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Case Report

Early Onset of Coronary Subclavian Steal Syndrome: A Case Report and Literature Review

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Abstract

Introduction

Coronary subclavian steal syndrome (CSSS) is a rare phenomenon that often goes undiagnosed and causes severe complications, including death. This report presents a case of CSSS with unexpectedly early presentation following coronary artery bypass grafting (CABG).

Case presentation

A 49-year-old male with diabetes, smoking history, and ischemic heart disease underwent CABG with a left internal mammary artery graft to the LAD and saphenous vein grafts. Three months later, he presented with exertional chest pain and left arm discomfort. Examination revealed a significant inter-arm blood pressure difference (right 140/90 mmHg, left 90/65 mmHg) and a diminished left radial pulse. Computed tomography angiography revealed complete proximal left subclavian artery occlusion with patent grafts. Percutaneous revascularization with balloon pre-dilatation and a 7.0 × 27 mm stent restored flow. The procedure was uneventful, and at 10-month follow-up, he remained asymptomatic with normalized arm pressures.

Literature review

A review of ten recent CSSS cases revealed a predominance of males (7/10), with ages ranging from 58 to 81 years. Comorbidities included cardiovascular, renal, and metabolic disorders. Chest pain was the most frequent presenting symptom. The interval from CABG to CSSS onset ranged from two days to 13 years. Management strategies encompassed percutaneous coronary interventions, nitrates, antihypertensives, and statins, with all patients achieving favorable outcomes.

Conclusion

Coronary subclavian steal syndrome can present shortly after CABG. Percutaneous endovascular stenting via a dual approach might offer good long-term outcomes.

1. Introduction

Subclavian steal syndrome (SSS) is a condition in which severe stenosis or occlusion of the proximal subclavian artery causes reversal of blood flow in the ipsilateral vertebral artery [1]. It affects 0.6%–6.4% of the general population, with higher prevalence in elderly men owing to the increased atherosclerosis [2]. In patients with three-vessel or left main coronary artery disease, the prevalence of SAS can be as high as 5.3% [1].

Coronary subclavian steal syndrome (CSSS) is an uncommon complication of coronary artery bypass grafting (CABG) that arises when the left internal mammary artery (LIMA) is used in patients with previously unrecognized, significant left subclavian artery stenosis (SAS) [3]. This phenomenon reduces blood flow through the internal mammary artery (IMA), thereby compromising coronary perfusion and potentially resulting in myocardial ischemia and angina [1].

The most common cause of subclavian artery stenosis is atherosclerosis, and, more rarely, arteritis, radiation, fibromuscular dysplasia, and compression syndromes [4]. Using the LIMA as the primary conduit increases the risk of developing CSSS. Although CSSS remains rare, with a reported incidence of 0.2%–6.8%, its occurrence is rising in parallel with the growing use of LIMA in CABG [3]. A limited number of case reports and case series on CCCS have been published in the available literature [4]. CSSS typically manifests several years after CABG [3]. However, this case represents one of the earliest documented occurrences of CSSS associated with complete subclavian artery occlusion, highlighting its potential for unexpectedly early presentation. This report was written following CaReL guidelines, and all the references have been checked for validity [5,6].

2. Case presentation

2.1. Patient information

A 49-year-old male with a history of smoking, long-standing diabetes mellitus, and ischemic heart disease underwent CABG. The surgery involved a left internal mammary artery LIMA graft to the left anterior descending (LAD) artery and saphenous vein grafts to the first and last obtuse marginal branches, as well as the first diagonal branch. Three months later, he presented with recurrent chest pain and left arm discomfort, predominantly triggered by exertion of the left upper limb.

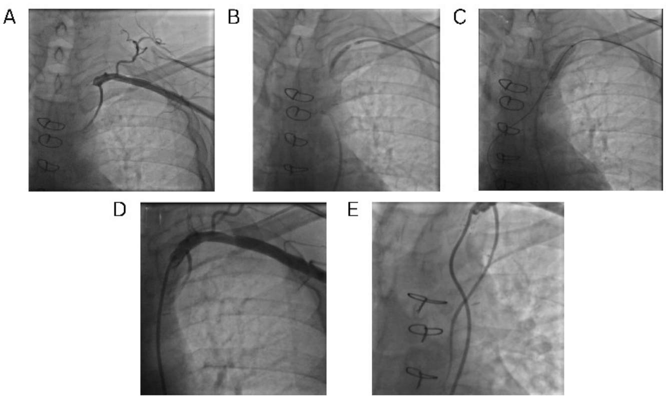

Figure 2. A) Selective angiography of the left internal mammary artery demonstrating proximal subclavian artery occlusion. Only a short segment of the proximal left internal mammary artery is opacified, with rapid retrograde washout into the distal subclavian artery.
B) Balloon angioplasty performed after successfully crossing the lesion with a guidewire, using multiple balloon sizes. C) Deployment of a balloon-expandable peripheral stent across the lesion. D) Restoration of antegrade flow in the subclavian artery following stenting. E) Cessation of retrograde flow in the LIMA

2.2. Clinical findings

The patient appeared well and hemodynamically stable. Notably, systemic peripheral arterial blood pressure measured 140/90 mmHg in the right arm and 90/65 mmHg in the left arm, with a diminished radial pulse on the left side.

2.3. Diagnostic approach

An electrocardiogram was performed and was unremarkable, and echocardiography revealed no significant abnormalities. A CT angiography of the coronary grafts and thoracic outlet was subsequently obtained, demonstrating complete occlusion of the left subclavian artery just proximal to the LIMA ostium. In contrast, all coronary grafts, including the LIMA, remained patent (Figure 1).

Figure 1. CT angiography of the coronary grafts and thoracic outlet demonstrates complete occlusion of the left subclavian artery immediately proximal to the origin of the left internal mammary artery, compromising graft inflow.

2.4. Therapeutic intervention

Percutaneous revascularization of the left subclavian artery (SA) was undertaken via a left radial approach. Selective angiography of the LIMA demonstrated complete occlusion of the proximal SA, with opacification limited to a few centimeters of the proximal LIMA and rapid retrograde filling of the SA, consistent with collateral flow from the LAD artery through the LIMA.

The lesion was crossed using a 0.014" Pilot 200 guidewire (Abbott, USA). Pre-dilatation was performed with a 4.0 × 20 mm semi-compliant balloon, followed by deployment of a 7.0 × 27 mm balloon-expandable peripheral stent (Medtronic, USA). Optimal stent positioning was ensured with angiography via the right femoral approach. Post-procedural imaging confirmed restoration of anterograde flow, with complete resolution of the SA occlusion and improved perfusion of both the LIMA and distal SA (Figure 2). Hemostasis at the radial access site was achieved using a compression device, and manual compression was applied at the femoral site until adequate hemostasis was

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Table 1. Review of recent cases of coronary subclavian steal syndrome.

Author, year [reference]	Cases	Age	Sex	Comorbidities	Presentation	Period from CABG to presentation	ECG	Management	Outcome	Follow-up
Carmona et al., 2022 [4]	1	71	M	IHD, CKD, COPD, HT, dyslipidemia & T2D	Chest pain, abdominal pain & oliguria	13 years	ST depression (V5, V6, aVL), ST elevation in aVR	Coronary angiography, Angioplasty of the middle LCX with stents, Angioplasty and stenting of the LSA, & Aspirin + Clopidogrel	LVEF improved from 20% to 40%	N/A
Multani et al., 2025 [8]	1	64	M	CAD	Recurrent angina and dyspnea	2 years	No ischemic changes	Beta-blocker, nitrate, ranolazine, Percutaneous occlusion of large unligated LIMA side branch using vascular plug	Improved LAD flow & resolution of angina	6 months
Trebišovský et al., 2025 [9]	1	58	M	IHD, HT, hemochromatosis	Exertional chest pain & dyspnea	8 months	No ischemic changes	Percutaneous obliteration of LCA using Amplatz Vascular Plug II	Resolution of exertional angina	1 year
Elhakim et al., 2025 [10]	1	81	M	IHD, Hyperlipoproteinemia & HT	Cardiogenic shock, STEMI of the anterior lateral wall	9 years	Sinus rhythm, ST elevation in leads V1–V6, I, and aVL	Emergent cardiac catheterization, PCI of the LSA using two stents, Aspirin, Clopidogrel, Statin, ACE inhibitor, Beta-blocker	Hemodynamic stabilization & symptom relief	1 year
Şahin et al., 2021 [1]	1	77	F	N/A	Exertional dyspnea, chest pain & exhaustion	10 years	Sinus rhythm, no ischemic changes	Coronary angiography, Percutaneous transluminal angioplasty with drug-coated balloon, self-expandable stent placement, aspirin & clopidogrel.	Correction of reverse flow in LIMA, resolution of angina	1 year
Choubdar, 2024 [11]	1	60	F	CAD, PAD, CVA, T1D, HT, dyslipidemia, HF & COPD	Tachycardia, chest pain, pulmonary edema, elevated troponin	4 years	Sinus rhythm, Ventricular and premature atrial complexes, Nonspecific ST-segment changes	Conservative medical management, left upper extremity angiogram with stent placement (unsuccessful), planned interval operative intervention for the SA	N/A	N/A

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confirmed. No vascular closure device or surgical drain was equired. The patient remained hemodynamically stable throughout the procedure, with no immediate complications.

This intervention eliminated coronary subclavian steal, thereby preserving LIMA graft patency and ensuring adequate myocardial perfusion. He was discharged on dual antiplatelet therapy along with standard medical management.

2.5. Follow-up

Ten months post-intervention, he remained asymptomatic, with no recurrence of chest pain or exertional discomfort. Blood pressure measurements and pulse volume were comparable between the right and left arms.

3. Discussion

The LIMA is the preferred and most frequently used conduit for myocardial revascularization. During CABG, the proximal end of the LIMA is typically attached to the left SA, while the distal end is anastomosed to the stenotic coronary artery [7]. Anatomically, the LIMA gives off several side branches that supply the chest wall, sternum, and adjacent structures. During bypass surgery, these branches are typically ligated to prevent coronary steal from the LAD, which could otherwise lead to cardiac ischemia [7].

The clinical presentation of CSSS is highly variable; it can manifest as stable angina, STEMI, arrhythmias, or sudden death, resembling other coronary syndromes [1]. Most patients develop stable angina years after CABG (mean 9 ± 8.4 years). However, Mustapić et al. described STEMI on the second postoperative day due to missed SA occlusion [3]. The mean duration from CABG to clinical presentation of CSSS was 4.3±4.7 years, with some durations exceeding 10 years; chest pain was the most common symptom, followed by dyspnea (Table 1) [1,3,4,7-11]. In contrast, this patient developed subacute angina and left arm discomfort three months after CABG, and progressed to complete occlusion, earlier than the mean interval. The absence of ECG changes or hemodynamic changes reflects a more indolent yet clinically significant presentation.

The diagnosis of CSSS is often challenging and relies on clinical suspicion, particularly when certain physical signs are present, such as an inter-arm blood pressure difference of ≥15 mmHg [7]. This patient exhibited a striking 50/25 mmHg difference between the right and left arms, strongly suggesting subclavian artery involvement. Shadman et al. reported that a 15-mmHg difference could indicate clinically significant SAS [12]. However, the primary limitation of blood pressure measurement is that it provides only an indirect assessment [1]. While digital subtraction angiography remains the traditional gold standard for imaging SAS, it has increasingly been replaced by duplex ultrasound, CT angiography, or magnetic resonance angiography [9]. For the current patient, the electrocardiogram was unremarkable, and echocardiography revealed no significant abnormalities. CT angiography of the coronary grafts and thoracic outlet demonstrated complete occlusion of the left SA just proximal to the LIMA ostium.

Table 1. Continued.

Mustapić et al., 2024 [3]	1	62	M	T2D & hypercholesterolemia	Acute NSTEMI, instability, ST elevation in lateral and anteroseptal leads	2 days	Initial: Diffuse ST depression (inferior/lateral), ST elevation in aVR, Post-op: ST elevation in lateral and anteroseptal leads	Coronary angiography and aortic arch angiography, PTA of the LSA using balloon dilatation and stent placement, PCI of the obtuse marginal artery with two drug-eluting stents	Resolution of ECG changes, Hemodynamic stabilization	3 months
		61	F	Familial hypercholesterolemia, Carotid artery stenosis	Unstable angina with ST depression	3 years	Extensive ST-segment depression, ST elevation in aVR and V1	Balloon-expandable endoprosthesis implantation	Resolution of symptoms	5 months
Real et al., 2021 [7]	3	72	M	T2D, CKD	NSTEMI with prolonged chest pain	5 months	No ST/T changes	Balloon-expandable stent	Resolution of symptoms	6 months
		76	M	HT, carotid artery stenosis	Asymptomatic, detected during follow-up due to an absent left arm pulse	1 year	Sinus rhythm, No ischemic changes	Balloon-expandable stent, Predilatation with Mustang balloon	Resolution of symptoms	10 months

F: Female, M: Male, IHD: Ischemic heart disease, CKD: Chronic kidney disease, COPD: Chronic obstructive pulmonary disease, HT: Hypertension, T2D: Type 2 diabetes, CAD: Coronary artery disease, N/A: Not applicable, PAD: Peripheral artery disease, CVA: Cerebrovascular accident, T1D: Type 1 diabetes, HF: Heart failure, STEMI: ST-Elevation Myocardial Infarction, NSTEMI: Non-ST-elevation Myocardial Infarction, ECG: Electrocardiogram, LCX: Left circumflex artery, LSA: Left Subclavian Artery, LIMA: left internal mammary artery, LCA: Left Coronary Artery, PCI: Percutaneous coronary intervention, ACE: Angiotensin-Converting Enzyme, SA: Subclavian artery, PTA: Percutaneous transluminal angioplasty, LVEF: Left ventricular ejection fraction, LAD: Left anterior descending

Axillary-to-axillary or carotico-subclavian bypass are major surgical techniques for the treatment of SAS [1]. However, percutaneous transluminal angioplasty with or without stenting and subclavian artery bypass surgery are the most commonly employed methods for managing SSS. Among these, percutaneous transluminal angioplasty is generally preferred due to its lower morbidity and shorter hospital stay [1]. The choice of endovascular intervention in this case as first-line therapy aligns with current evidence-based recommendations, as Jahic et al. established percutaneous intervention as the preferred initial approach for subclavian artery stenosis, with success rates ranging from 84-100% for stenotic lesions [13]. However, this case presented the additional challenge of complete occlusion, which typically carries lower success rates [13]. Utilizing both radial and femoral access for optimal visualization improved the procedural outcome. Steinberger et al. reported treating a similar case with dual access, which resulted in complete resolution of symptoms [14]. A balloon-expandable peripheral stent was used in the current patient, as in five of the reviewed cases, because it is preferred for lesions requiring precise positioning and offers favorable outcomes [1,3,7,10].

Management of CSS also involves secondary prevention following CABG, which includes controlling risk factors and using therapies such as antithrombotic agents and statins [4]. Antiplatelets, lipid-lowering agents, renin–angiotensin–aldosterone system inhibitors, and beta-blockers are among the therapies utilized in CSSS cases [1,4,10].

4. Conclusion

Coronary subclavian steal syndrome can present shortly after CABG. Percutaneous endovascular stenting via a dual approach might offer good long-term outcomes.

Declarations

Conflicts of interest: The authors have no conflicts of interest to disclose.

Ethical approval: Not applicable.

Patient consent (participation and publication): Written informed consent was obtained from the patient for publication.

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Use of AI: ChatGPT version 5.2 (OpenAI) was used solely for language editing, paraphrasing, and improvement of clarity and grammar in this manuscript. The artificial intelligence tool did not contribute to the study design, data collection, data analysis, data interpretation, or the generation of scientific content. All outputs produced with the assistance of ChatGPT were carefully reviewed, verified, and approved by the authors. The authors take full responsibility for the accuracy, integrity, and originality of the entire manuscript.

Data availability statement: The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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