERENCES

1. Otto CM, Nishimura RA, Bonow RO, et al. 2020 ACC/AHA guideline for the management of patients with valvular heart disease: executive summary: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation. 2021;143(5):e35-e71. doi: 10.1161/CIR.0000000000000932. Epub 2020 Dec 17. Erratum in: Circulation. 2021;143(5):e228. doi: 10.1161/CIR.0000000000000960. Erratum in: Circulation. 2021;143(10):e784. doi: 10.1161/CIR.0000000000000966.
2. Vahanian A, Beyersdorf F, Praz F, et al. 2021 ESC/EACTS Guidelines for the management of valvular heart disease. Eur Heart J. 2022;43(7):561-632. doi: 10.1093/eurheartj/ehab395.
3. Lawton JS, Tamis-Holland JE, Bangalore S, et al. 2021 ACC/AHA/SCAI guideline for coronary artery revascularization: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation. 2022 Jan 18;145(3):e18-e114. doi: 10.1161/CIR.0000000000001038.

Funding: none.
Disclosure: the authors have no conflicts of interest to disclose.

CASE REPORT
Vol. 10 No. 3 July-September 2025
doi: 10.35366/120491

Tracheal injury from blunt trauma and electrical burn in infant with primary repair by tracheoplasty

Lesión traqueal por trauma directo y quemadura eléctrica en infante con reparación primaria por traqueoplastia

Reynaldo J. Jiménez-González,* María C. Ogaz-Escarpita,* Raúl M. Guillén-Ramírez,‡ Rigoberto Marmolejo-Rivera* and Ovidio A. García-Villarreal§

* Department of Cardiac Surgery, Hospital Ángeles Chihuahua. Chihuahua, Chihuahua, Mexico.
‡ Department of Cardiovascular Anesthesia, Hospital Ángeles Chihuahua. Chihuahua, Chihuahua, Mexico.
§ Mexican College of Cardiovascular and Thoracic Surgery. Mexico City, Mexico.

ABSTRACT

Cervical injuries occur in 10-23% of trauma injuries. The trachea is one of the most affected areas. We report a challenging case of a pediatric patient who suffered a tracheal trauma caused by two types of injury: electrical burn and blunt trauma. Due to the age of the patient and the mechanism of injury, its repair by tracheoplasty was essential to avoid compromise of the airway development.

Keywords: tracheal injuries, blunt trauma, electrical burn, tracheoplasty.

RESUMEN

Las lesiones cervicales se presentan en 10-23% de los traumatismos. La tráquea es una de las zonas que más se ve afectada. Se describe el caso de un paciente pediátrico que sufrió un traumatismo traqueal causado por dos tipos de lesión: quemadura eléctrica y traumatismo contuso. Debido a la edad del paciente y el mecanismo de lesión, resulta fundamental su reparación por medio de traqueoplastia para no comprometer el desarrollo de la vía aérea.

Palabras clave: *lesiones traqueales, traumatismo contuso, quemadura eléctrica, traqueoplastia.*

Of the total number of traumas affecting the cervical region, approximately 5-8% are injuries localized to the cervical vertebrae,[1] whereas tracheal injuries are more common, accounting for 10-23% of the series.[1,2] Notably, the majority of these traumas occur in men under the age of 40, with a male-to-female ratio of 3:1.[3]

In order to facilitate the diagnosis and treatment of cervical injuries, the neck is anatomically divided into three zones. Zone I encompasses the subclavian and carotid arteries, jugular vein, vagus nerves, and trachea.[4] Penetrating trauma is the primary mechanism of injury affecting this zone, resulting in a mortality rate of 11%.[5] When trauma occurs in this area, tracheal injury is clinically evident by the presence of subcutaneous emphysema, dyspnea, and even air escaping through the wound.[6]

Electrical burn injuries occur when a patient comes into direct or indirect contact with an electric current.[7] In children, such injuries are relatively uncommon, typically affecting individuals between the ages of 11 and 20.[3] The characteristic lesion associated with this type of trauma is coagulative

How to cite: Jiménez-González RJ, Ogaz-Escarpita MC, Guillén-Ramírez RM, Marmolejo-Rivera R, García-Villarreal OA. Tracheal injury from blunt trauma and electrical burn in infant with primary repair by tracheoplasty. Cir Card Mex. 2025; 10 (3): 95-98. https://dx.doi.org/10.35366/120491

Received: 04-08-2025. Accepted: 04-15-2025.

Correspondence: Dr. Reynaldo J. Jiménez-González. E-mail: jesusr72@hotmail.com

necrosis, resulting from the disruption of cellular membranes in the affected tissues.[8]

Neurological damage occurs due to ischemia in tissues supplied by the damaged vessels immediately following electrocution.[9] When such injuries occur at the cervical level, they can be severe due to the concentration of vital structures in close proximity within a confined anatomical area.[10]

Since this type of burn injury predominantly affects deeper tissue planes, assessing the extent of the burns by examining the skin surface is of limited utility, as it does not accurately reflect the magnitude of damage to internal organs.[1,11,12]

CASE DESCRIPTION

A 10-year-old male suffered a catastrophic accident on March 29, 2024, when he inadvertently fell onto an electrified cattle fence in a rural area, resulting in a complex cervical trauma involving both compression contusion and electrical burns. Upon admission, the patient presented with severe symptoms, including generalized emphysema, shock, bilateral tension pneumothorax, and extensive subcutaneous emphysema extending from the forehead to the proximal third of both thighs. A distinctive longitudinal lesion was observed in the neck area, characterized by a closed and well-delimited wound caused by the dual mechanisms of electrical burns and compressive trauma. Given the dual trauma mechanisms involved, prioritizing treatment and tracheal repair was crucial to ensure optimal airway development. The high-voltage electric current, estimated to be at least 6,000 volts, posed a significant risk of restenosis and laryngeal nerve damage, which would likely impact the patient's long-term prognosis.[13] Following a comprehensive evaluation, the tracheoplasty technique was deemed the most suitable option for this patient.

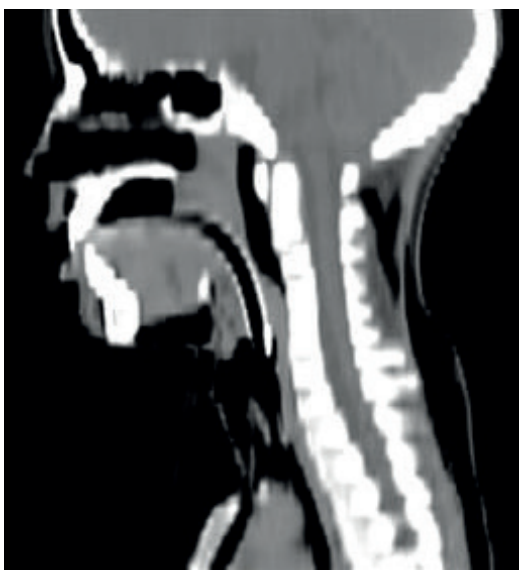


Figure 1: Simple computed axial tomography showing tracheal stenosis at the C7 level.

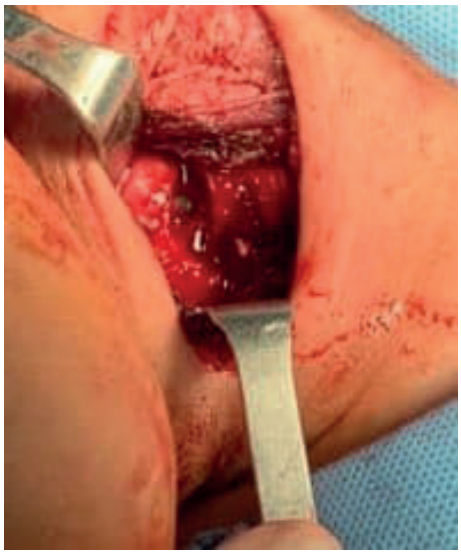


Figure 2: Surgical exposure of the tracheal lesion.

Simultaneous management of shock and pneumothorax was initiated, involving bilateral thoracostomy tube placement with subsequent water seal drainage, which effectively achieved drainage. Given the presence of circumferential ecchymosis and abundant blood clots, a post-intubation fibrobronchoscopy was performed to investigate suspected airway injury. Computed axial tomography (CT) revealed tracheal widening at the C7 level, consistent with an anterior traumatic lesion of the trachea *(Figure 1)*.

The patient's hemodynamic stability allowed for transfer to the intensive care unit, where he remained for four days before being evaluated for surgical intervention. A Kocher approach was employed, revealing ecchymosis in all planes, and the infrahyoid muscles were dissected. The thyroid gland was found to be extensively infiltrated by a post-traumatic hematoma, prompting the decision to open the isthmus to expose the cervical trachea. A longitudinal lesion was identified, involving the tracheal cartilages and the posterior surface of the thyroid gland at the C7 level. Following thorough washing, debridement, and remodeling of the tracheal cartilages, a tracheoplasty was performed using a conventional technique: termino-terminal anastomosis with subtotal points of absorbable PDS 5/0 material. Upon completion of the anastomosis, a water tightness test was conducted to ensure integrity *(Figures 2 to 4)*. After verifying hemostasis, a closed wound drainage system was implemented prior to layered closure.

Upon completion of the procedure, a concurrent bronchoscopy was performed, which revealed no evidence of lesions and confirmed that the repair area was hermetically sealed. Subsequently, bronchial lavage was conducted, resulting in the extraction of hematic remnants. Following orotracheal intubation, the patient was transferred to the intensive care unit, where he demonstrated a favorable progression and was successfully weaned off the ventilator.

By the fourth postoperative day, the patient began oral intake and mobilization without experiencing any additional complications. He was subsequently transferred to the pediatric ward, where he showed no signs of stridor, dyspnea, or dysphonia. The patient was ultimately discharged without any further complications.

COMMENT

The most common cause of tracheal stenosis is prolonged intubation, followed by trauma or neoplasia. The definitive treatment for this condition is tracheoplasty, which involves resection of the affected segment and end-to-end anastomosis of the healthy segments.[14] Notably, the complication rate for this procedure is reported to be approximately 33%, with restenosis being the most frequent complication, occurring in around 21% of cases.[15] A crucial aspect of tracheoplasty is ensuring that the distal ends are aligned without tension before resecting the injured portion of the trachea, as this helps prevent the development of stenosis.[16] Several factors are associated with complications during anastomosis, including pediatric age, which is a significant consideration.[17] Pediatric patients tend to have shorter tracheal lengths and smaller transverse diameters compared to adults, making trauma in this population more severe due to the larger surface area of affected tissue.[18] Consequently, tracheal stenosis in children is a complex pathology that requires a carefully defined treatment approach. The success of tracheoplasty depends on timely assessment to confirm the diagnosis, determine the extent and location of the stenotic area, and evaluate the degree of obstruction.[19]

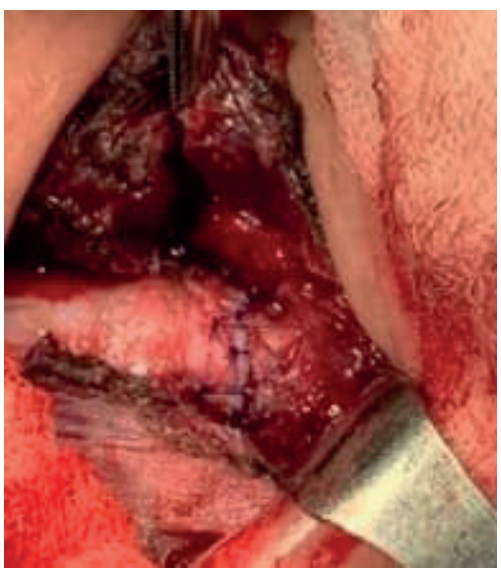


Figure 3: Tracheal repair by tracheoplasty with end-terminal junction.

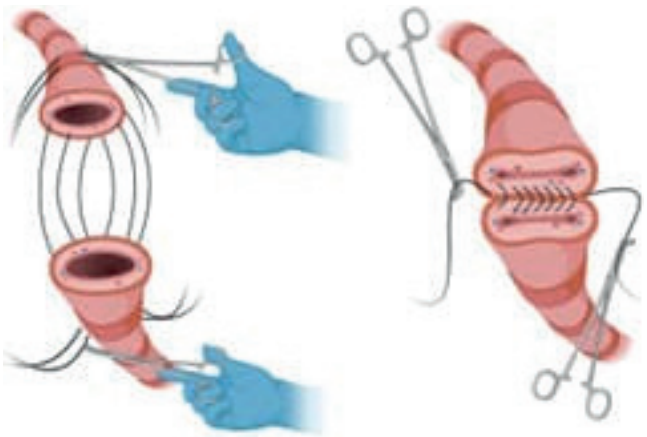


Figure 4: Schematic diagram of the surgical technique of tracheoplasty with termino-terminal junction.

CONCLUSION

Although tracheoplasty is the preferred procedure for treating tracheal stenosis in pediatric patients,[20] it is a complex surgical intervention associated with a range of potential complications, including restenosis and anastomotic dehiscence.

REFERENCES

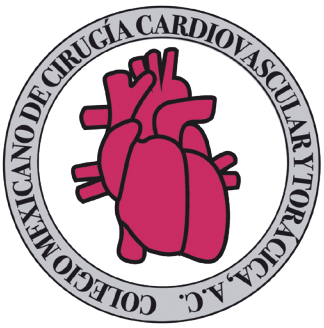
1. Magaña SI, Cabello PR, Melgoza MD, Galván RJ, Chávez RJJ. Patrón de lesiones de cuello en el Hospital Central Militar. Cir Gen. 2001;23(4):240-244.
2. Vázquez-Minero JC, Morales-Gómez J, Guzmán-de Alba E, et al. Penetrating tracheal trauma. Recommendations for its management. About a case. Neumol Cir Torax. 2018;77(4):286-292.
3. Gonzalez Castro LF, Ávila Vargas SV, Quezada-Rueda JT, Vivas-García SM. Physiopathology of electrical burns: review article. Rev Argent Cir Plástica. 2018;24(2):51-56. doi: 10.32825/RACP/201802/0051-0056.
4. Fernández Russo GAH. Anatomía clínica y quirúrgica del cuello. Rev Arg Anat Onl. 2012;3(supl 3):7-113.
5. Millán HM, Gómez BJ, Hernández HJ, Duhalde SI. Manejo del trauma penetrante cervical de Zona II. Hospital Clínico Regional Valdivia. Serie de casos clínicos. Cuad Cir. 2008;22:11-17. doi: 10.4206/cuad.cir.2008.v22n1-02.
6. Koletsis E, Prokakis C, Baltayiannis N, Apostolakis E, Chatzimichalis A, Dougenis D. Surgical decision making in tracheobronchial injuries on the basis of clinical evidences and the injury's anatomical setting: a retrospective analysis. Injury. 2012;43(9):1437-1441. doi: 10.1016/j.injury.2010.08.038.

7. Kamble PB, Kshirsagar HS. A retrospective analysis of electrical burn injuries. Int J Community Med Public Health. 2023;10(12):4677-4683. doi: 10.18203/2394-6040.ijcmph20233762.
8. Knuth CM, Auger C, Jeschke MG. Burn-induced hypermetabolism and skeletal muscle dysfunction. Am J Physiol Cell Physiol. 2021;321(1):C58-C71. doi: 10.1152/ajpcell.00106.2021.
9. Yiannopoulou KG, Papagiannis GI, Triantafyllou AI, et al. Neurological and neurourological complications of electrical injuries. Neurol Neurochir Pol. 2021;55(1):12-23. doi: 10.5603/JNNS.a2020.0076.
10. Ramírez-Morin MA, Vergara-Miranda H, Guerrero-Arroyo AA, et al. Penetrating cervical trauma: experience of a teaching hospital in Mexico. Rev Colomb Cir. 2022;37(3):393-400. doi: 10.30944/20117582.1285.
11. Friedstat J, Brown DA, Levi B. Chemical, electrical, and radiation injuries. Clin Plast Surg. 2017;44(3):657-669. doi: 10.1016/j.cps.2017.02.021.
12. Braga MJ, Oliveira I, Egipto P, Silva A. High-voltage electrical burns due to copper theft - Case series. Ann Burns Fire Disasters. 2016;29(1):41-42.
13. Chahín AM, Fernández CM, Riquelme PI. Instalación y manejo de cerco eléctrico con ganado ovino [Internet]. Temuco (Chile): Instituto de Investigaciones Agropecuarias, INIA Carillanca; 2023. (Informativo INIA Carillanca; no. 181). Disponible en: https://hdl.handle.net/20.500.14001/69014
14. Obregón-Guerrero G, Martínez-Ordaz JL, Peña-García JF, Ramírez-Martínez M, Jurado-Reyes J, Pérez-Álvarez C. Anastomotic complications following tracheal plasty for postintubation tracheal stenosis. Cir Cir. 2013;(6):485-489.
15. Berrios-Mejía JA, Morales-Gómez J, Guzmán-de Alba E, Martín-Ibarra J, Zotés-Valdivia VH, Téllez-Becerra JL. Tracheal and laryngotracheal resection in tracheal stenosis: predictors of postoperative recurrence. Neumol Cir Tórax. 2016;75(4):275-280. doi: 10.35366/69365.
16. Rea F, Callegaro D, Loy M, Zuin A, et al. Benign tracheal and laryngotracheal stenosis: surgical treatment and results. Eur J Cardiothorac Surg. 2002;22(3):352-356. doi: 10.1016/s1010-7940(02)00342-1.
17. Wright CD, Grillo HC, Wain JC, et al. Anastomotic complications after tracheal resection: prognostic factors and management. J Thorac Cardiovasc Surg. 2004;128(5):731-739. doi: 10.1016/j.jtcvs.2004.07.005.
18. Coskun ZK, Atalar K, Akar B. Systematic literature study of trachea and bronchus morphology in children and adults. Folia Morphol (Warsz). 2023;82(3):457-466. doi: 10.5603/FM.a2022.0073.
19. Ashiku SK, Kuzucu A, Grillo HC, et al. Idiopathic laryngotracheal stenosis: effective definitive treatment with laryngotracheal resection. J Thorac Cardiovasc Surg. 2004;127(1):99-107. doi: 10.1016/j.jtcvs.2002.11.001.
20. Zaldívar Cervera JA, Santiago Romo JE, Mora Fol R, Torres Guillén NA, Carega Reyna G. Manejo quirúrgico de la estenosis traqueal en pediatría. Experiencia de 2001 a 201. Neumol Cir Torax. 2011;70(4):243-246.

Funding: none.
Disclosure: the authors have no conflicts of interest to disclose.


SOCIEDAD MEXICANA DE CIRUGÍA CARDIACA
A
1990
LABOR OMNIA VINCIT

Contents



Contents

Author instructions

Instrucciones para los autores

GENERAL INFORMATION

Cirugía Cardiaca en México is the official journal of the Mexican Society of Cardiac Surgery, A.C. and of the Mexican College of Cardiovascular and Thoracic Surgery, A.C. We publish articles about diverse topics in cardiac surgery in the following modalities: Editorial, Original Articles, Review Articles, Viewpoint, Expert Opinion, Case Report, Surgical Technique, Images in Cardiac Surgery, New Technology, Historical Notes and Letters to the editor.

Cirugía Cardiaca en México is adapted to the indications established by the International Committee of Medical Journal Editors. Manuscripts must be prepared in accordance with the Uniform Requirements for Sending Manuscripts to Biomedical Journals. The updated version is available at: www.icmje.org. All manuscripts, editorial material and correspondence should be sent by electronic email to: revmexcircard@gmail.com

Once accepted for publication, all manuscripts will be property of ***Cirugía Cardiaca en México*** and may not be published anywhere else without the written consent by the editor.

Each submission, regardless of its category, must include:

- A cover letter indicating the category of the article and the idea or justification of the authors to publish the manuscript.
- The complete manuscript including a front page, an abstract and keywords (in Spanish and English), text, tables, acknowledgments, declarations, references, and images and / or figures.
- Written permission from the editor for any table, image or illustration that has been previously published in print or electronic media.
- All authors must sign the Copyright Transfer Agreement, which is herein at the end of this document.

MANUSCRIPT PREPARATION PROCESS

All manuscripts must be prepared using Microsoft Word, 12-point Times New Roman or Arial font, single line spacing, letter size with 2.5 cm margins on all sides.

The manuscript should be arranged as follows:

1) Front page
2) Abstract and keywords (Spanish and English)
3) Text, acknowledgements, disclosure, references
4) Tables
5) Figures
6) Figures Legends

Each section mentioned above should start on a separate sheet. All pages must be consecutively numbered at the center at the top, starting with the front page and ending with the figure legends. Do not list the lines. Do not include the tables in the text.

Original articles: should include front page, structured abstract including any background if necessary, objective, material and methods, results and conclusions (maximum 250 words) and keywords (3 to 6), text (divided into introduction, material and methods, results and discussion), tables, figures and legends of figures. Number of references: maximum 40.

Review articles. Expert opinion, or Viewpoint: front page, Non-structured abstract (maximum 250 words) and keywords (3 to 6), text (divided into sections depending on the case), tables, figures and figures legends. Number of references: maximum 50.

Case report: front page, non-structured abstract (maximum 75 words) and keywords (3 to 6), text (introduction, clinical case, comment), tables, figures and figures legends. Number of references: maximum 8. Number of figures and / or tables: maximum 4 (altogether).

Surgical technique: front page, non-structured abstract (maximum 75 words) and keywords (3 to 6), text (introduction, surgical technique, comment), tables, figures and figures legends. Number of references: maximum 8. Number of figures: unlimited.

Images in cardiac surgery: front page, non-structured abstract (maximum 75 words) and keywords (3 to 6), text (exclusively to describe the case and the images presented, without introduction, or comments), figures and legends of figures. It should not include references or tables. Number of figures: maximum 2.

New technologies: front page, non-structured abstract (maximum 75 words) and keywords (3 to 6), text (divided into introduction, new technology, comments), tables, figures and figures legends. Number of references: maximum 10. Number of figures: maximum 4.

Historical notes: front page, keywords (3 to 6), text (free, divided into sections as considered), figures and figure legends. Does not include any abstract. Number of references: unlimited. Number of figures: unlimited.

Letter to the editor: front page, keywords (3 to 6), text (free style, limited to 500 words). Does not include any abstract, tables or figures. Number of references: maximum 5.

Editorial (by invitation): front page, keywords (3 to 6), text (free style, divided into sections as considered). Does not include any abstract, tables or figures. Number of references: maximum 10.

FRONT PAGE

Must include title (spanish and english) of up to 80 characters including spaces; short title: up to 30 characters including spaces, authors: list of all authors (maximum 6; in case of more than 6 it must be justified in the cover letter) starting with the first name, middle initial, last names (in case of two surnames, both of them should be joined by an en-dash), institution where the study was conducted (Department and Hospital Center; city and country), connect the authors with the Departments by using superscripts if necessary, include if it has been presented at any congress, number of words in the abstract (not including keywords), corresponding author (full name, phone number and contact email).

ABSTRACT

It must be provided in Spanish and English. See specifications in each item according to the type of article involved. It must be followed by the keywords.

TEXT

See specifications regarding each of the article types.

ABBREVIATIONS

Abbreviations are not accepted in the abstract. Abbreviations in the text are allowed by using in parentheses after being cited the first time. Only 4 abbreviations per manuscript will be accepted. Use abbreviations only if the term is repeated more than 4 times in the text.

REFERENCES

Note the references by using arabic numbers between brackets [ ] at the end of the quote and before the point signal. DO not use superscripts. List the references according to the order they appear in the text. Journal abbreviations should be written according to the Index Medicus. Cite the authors (surname and initial of the name [s]), title, abbreviated title of the Journal, year, volume, and initial and final pages. Example: Cox JL. Mechanical closure of the left atrial appendage: Is it time to be more aggressive? J Thorac Cardiovasc Surg 2013;146: 1018-1027. ***JUST IF THE AUTHORS ARE MORE THAN SIX, CITE ONLY THE FIRST 3, AND INCLUDE THE SUFFIX "et al".*** Within the bounds of possibility, include the doi of each article in the References.

Book References: Write down the author (s), book title, publisher, year, and consulted pages. Example: Bonser RS, Pagano D, Haverich A. Mitral valve surgery. London: Springer Science & Business Media, 2010: 70-74. Book chapter references: Write down the author (s) of the chapter, title of the chapter; then write "In" followed by the book reference (see book references). Example: Perier P. How I assess and repair the Barlow mitral valve: the respect rather than resect approach. In: Bonser RS, Pagano D, Haverich A. Mitral valve surgery. London: Springer Science & Business Media, 2010: 69-76.

Electronics references. Author, "Title of the contribution", Title of the serial publication. [type of support].

Edition. Location of the part within the source document. [Date of consultation]. Availability and access. Example: Gavela B. "The asymmetries of nature". The digital country [online]. October 15, 2008. [Query: October 15, 2008] http://www.elpais.com/articulo/futuro/asimetrias/naturaleza/elpepusocfut/20081015elpepifut_1/Tes

TABLES

Each table must be numbered consecutively with arabic numerals, and accompanied by a title. Explanatory notes should appear at the bottom, as well as the abbreviations used into. You should avoid supersaturation of information in it. They must be sent as part of the text, after the references, not as supplementary images.

FIGURES

Color images must be sent in TIFF, JPG, PSD, EPS, PNG format. Power point will not be accepted. For color images, width size greater than 16.8 cm is recommended, File Format: CMYK, resolution: 300 DPI. For drawings or graphic images, it is recommended to send in TIFF format, width greater than 16.8 cm, File Format: CMYK, resolution: 1000 DPI. The reproduction of the images will preferably be in color WITHOUT any extra charge.

Each of the images will be sent as a separate file, not as part of the text.

Resolution and quality images must be as high as possible.

THIS IS THE MOST ATTRACTIVE PART OF THE CASE REPORT and SURGICAL TECHNIQUE sections. Therefore, the submission MUST BE EXCLUSIVELY in the FORMATS as MENTIONED ABOVE. Other than these, they will not be accepted.

FIGURE LEGENDS

They should properly describe the figures. Each legend will correspond to the image described. It will consist of a title, and if the author considers it pertinent, a brief explanation. If abbreviations are handled in the images, these should be included at the end of the legend text.

SUBMISSIONS

All manuscripts, editorial material and correspondence, including the AUTHOR COPYRIGHT TRANSFER AGREEMENT form must be sent through the following link:

https://revision.medigraphic.com/RevisionCirCar/revistas/revista5/index.php

Copyright transfer agreement

Title:

Author (s):

The undersigned authors herein certify that the article is original and it has not previously published, nor simultaneously sent to another journal with the same purpose. Once accepted for publication in ***Cirugía Cardiaca en México***, the latter acquires the copyright. The article might be included in the media at the convenience for the editors from ***Cirugía Cardiaca en México***. All Works accepted for publication will be property of ***Cirugía Cardiaca en México*** and they may not be published anywhere else without the editor's written consent.

Author's name

Signature

Date and place:

Colegio Mexicano de Cirugía Cardiovascular y Torácica, A.C.

Si está interesado en formar parte del Colegio Mexicano de Cirugía Cardiovascular y Torácica, A.C., favor de consultar las **BASES PARA SU REGISTRO** en la siguiente dirección:

https://www.colegiomxcircardio.org