A complex case of peripheral artery disease by suspected microembolization in a diabetic patient - the importance of a multidisciplinary approach (case report)

Veronica Galizia[1], Enikő Nemes-Nagy[2*], Zoltán Preg[3]

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ABSTRACT

Background: The purpose of this article is to highlight the importance of in a case of peripheral arterial disease (PAD) with suspected microembolization, through the presentation of a complex clinical case involving a patient with a mechanical heart valve, anemia, and heart failure. The aim is also that of emphasizing the importance of the multidisciplinary approach to treating comorbid conditions, such as type 2 diabetes, in patients with PAD.

Case Presentation: A 48-year-old diabetic and hypertensive man presented with rest pain and left forefoot gangrene. He was diagnosed with advanced PAD (Fontaine stage IV) with multiple comorbidities. Endovascular revascularization and optimized multidisciplinary management were performed, resulting in clinical improvement, increased walking distance, and regression to Fontaine stage IIA.

Conclusion: This case emphasizes that advanced PAD requires prompt multidisciplinary management and strict control of comorbidities, highlighting also that poor adherence to anticoagulation therapy and risk factor management may contribute to complications such as microembolization, which was considered the most likely underlying mechanism in this case, whereas active patient engagement is essential to optimize outcomes and prevent disease progression.

Keywords: Case report, diabetes mellitus, multidisciplinary approach, peripheral arterial disease, quality of life.

Type of Article: Case Report **Specialty:** Cardiology

Correspondence to: Enikő Nemes-Nagy
*Department of Chemistry and Medical Biochemistry, Faculty of Medicine in English, George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Targu Mures, Târgu Mureș, Romania.
Email: eniko.nemes-nagy@umfst.ro
Full list of author information is available at the end of the article.

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Introduction

Peripheral arterial disease (PAD) represents the partial or complete obstruction of peripheral vessels, mainly affecting the lower limbs. Its prevalence is projected to rise steadily, primarily due to the increasing incidence of major risk factors such as diabetes mellitus (DM). Within the diabetic population, the prevalence of PAD is more than double compared to the general population [1]. The present article emphasizes the relevance of a multidisciplinary clinical approach in the management of PAD, especially in the presence of multiple comorbid conditions, integrating non-pharmacological strategies alongside conventional medical treatment.

Complications, such as hyperglycemic crises and diabetic foot ulcers, increase hospitalization rates, diminish quality of life, and elevate mortality. Chronic nonhealing ulcers can lead to limb amputation and functional disability. PAD is often underdiagnosed in diabetic patients. Atherosclerosis is the principal underlying mechanism, with a specific predilection for distal arterial segments in diabetic individuals, particularly in the lower limbs [1].

Regarding the progression of the patient's condition from symptom onset to long-term follow-up, Table 1 summarizes the rapid evolution from rest pain and tissue loss to a diagnosis of advanced PAD (Fontaine stage IV), emphasizing the importance of timely recognition and intervention. Notably, the documented clinical improvement during follow-up, including functional recovery and stage regression to a lower Fontaine stage, illustrates the effectiveness of combined interventional and conservative strategies.

Table 1. *Timeline of key clinical events.*

Admission 18.04.2023	Rest pain in the left forefoot and progressive gangrene Clinical evaluation: absent distal pulses (anterior tibial artery - ATA, posterior tibial artery - PTA) Laboratory assessment: anaemia, hyperglycaemia, dyslipidaemia, INR in lower therapeutic range ABI: left 0.52, right 0.72 → significant ischemia Doppler ultrasound and angio-CT: occlusion of the left SFA (superficial femoral artery) Multidisciplinary diagnosis: PAD Fontaine stage IV
Shortly after diagnosis	Endovascular revascularization (balloon angioplasty) (interventional radiology team)
Post-procedure	Optimization of medical therapy and anticoagulation monitoring (cardiovascular rehabilitation team)
Follow-up	Functional improvement: Fontaine stage IV -> IIA (walking distance 360 m) clinically confirmed.
Long-term follow-up	Annual multidisciplinary monitoring + ADA (American Diabetes Association)-guided diabetes follow-up (diabetology team)

Table 2. *Laboratory test results.*

Parameter	Baseline value	Normal range
Hemoglobin	11.7 g/dl	13.7-17.5 g/dl
Hematocrit	35%	40-51%
MCV	91.1 fl	79-92 fl
MCHC	33.4 g/dl	32-36 g/dl
Leukocyte number	10.26 × 10^3/µl	4.23-9.07 × 10^3/µl
ESR	53 mm/h	5-15 mm/h
Fibrinogen	6.02 g/l	1.5-4.0 g/l
INR	2.07	0.8-1.2 (therapeutic target: 2-3)
Blood glucose (morning)	177 mg/dl	70-99 mg/dl
Blood glucose (noon)	220 mg/dl	70-140 mg/dl
Blood glucose (evening)	223 mg/dl	70-140 mg/dl
Total cholesterol	210 mg/dl	<200 mg/dl
Triglycerides	308 mg/dl	<150 mg/dl
eGFR	48.8 ml/min/1.73 m^2	>90 ml/min/1.73 m^2

Case Presentation

A diabetic and hypertensive male patient aged 48 years presented with rest pain localized in the left forefoot and a 3-week history of multiple punctate necrotic lesions (Figure 1). The lifestyle-related risk factors were a history of smoking (18 pack-years), dyslipidemia, and a series of comorbid conditions: mechanical heart valve in the aortic position, coronary bypass graft surgery, chronic heart failure (CHF) classified as New York Heart Association (NYHA) functional class II with reduced ejection fraction, chronic kidney disease (CKD), and iron deficiency anemia.

Laboratory findings (Table 2) highlight the coexistence of poorly controlled metabolic risk factors, renal impairment consistent with moderate CKD, inflammatory activation, and mild anemia, which are indicative of an increased cardiovascular burden. Vascular assessment demonstrated an Ankle-Brachial Index (ABI) of 0.52 in the left lower limb and 0.72 in the right, consistent with PAD and indicating more severe ischemia on the left side. An ABI <0.90 is also an independent predictor of major adverse cardiovascular events and mortality [2].

Imaging modalities are presented sequentially, with duplex-ultrasound (US) and angiography-computed tomography (angio-CT) (Figure 2) serving complementary roles in confirming arterial occlusion and delineating the anatomical extent of the disease besides angiography (Figure 3).

Electrocardiography showed left ventricular hypertrophy with secondary ST segment and T wave abnormalities during repolarization.

Transthoracic echocardiography revealed concentric left ventricular hypertrophy with septal predominance, reduced systolic function (ejection fraction 39%), and diastolic dysfunction. The mechanical aortic valve was functioning normally, with mild paravalvular leak, and mild mitral and tricuspid regurgitation were also noted.

Additional vascular imaging excluded significant carotid disease.

Diabetic peripheral neuropathy may coexist with PAD and contribute to lower-limb symptoms; however, the presence of ischemic rest pain, tissue loss, and objective hemodynamic impairment favored a vascular etiology [3]. The clinical appearance of diffuse punctiform necrotic lesions was highly suggestive of microembolization; however, this could not be demonstrated by paraclinical findings, nor could the source of embolization

Figure 1. *Clinical pictures of the left foot demonstrating distal forefoot ischemic tissue loss, characterized by multiple punctate necrotic lesions involving the toes and plantar surface, with areas of dry gangrene and focal coalescence of necrotic tissue. No patient-identifying features are visible.*

Table 3. *Comprehensive overview of clinical presentation, diagnosis, and management.*

Assessment	Key findings	Diagnosis	Intervention
Clinical exam	Rest pain, gangrene	Critical limb ischemia (Fontaine IV)	Urgent revascularization
ABI	0.52 (left), 0.72 (right)	PAD	Severe limb ischaemia
Duplex-US + angio-CT	SFA occlusion (left)	Advanced PAD	Endovascular treatment
Laboratory	Hyperglycaemia, dyslipidaemia, CKD, inflammation, anaemia	High CV risk profile	Risk factor optimization, IV (intravenous) iron
ECG (electrocardiogram)	LVH (left ventricle hypertrophy), ST-T changes	Cardiac involvement	Further cardiac evaluation
Echocardiography	EF (ejection fraction) 39%, LVH, valvular findings	HFrEF, valvular disease	GDMT (Guideline-Directed Medical Therapy) optimization
Carotid Doppler	No significant stenosis	Excludes carotid disease	No intervention needed
Differential assessment	Neuropathy versus NAADs (Non-atherosclerotic Arterial Disorders) excluded	Atherosclerotic PAD	Targeted vascular treatment
Post-procedure status	Stable after revascularization	Chronic disease management	Anticoagulation, statin + ezetimibe, CHF therapy
Functional status	Limited mobility	PAD-related impairment	Home-based exercise program

(mechanical valve, intracardiac, or intravascular) be identified. We could not clearly distinguish between atherosclerotic PAD progression, diabetic foot disease, thromboembolism, and microembolization, but we believe that all these mechanisms may have contributed to the clinical picture. The differential diagnosis included thromboangiitis obliterans, adventitial cystic disease, and fibromuscular dysplasia [3] compared with atherosclerotic PAD through imaging characteristics and pathophysiological mechanisms.

The first therapeutic intervention consisted of an urgent revascularization.

Post-procedural management included a systematic optimization of medical therapy. Correction of anemia was achieved with intravenous iron carboxymaltose 1,000 mg, in Table 4. 2-3 (therapeutic target range, optimal value 2.5 in patients with mechanical valve in aortic position) anticoagulation with a vitamin K antagonist (VKA), short-term antiplatelet therapy, intensification of heart failure treatment with sacubitril/valsartan (49/51 mg), lipid-lowering treatment with maximally tolerated dose of atorvastatin/ezetimibe combination, and individualized glycemic control, according to current guidelines [4,5]. Pain management was also addressed by a paracetamol/tramadol combination and gabapentin.

Non-pharmacological interventions included patient education and self-management, together with glycemic monitoring, dietary advice, anticoagulation, and preventive foot care (Table 3). A structured exercise program was introduced as a key rehabilitative component, while International Normalized Ratio (INR) values were reported at least monthly by the patient in electronic form (Table 4). After revascularization, there was no need for debridement or minor amputation, but adjustments in

Figure 2. *Angio-CT three-dimensional reconstruction of the left lower limb showing complete occlusion of the left SFA with interruption of contrast opacification along the affected segment and distal collateral vessel development.*

Table 4. *Post-interventional laboratory values.*

Parameter	Baseline value	Follow-up values after 6 months	Normal range/therapeutic target
HbA1c	7.9%	6.1%	<7% (target in DM)
LDL cholesterol	101 mg/dl	68 mg/dl	<55 mg/dl
INR	2.04-2.07	2.5-3.0	2-3.0 (therapeutic target range, optimal value 2.5 in patients with mechanical valve in aortic position)

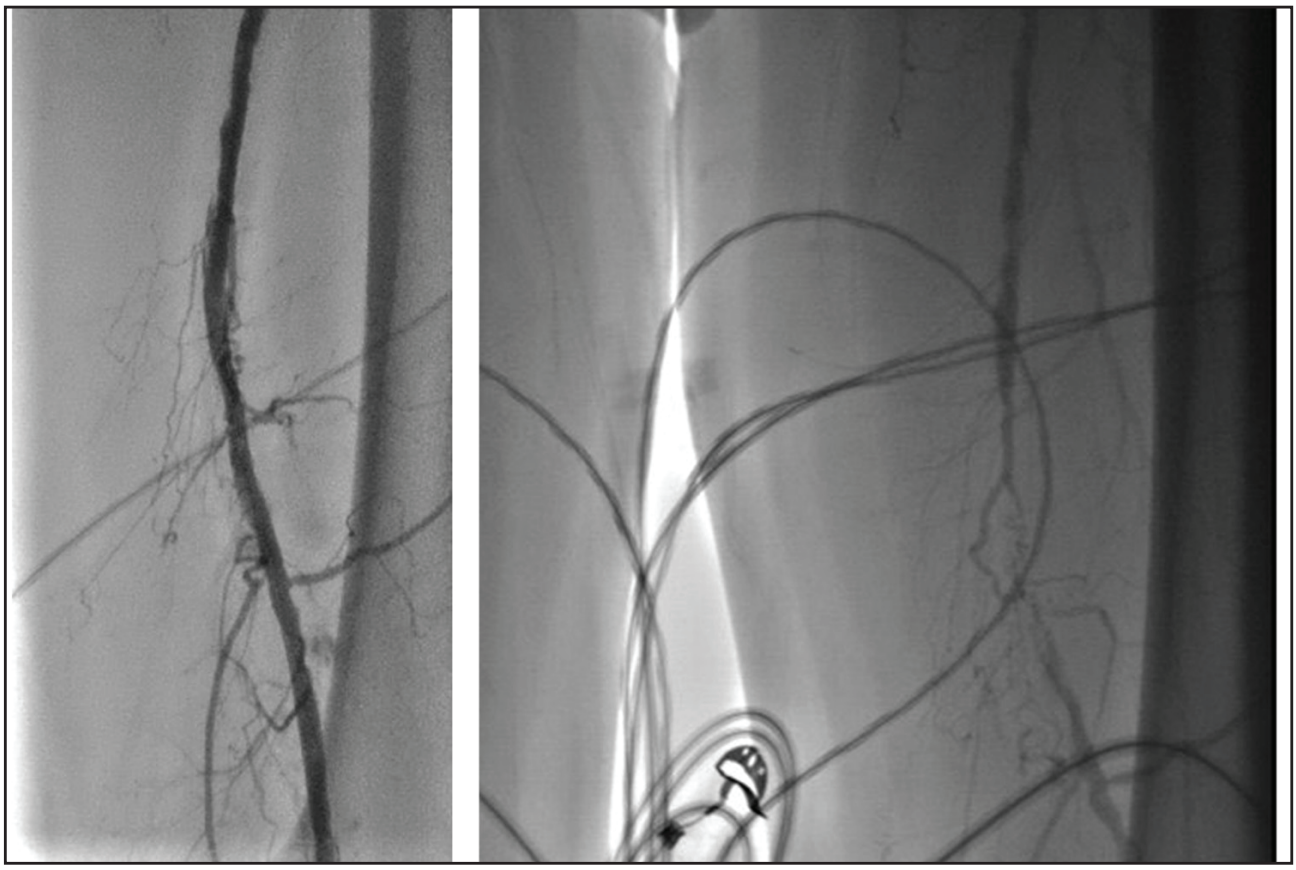

Figure 3. *Angiographic images of the SFA during endovascular revascularization for PAD. Left: pre-treatment angiography demonstrating complete occlusion of the SFA in the middle third, 4.5 cm in length, with absence of anterograde flow and presence of collateral circulation. Right: post-percutaneous transluminal angioplasty (balloon size 5 mm, femoral access) without stenting, showing restoration of vessel patency with re-established anterograde flow and no significant residual stenosis.*

VKA therapy were made by the cardiovascular rehabilitation team, and antibiotic therapy with IV oxacillin was needed for methicillin-sensitive *Staphylococcus aureus* for 10 days.

The patient's adherence to this complex therapy was essential for achieving a rapid improvement in clinical and laboratory parameters.

Discussion

This case report shows the evolution of a diabetic patient with PAD facing mechanical valve anticoagulation issues, offering details regarding his complex and multidisciplinary management.

The chosen intervention, percutaneous balloon angioplasty, was an appropriate option that is associated with reduced mortality and limb loss [6].

Treatment optimization played an important role in improving tissue oxygen delivery, including correction of iron deficiency anemia, which has a proven role in heart failure management [4]. Postoperative optimization of glycated hemoglobin values correlates with a lower risk of critical limb ischemia [7]. Titrating sacubitril/valsartan to target levels may improve peripheral circulation in patients with heart failure with reduced ejection fraction (HFrEF). The therapy improves peripheral vascular function, reduces systemic vascular resistance, and augments tissue perfusion [8].

All these therapies are intended to improve the clinical outcomes of the initial interventional therapy. The importance of the early interventional approach is supported by several clinical studies [9].

The role of exercise therapy is also emphasized, as it improves the quality of life and reinforces the importance of non-pharmacological interventions within comprehensive care [5]. This aspect shouldn't be underestimated, since most of the patients are not adherent to the treatment, worsening their clinical situation [10].

Improvement of patient adherence to medication, INR monitoring, nonpharmacological therapies, dietetic changes, and carbohydrate metabolic control according to current guidelines also had a very important role in the success of therapy, together with the risk of developing complications related to diabetes and lower mortality [11].

Reductions in key biomarkers and achievement of therapeutic targets are linked to improved adherence and effectiveness of a personalized treatment strategy. The patient's prognosis remains guarded due to the high burden of systemic atherosclerosis and comorbidities, with an elevated long-term risk of recurrent cardiovascular and limb events.

Strengths include real-world applicability, exploration of complex pathophysiological interactions, and longitudinal follow-up. Limitations are framed in terms of generalizability and incomplete mechanistic evidence.

Key clinical principles, including the importance of multidisciplinary care, risk factor modification, and individualized antithrombotic strategies, are applicable beyond this case. The potential role of inadequate anticoagulation, which might have promoted disease progression, should be taken into consideration, in addition to diabetes [12,13].

Conclusion

The case underlines the importance of optimizing antithrombotic therapy in order to prevent peripheral microembolization, as suggested by the clinical appearance of necrotic lesions. Improvements in anticoagulation control, glycemic status, and lipid levels are indicators of successful therapeutic adherence. Functional recovery was achieved, as evidenced by increased walking distance and improved disease staging.

Follow-up strategies incorporate regular monitoring of clinical status, risk factors, and treatment adherence in addition to proper diabetes management.

Integration of interventional, pharmacological, and lifestyle strategies was tailored to individual patient profiles, based on a relationship of trust, to optimize both limb-related and cardiovascular outcomes.

Take-home message: A multidisciplinary approach is essential in the management of complex vascular conditions, as it allows for a comprehensive evaluation and integration of different clinical perspectives. In this context, recognizing PAD requires a thorough and accurate differential diagnosis to avoid misinterpretation and delays in treatment. Equally important is the implementation of a tailored medical strategy, carefully adapted to the individual patient's clinical profile and comorbidities. A strong and trusting patient-physician relationship plays a pivotal role, as it encourages timely healthcare-seeking behavior and helps prevent disease progression and clinical deterioration. Ultimately, a comprehensive understanding of the combined role of medical, pharmacological, and non-pharmacological interventions is crucial to optimize patient outcomes and significantly improving quality of life.

What is new?

PAD is a frequent pathology with increasing prevalence, atherosclerosis being an important cause of obstructions in the vessels. Comorbidities such as DM increase the occurrence of complications in patients with PAD.

This paper presents a complex case of PAD by suspected microembolization in a diabetic patient with several other comorbidities, emphasizing the multidisciplinary approach necessary in these cases. The interventions (surgical, medical, and lifestyle-related) are described, and the follow-up of the patient is presented using imagistic, clinical, and laboratory data.

List of Abbreviations

ABI	Ankle-Brachial Index
ADA	American Diabetes Association
Angio-CT	Angiography-computed tomography
ATA	Anterior tibial artery
CHF	Chronic heart failure
CKD	Chronic kidney disease
DM	Diabetes mellitus
ECG	Electrocardiogram
EF	Ejection fraction
eGFR	estimated glomerular filtration rate
ESR	Erythrocyte sedimentation rate
GDMT	Guideline-directed medical therapy
HbA1c	Glycated Haemoglobin
HFrEF	Heart Failure with reduced Ejection Fraction
INR	International Normalized Ratio
LDL	Low-density lipoprotein
LVH	Left ventricular hypertrophy
NAADs	Non-atherosclerotic arterial disorders
NYHA	New York Heart Association
PAD	Peripheral arterial disease
PTA	Posterior tibial artery
SFA	Superficial femoral artery
US	Ultrasound
VKA	Vitamin K antagonist

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent for publication

Written informed consent was obtained from the patient for publication of this case report and accompanying images. All images were fully de-identified before publication, and no patient-identifying information is visible.

Ethics approval

Not required for a single-patient, anonymous case report at our institution.

Author details

Veronica Galizia[1], Enikő Nemes-Nagy[2], Zoltán Preg[3]

1. Medical Student, Faculty of Medicine, George Emil Palade University of Medicine, Pharmacy, Sciences, and Technology of Târgu Mureș, Târgu Mureș, Romania
2. Department of Chemistry and Medical Biochemistry, Faculty of Medicine in English, George Emil Palade University of Medicine, Pharmacy, Sciences, and Technology of Targu Mures, Târgu Mureș, Romania
3. Department of Family Medicine, Faculty of Medicine, George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Targu Mures, Târgu Mureș, Romania

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Summary of the case

Patient (gender, age)	Male, in his 40s
Final diagnosis	Advanced PAD, Fontaine stage IV due to occlusion of the left superficial femoral artery, type 2 DM, heart failure (HFrEF, NYHA II), and mechanical aortic valve, Iron deficiency anaemia, hypercholesterolaemia, obesity grade 1.
Symptoms	Rest pain, progressive gangrene, limited walking capacity
Medications	Acenocumarol, atorvastatin, bisoprolol, sacubitril/valsartan, dapagliflozin, spironolactone, pantoprazole, paracetamol/tramadol, gabapentin, insulin; post procedure: aspirin, ezetimibe, IV iron
Clinical procedure	Urgent endovascular revascularization of the left superficial femoral artery
Specialty	Cardiology, clinical biochemistry, vascular surgery