

Non-ST-Segment Elevation Myocardial Infarction in a Woman in her Fifth Decade Secondary to Anomalous Left Coronary Artery from The Pulmonary Artery (ALCAPA) Treated with Surgical Correction Using The Takeuchi Technique: A Case Report

Parra Mora Héctor Alejandro^{*1}, Castañeda Vargas Jorge Antonio², Vazquez Coronado David³, Norzagaray Figueroa Luis David⁴, Orejel Amezcua Alfredo⁵, Lozano Ibarra Alexia Valentina⁶, Guerrero Hernandez Dajher Alonso⁷

^{1,2,3,4,5,6,7}Hospital Regional Valentín Gomez Fariás.

ABSTRACT

Anomalous left coronary artery from the pulmonary artery (ALCAPA), also known as Bland-White-Garland syndrome, is a rare congenital coronary anomaly with an estimated incidence of 1 in 300,000 live births and represents less than 0.5% of all congenital heart diseases. The condition is characterized by the abnormal origin of the left coronary artery from the pulmonary artery, resulting in progressive myocardial ischemia after the physiological decline in pulmonary vascular resistance during infancy. The subsequent coronary steal phenomenon leads to left ventricular dysfunction, myocardial infarction, mitral regurgitation, heart failure, malignant ventricular arrhythmias, and sudden cardiac death if left untreated. Clinical manifestations vary according to the degree of collateral circulation and the patient's age, ranging from severe heart failure in infancy to exertional angina, syncope, ventricular arrhythmias, or sudden death in adults. Transthoracic echocardiography remains the first-line diagnostic modality, while coronary computed tomography angiography, cardiac magnetic resonance imaging, and invasive coronary angiography provide detailed anatomical and functional assessment for diagnosis and surgical planning. Surgical correction aimed at restoring a dual-coronary circulation is the treatment of choice in all patients regardless of age or symptoms, with direct reimplantation of the anomalous coronary artery into the aorta considered the preferred technique. Advances in imaging and surgical management have markedly improved long-term survival and ventricular recovery. Nevertheless, lifelong follow-up is recommended to monitor residual myocardial dysfunction, mitral valve disease, ventricular arrhythmias, and other late complications. Early recognition and timely surgical intervention remain the cornerstone for achieving favorable clinical outcomes.

KEYWORDS: ALCAPA, myocardial infarction, anomalous left coronary artery

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I. INTRODUCTION

Anomalous Left Coronary Artery from the Pulmonary Artery (ALCAPA), also known as Bland-White-Garland syndrome, is a rare congenital coronary anomaly that accounts for approximately 0.25% to 0.5% of all congenital heart defects, with an estimated incidence of one case per 300,000 live births (1,2). Despite its rarity, ALCAPA is of considerable clinical importance because, if left untreated,

mortality exceeds 90% during the first year of life, primarily due to progressive heart failure, myocardial infarction, and sudden cardiac death (2,3). From an embryological perspective, ALCAPA is characterized by the anomalous origin of the left coronary artery from the main pulmonary artery rather than the aortic root. During fetal life, this anomaly has minimal hemodynamic consequences because pulmonary and systemic arterial pressures, as well as

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oxygen saturation, are comparable. However, following birth, the physiological decline in pulmonary vascular resistance leads to a marked reduction in pulmonary artery pressure and oxygen content, resulting in inadequate perfusion of the myocardium supplied by the left coronary artery. As collateral circulation develops from the right coronary artery, the so-called coronary steal phenomenon occurs, whereby blood flows retrogradely into the pulmonary artery instead of perfusing the left ventricular myocardium, ultimately leading to chronic myocardial ischemia, fibrosis, left ventricular dysfunction, and ischemic mitral regurgitation secondary to papillary muscle involvement (2,4). The clinical presentation depends largely on the extent of collateral coronary circulation. Most infants become symptomatic within the first weeks to months of life, presenting with feeding difficulties, diaphoresis, irritability, tachypnea, and signs of congestive heart failure. In contrast, a small proportion of patients develop an extensive collateral network that allows survival into adolescence or adulthood. Nevertheless, these individuals remain at substantial risk of myocardial ischemia, heart failure, malignant ventricular arrhythmias, and sudden cardiac death, even in the absence of significant symptoms (3,5). Advances in cardiovascular imaging have significantly improved the diagnosis of this condition. Transthoracic echocardiography is currently considered the first-line imaging modality because of its wide availability and high diagnostic sensitivity. Coronary computed tomography angiography, cardiac magnetic resonance imaging, and invasive coronary angiography provide detailed assessment of coronary anatomy, myocardial viability, and surgical planning (2,6). The primary therapeutic goal is to restore a two-coronary artery system through surgical reimplantation of the anomalous left coronary artery into the aorta, a procedure that has demonstrated substantial improvement in left ventricular function, reduction of mitral regurgitation, and excellent long-term survival outcomes (2,7). Because of its rarity and highly variable clinical presentation, ALCAPA continues to represent a significant diagnostic challenge in both pediatric and adult populations. Early recognition is essential to allow timely surgical correction, thereby altering the natural history of the disease and reducing the risk of life-threatening complications. In this context, the present report reviews the historical background, pathophysiology, clinical manifestations, diagnostic modalities, surgical management, and prognosis of ALCAPA, emphasizing the importance of a multidisciplinary approach to optimize patient outcomes.

II. CASE PRESENTATION

A woman in her fifth decade of life presented with a history of non-ST-segment elevation acute coronary syndrome

(NSTEMI-ACS). During the diagnostic evaluation, anomalous left coronary artery from the pulmonary artery (ALCAPA) was identified as the underlying cause of the ischemic event. This rare congenital coronary anomaly results in coronary steal, chronic myocardial hypoperfusion, and a substantially increased risk of myocardial ischemia, heart failure, malignant ventricular arrhythmias, and sudden cardiac death, thereby requiring definitive surgical correction. According to the current American College of Cardiology/American Heart Association (ACC/AHA) guidelines, surgical repair is recommended regardless of symptom status or clinical presentation, including adult patients presenting with non-ST-segment elevation acute coronary syndrome, and carries a Class I recommendation. Surgical correction remains the treatment of choice and the only definitive strategy capable of restoring a physiological dual-coronary circulation, improving myocardial perfusion, and optimizing long-term clinical outcomes. Accordingly, the patient was considered an appropriate candidate for surgical repair and was referred for cardiovascular surgical evaluation to plan definitive correction.

III. TABLE

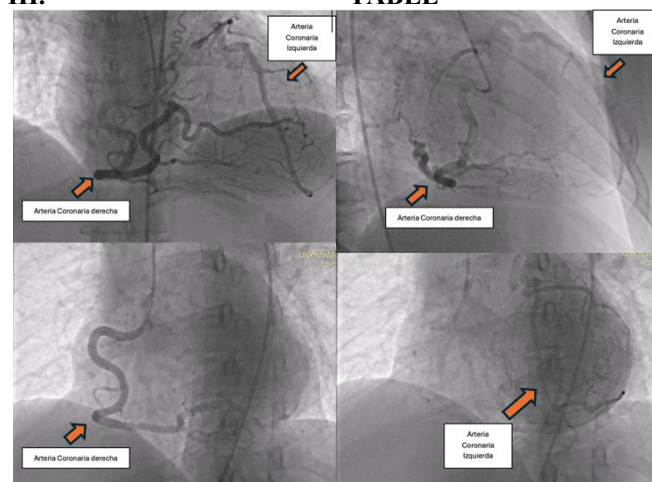


Figure 1. (A, B) Antegrade opacification of the right coronary artery with retrograde opacification of the left coronary artery through extensive collateral circulation. (C) Retrograde filling of the right coronary artery following selective cannulation of the right coronary ostium. (D) Retrograde opacification of the left coronary artery following selective cannulation of the right coronary ostium, demonstrating collateral flow and coronary steal consistent with anomalous left coronary artery from the pulmonary artery (ALCAPA).

V. DISCUSSION

Anomalous left coronary artery from the pulmonary artery (ALCAPA), also known as Bland-White-Garland syndrome,

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is a rare congenital coronary anomaly first described in 1933 by Bland, White, and Garland, who reported a series of infants presenting with heart failure and myocardial ischemia secondary to the anomalous origin of the left coronary artery from the main pulmonary artery (1). The estimated incidence is approximately 1 in 300,000 live births, accounting for 0.25% to 0.5% of all congenital heart defects (2). Without surgical correction, more than 90% of affected patients die during the first year of life. However, a small proportion survive into adulthood owing to the development of an extensive collateral network arising from the right coronary artery (2,3). During fetal life and the immediate neonatal period, elevated pulmonary vascular resistance allows antegrade perfusion of the left coronary artery, thereby maintaining adequate myocardial blood flow. Following birth, the physiological decline in pulmonary vascular resistance results in a progressive reduction in pulmonary artery pressure and oxygen content, leading to impaired perfusion of the left coronary circulation (2,4). Consequently, the coronary steal phenomenon develops, whereby blood supplied through collateral vessels from the right coronary artery flows retrogradely through the anomalous left coronary artery into the pulmonary artery rather than perfusing the left ventricular myocardium. This mechanism results in chronic myocardial ischemia, infarction, fibrosis, left ventricular systolic dysfunction, and ischemic mitral regurgitation secondary to papillary muscle involvement (2,5). Even in patients who survive into adulthood because of well-developed collateral circulation, persistent myocardial hypoperfusion predisposes them to ventricular arrhythmias, heart failure, and sudden cardiac death (2,6). The clinical presentation depends primarily on the degree of collateral coronary circulation and the patient's age. In infancy, symptoms typically develop between six and twelve weeks of life, coinciding with the physiological decline in pulmonary vascular resistance. Affected infants commonly present with feeding difficulties, diaphoresis, irritability, tachypnea, failure to thrive, and signs of congestive heart failure (2,7). Physical examination may reveal cardiomegaly, a gallop rhythm, and varying degrees of mitral regurgitation. In adolescents and adults, the disease may remain asymptomatic for many years or present with exertional angina, dyspnea, syncope, palpitations, ventricular arrhythmias, or sudden cardiac death as the initial manifestation (3,6). Electrocardiography frequently demonstrates evidence of previous anterolateral myocardial infarction, characterized by deep Q waves in leads I, aVL, and the left precordial leads. Transthoracic echocardiography may reveal left ventricular dilation, reduced left ventricular ejection fraction, and mitral regurgitation (2). Transthoracic echocardiography is considered the first-line diagnostic modality because of its

widespread availability and high diagnostic sensitivity when performed by experienced operators. Characteristic findings include dilation of the right coronary artery, visualization of the anomalous origin of the left coronary artery, extensive intramyocardial collateral vessels, and retrograde flow from the left coronary artery into the pulmonary artery on color Doppler imaging (2,8). Coronary computed tomography angiography and cardiac magnetic resonance imaging accurately define the anomalous coronary anatomy while simultaneously assessing myocardial ischemia, fibrosis, and ventricular function (2). Invasive coronary angiography remains the reference standard when diagnostic uncertainty exists or detailed anatomical information is required for surgical planning. Typical angiographic findings include a markedly dilated right coronary artery, extensive collateral circulation, and retrograde opacification of the left coronary artery with drainage into the main pulmonary artery (3). Furthermore, late gadolinium enhancement on cardiac magnetic resonance imaging provides valuable information regarding myocardial viability and the burden of myocardial fibrosis, facilitating risk stratification for ventricular arrhythmias (9). Definitive management consists of surgical correction, which is recommended for all patients regardless of age or symptom status because of the lifelong risk of sudden cardiac death (2,10). The primary objective is to restore a physiological dual-coronary artery system. Direct reimplantation of the anomalous left coronary artery into the aorta is considered the preferred surgical technique, providing the most favorable long-term outcomes. When direct reimplantation is anatomically unfeasible, the Takeuchi procedure, which creates an intrapulmonary tunnel to redirect oxygenated blood from the aorta to the anomalous left coronary artery, represents an effective alternative. Less commonly employed techniques include coronary artery bypass grafting combined with ligation of the anomalous pulmonary origin (2,5). Mitral valve repair or replacement is generally reserved for patients with persistent severe mitral regurgitation after myocardial revascularization, as mitral valve function often improves following restoration of myocardial perfusion (2). The prognosis of ALCAPA has improved substantially with early diagnosis and timely surgical intervention. Most patients experience progressive recovery of left ventricular systolic function within the first months after surgery, accompanied by significant improvement or resolution of mitral regurgitation (2). Contemporary surgical series report long-term survival rates exceeding 90–95% when definitive repair is performed promptly (2,10). Nevertheless, some patients continue to exhibit residual myocardial fibrosis, ventricular dysfunction, persistent mitral regurgitation, or ventricular arrhythmias, underscoring the importance of lifelong follow-up in specialized adult congenital heart

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disease centers. Periodic evaluation with echocardiography, cardiac magnetic resonance imaging, and functional testing remains essential for detecting late complications and optimizing long-term clinical outcomes (2,9).

IV. CONCLUSION

Anomalous left coronary artery from the pulmonary artery (ALCAPA) is an exceptionally rare congenital cardiac anomaly, with survival into the fifth decade of life representing an uncommon finding that reflects the development of sufficient collateral coronary circulation to delay the onset of clinical manifestations. Nevertheless, these patients remain at high risk for myocardial ischemia, heart failure, malignant ventricular arrhythmias, and sudden cardiac death, even in adulthood. This case highlights that ALCAPA should be included in the differential diagnosis of acute coronary syndrome in adults, particularly when angiographic findings are not consistent with obstructive atherosclerotic coronary artery disease. In this context, the integration of coronary angiography with multimodality imaging techniques, such as echocardiography, coronary computed tomography angiography, and cardiac magnetic resonance imaging, is essential to establish the diagnosis, accurately define coronary anatomy, and guide definitive surgical planning. According to current ACC/AHA guideline recommendations, surgical correction carries a Class I indication in all patients with ALCAPA, regardless of age or clinical presentation, as it represents the only definitive strategy capable of restoring a physiological dual-coronary circulation and altering the natural history of the disease. This case underscores the importance of maintaining a high index of suspicion for non-atherosclerotic causes of myocardial ischemia and demonstrates that timely diagnosis followed by early surgical intervention remains the principal determinant of favorable outcomes and long-term survival.

REFERENCES

- I. Bland EF, White PD, Garland J. Congenital anomalies of the coronary arteries. *Am Heart J*. 1933;8:787-801.
- II. 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;13:1561.
- III. Suchodolski A, Królikowska M, Kowal A, et al. Anomalous left coronary artery from the pulmonary artery in adults: a systematic review of clinical presentation, diagnosis, and outcomes. *Int J Cardiovasc Imaging*. 2026;42:161-174.
- IV. Carter YM, Wehrle CJ, Mahajan K. *Anatomy, Thorax, Heart Anomalous Left Coronary Artery*. StatPearls Publishing; 2023.
- V. American Association for Thoracic Surgery. Congenital Cardiac Surgery literature on ALCAPA repair.
- VI. European Society of Cardiology. Guidelines for the management of adult congenital heart disease. *Eur Heart J*. 2020.
- VII. American Heart Association. Scientific Statement on Management of Congenital Heart Disease in Adults.
- VIII. American Society of Echocardiography. Recommendations for Multimodality Assessment of Congenital Coronary Anomalies.
- IX. Society for Cardiovascular Magnetic Resonance. Expert Consensus on Cardiovascular Magnetic Resonance in Congenital Heart Disease.
- X. Dodge-Khatami A, Mavroudis C, Backer CL. Surgical repair of ALCAPA: long-term outcomes. *Ann Thorac Surg*.