



Congenital Absence of the Left Anterior Descending Artery with Compensatory Septal and Diagonal Supply in a 68-Year-Old Patient: A Rare Angiographic Finding

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ABSTRACT

Congenital coronary artery anomalies are uncommon and are most often discovered incidentally during coronary imaging. Among these anomalies, absence or agenesis of the Left Anterior Descending artery (LAD) is exceptionally rare. We report the case of a 68-year-old patient referred for invasive coronary angiography following a positive stress echocardiogram suggestive of inducible ischemia in the anterior territory. Coronary angiography unexpectedly demonstrated the absence of a conventional LAD arising from the left main coronary artery. Instead, a large diagonal branch and a prominent septal artery provided effective perfusion of the anterior wall and interventricular septum. No significant obstructive coronary artery disease was identified. This case illustrates the importance of recognizing rare coronary anatomical variants, avoiding misdiagnosis as chronic LAD occlusion, and considering complementary multimodality imaging for definitive anatomical characterization.

KEYWORDS: Congenital coronary artery anomaly, Left Anterior Descending artery agenesis, Coronary angiography, Diagonal branch, Septal artery, Inducible anterior ischemia

INTRODUCTION

Coronary artery anomalies are identified in approximately 0.5% to 2% of patients undergoing coronary angiography. Most variants are benign incidental findings, whereas some may be associated with ischemia, arrhythmia, heart failure, or sudden cardiac death depending on their anatomical course and hemodynamic consequences.

The Left Anterior Descending artery is one of the most clinically relevant coronary vessels, supplying the anterior wall of the left ventricle, the apex, and a major portion of the interventricular septum. Pathology involving the LAD frequently carries substantial prognostic implications. Congenital anomalies affecting the LAD include anomalous origin, duplication, short LAD variants, hypoplasia, and, in exceedingly rare cases, complete absence.

CASE PRESENTATION

A 68-year-old patient with cardiovascular risk factors was referred for evaluation of suspected stable coronary artery disease after a positive stress echocardiogram. The stress test demonstrated inducible ischemia involving the anterior myocardial territory, prompting invasive coronary angiography.

At presentation, the patient was hemodynamically stable. Physical examination was unremarkable. Resting electrocardiography showed no acute ischemic abnormalities. Baseline transthoracic echocardiography demonstrated preserved left ventricular systolic function without significant resting regional wall motion abnormalities.

Given the positive functional ischemia test and the patient's age-associated cardiovascular risk profile, coronary angiography was indicated.

Coronary Angiography Findings

Selective left coronary angiography demonstrated a normally arising left main coronary artery. However, no conventional LAD artery was visualized arising from the left main bifurcation and coursing within the anterior interventricular groove.

Instead, the following findings were observed:

- A well-developed large diagonal branch arising from the left coronary system and supplying the anterolateral wall.
- A prominent septal perforator artery extending deeply into the interventricular septum with distal contribution toward the anterior territory.
- Preserved distal myocardial perfusion without angiographic evidence of flow-limiting stenosis.

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Selective right coronary angiography was subsequently performed to evaluate the possibility of an anomalous LAD origin from the right coronary sinus or right coronary artery. No such anomalous vessel was identified. No significant obstructive coronary lesions were noted.

The angiographic appearance strongly suggested congenital absence or severe hypoplasia of the LAD with compensatory perfusion through collateral native substitute branches.

DISCUSSION

Absence of the LAD is an exceptionally rare coronary anomaly. In routine clinical practice, failure to visualize the LAD during angiography more commonly raises suspicion for proximal chronic total occlusion, anomalous origin, or dual LAD anatomy rather than true congenital absence.

Differential diagnosis includes chronic total proximal LAD occlusion, short or dual LAD anatomy, anomalous origin, or congenital hypoplasia/agenesis.

In this case, absence of a proximal stump, lack of collateral retrograde filling, and presence of structured compensatory branches favored a congenital variant.

The anterior myocardial wall is usually dependent on LAD flow. In rare congenital variants, alternative branches such as diagonal arteries or septal perforators may enlarge over time to maintain sufficient perfusion.

Stress-induced ischemia may be explained by relative flow limitation, microvascular dysfunction, or false-positive results.

Coronary CT angiography would be useful to confirm anatomy and exclude missed anomalous origin.

Management

As no significant obstructive coronary artery disease was present and perfusion appeared preserved, conservative medical management was favored. This included optimization of cardiovascular prevention measures and follow-up according to symptoms and risk profile.

CONCLUSION

We describe a rare case of apparent congenital absence of the LAD diagnosed during coronary angiography in a 68-year-old patient investigated for inducible ischemia. Recognition of such uncommon coronary variants is essential to avoid misclassification and guide management.

Learning Points

- Non-visualization of the LAD does not necessarily indicate occlusion.
- Congenital variants may remain silent until late adulthood.
- Compensatory branches may provide adequate perfusion.
- Multimodality imaging is useful for diagnosis.
- Recognition is important for intervention planning.

FIGURES

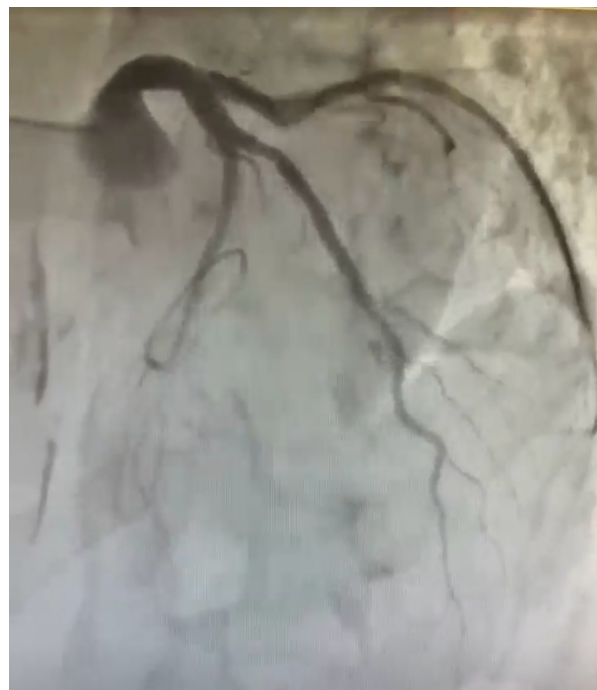


Figure 1. Coronary angiography showing absence of a conventional LAD with compensatory supply from a large diagonal branch and prominent septal artery.



Figure 2. Right coronary angiography excluding anomalous LAD origin from the right coronary system.

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