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Research Article

Distal Angioplasty in Diabetic Patients: A Two-Year Retrospective Study at Fann University Hospital, Dakar, Senegal

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Abstract

Background: Distal angioplasty has become a key therapeutic option for diabetic patients presenting with chronic limb-threatening ischemia (CLTI), particularly in settings where infrapopliteal, diffuse, and calcified lesions are predominant. Despite the growing burden of diabetes in sub-Saharan Africa, regional data remain scarce. *Methods:* This retrospective, single-center study included all diabetic patients who underwent distal angioplasty at Fann Hospital between January 2021 and December 2022. Clinical characteristics, cardiovascular risk factors, imaging findings, procedural techniques, and postoperative outcomes were analyzed. *Results:* Eighty-six patients were included (mean age 66.3 ± 7.5 years). Most presented with stage IV ischemia (84.88%). Type 2 diabetes was predominant (95.35%), with a mean duration of 14.3 years. CT angiography revealed multivessel distal disease in nearly all cases. Distal angioplasty was performed under local anesthesia in 96.52% of procedures, with antegrade puncture in 98.8%. A 3mm balloon was used in 87.2% of cases, and stenting was required in only one patient. Residual stenosis occurred in 10.47% of procedures and arterial dissection in 9.3%. Primary wound healing was achieved in 60.81% of patients, with a mean healing time of 4 months. Twenty-six amputations were performed (18 minor, 8 major). Overall mortality reached 17.4%, with hypertension significantly associated with death ($p = 0.028$). Median survival after angioplasty was 36 days. *Conclusion:* Distal angioplasty is feasible and effective in diabetic patients with severe lower-limb ischemia, even in resource-limited settings. However, high mortality highlights the need for comprehensive cardiovascular management, early PAD detection, and strengthened multidisciplinary care pathways to improve long-term outcomes.

Keywords

Distal Angioplasty, Diabetes, Chronic Limb-threatening Ischemia, Peripheral Arterial Disease

1. Introduction

Peripheral arterial disease of the lower limbs (PAD) represents one of the most severe complications of diabetes, characterized by diffuse, distal, and often calcified lesions that predominantly affect the tibial and peroneal arteries [1, 2]. In diabetic patients, the progression is frequently silent until an advanced stage, often leading to critical limb ischemia, chronic ulcerations, severe infections, and a high risk of major amputation [3, 4]. In low-re-

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source countries, this clinical picture is further aggravated by delayed diagnosis, limited access to vascular investigations, and a high prevalence of cardiovascular risk factors [5].

Over the past two decades, distal angioplasty has emerged as a preferred revascularization strategy for patients presenting with limb-threatening ischemia, particularly when lesions are infrapopliteal and surgical options are limited [6, 7]. This minimally invasive approach helps restore tissue perfusion, promote wound healing, and reduce the need for major amputation [8, 9]. However, the outcomes of distal angioplasty remain variable across settings, influenced by lesion severity, the patient's overall condition, the presence of cardiovascular comorbidities, and the expertise of the treating centers [6, 10].

In sub-Saharan Africa, data on distal angioplasty in diabetic patients remain scarce, even though the burden of diabetes and PAD continues to rise [11, 12]. Fann Hospital, a referral center in thoracic and cardiovascular surgery, has been performing endovascular procedures for several years in patients with complex lesions, often at a very advanced stage.

In this context, it is essential to document the clinical characteristics, technical modalities, and outcomes of distal angioplasty in our environment.

The objective of this study is to evaluate the outcomes of distal angioplasty in diabetic patients managed in the Department of Thoracic and Cardiovascular Surgery at Fann Hospital, by analyzing their epidemiological profile, lesion severity, technical aspects of revascularization, and postoperative outcomes, particularly regarding wound healing, amputation, and mortality.

2. Materials

2.1. Study Design

This was a single-center, retrospective, descriptive, and analytical study conducted in the Department of Thoracic and Cardiovascular Surgery at Fann Hospital.

The inclusion period extended from January 1, 2021, to December 31, 2022, corresponding to a total duration of 24 months.

2.2. Study Population

Inclusion criteria

All patients meeting the following criteria were included:

1) Known diabetes (type 1 or type 2).
2) Peripheral arterial disease requiring distal angioplasty (lesions located below the knee).
3) Complete medical records including clinical, paraclinical, and operative data.

Non-inclusion criteria

The following were excluded:

1) Patients who underwent non-endovascular revascularization.
2) Isolated proximal angioplasties (femoral, iliac).
3) Incomplete medical records.

2.3. Statistical Analysis

Data analysis was performed using the STATA software.

Quantitative variables were expressed as mean ± standard deviation.

Qualitative variables were presented as counts and percentages.

Comparisons were made using the Chi-square test.

A p-value < 0.05 was considered statistically significant.

3. Results

3.1. Epidemiological Data

The study included 86 diabetic patients who underwent distal angioplasty.

The mean age was 66.3 ± 7.5 years, with extremes ranging from 44 to 86 years. The most represented age group was 65-74 years (53.5%).

3.2. Cardiovascular Risk Factors

Most patients had type 2 diabetes (95.35%), while type 1 diabetes accounted for 4.65%, with a mean disease duration of 14.3 years.

Hypertension was present in 63.95%, smoking in 20.9%, and alcohol consumption in 6.98% (Table 1).

3.3. Medical and Surgical History

More than half of the patients (55.8%) had no prior medical history.

The most frequent histories were angioplasty and minor disarticulation (10.5% each), followed by major amputation (9.3%). (Table 1)

Table 1. *Epidemiological, clinical, paraclinical, operative and postoperative data.*

Epidemiological characteristics of the patients	
Characteristics	**Value**
Total number	86
Mean age (years)	66,3 ± 7,5
Age min-max (years)	44-86
Male sex	31 (36%)
Female sex	55 (64%)

Cardiovascular risk factors

Factor	Number	(%)
Type 2 Diabetes	82	95,35
Type 1 Diabetes	4	4,65
Hypertension	55	63,95
Smoking	18	20,9
Alcohol consumption	6	6,98

Patient history

History	Number	(%)
Lower-limb angioplasty	9	10,5
Minor Amputation	9	10,5
Miajor Amputation	8	9,3
Ischemic heart disease	6	7
Stroke	4	4,7

Location of involvement

Location	Number	(%)
Right lower limb	43	50
Left lower limb	39	45,35
Bilateral	4	4,65

Clinical stage of PAD

Stage	Number	(%)
IIb	4	4,65
III	9	10,5
IV	73	84,88

Preoperative ABI

ABI	Number	(%)
< 0,4	12	13,95
0,4 - 0,75	33	38,37
0,75 - 0,9	7	8,14
0,9-1,3	11	12,79
> 1,3 (medial calcification)	16	18,6

Preoperative ABI

ABI	Number	(%)
Not measured	7	8,14

Doppler ultrasound lesions

Artery	Occlusion (%)	Stenosis (%)	Total
Anterior tibial	15	24,5	39,5
Posterior tibial	13	20,7	33,7
Fibular	10,7	16,1	26,8

CT angiography lesions

Artery	Occlusion (%)	Stenosis (%)	Total
Anterior tibial	15	24,5	39,5
Fibular	10,7	16,1	26,8

Technical characteristics of angioplasty

Parameter	Value (%)
Local anesthesia	96,52
Anterograde puncture	98,8
Distal angioplasty alone	42
Distal + femoropopliteal angioplasty	44
3mm balloon	87,2
Femoral stent	1,16 (1 patient)

Amputations

Minor	Toes	12	46,1
	Forefoot	6	23,1
Major	Leg	4	15,4
	Thigh	4	15,4
Total		26	100

3.4. Clinical Data

3.4.1. Location of Arterial Involvement

The right lower limb was affected in 50% of cases, the left in 45.35%, and bilateral involvement was observed in 4.65% (Table 1).

3.4.2. Clinical Stage

Most patients were classified as stage IV according to Leriche and Fontaine (84.88%) (Table 1).

3.4.3. Vascular Examination

Distal pulses were absent in 96.51% of patients.

Preoperative ABI indicated severe or moderate PAD in more than half of the cases (Table 1).

3.5. Paraclinical Data

1) *Doppler ultrasound*

A Doppler ultrasound was performed in 27.9% of patients.

2) *CT angiography*

CT angiography was performed in 97.67% of patients.

3.6. Therapeutic

Operative technique

1) Local anesthesia was used in *96.52%* of procedures.
2) Antegrade puncture was performed in *98.8%* of cases, reflecting its status as the predominant access route.
3) A *7F introducer* was employed in *73.26%* of interventions.
4) Distal angioplasty alone accounted for *42%* of procedures, while a combined distal and femoropopliteal approach was required in *44%* of cases.
5) A *3-mm balloon* was used in *87.2%* of angioplasties, consistent with the small caliber of tibial vessels.
6) Stent placement was exceptional, performed in *only one patient*. (Table 1)

3.7. Postoperative Outcomes

3.7.1. Per-procedure Complications

Residual stenosis was observed in 10.47% of procedures.

Arterial dissection occurred in 9.3% of cases.

3.7.2. Clinical Evolution and Postoperative ABI

The early postoperative period was marked by clear clinical improvement. Most patients showed:

1) A significant reduction in resting pain
2) A measurable improvement in ABI, indicating partial restoration of limb perfusion (Figure 1).

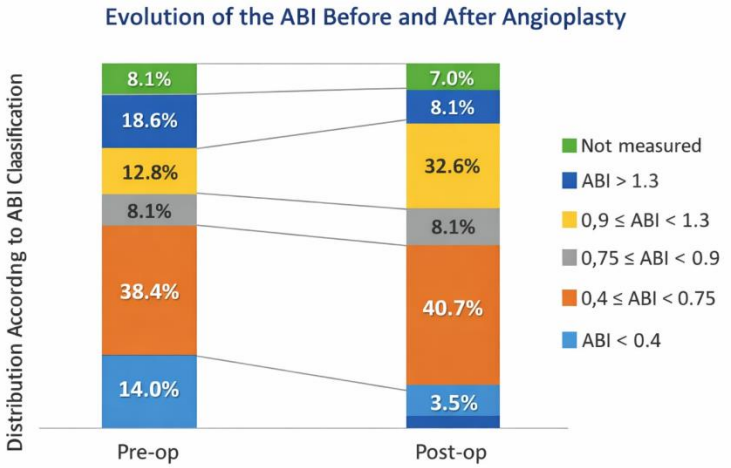

Figure 1. *Comparison of preoperative and postoperative ABI.*

3.7.3. Wound Healing

Primary healing was achieved in 60.81% of patients.

The mean healing time was 4 months.

3.7.4. Amputations

A total of 26 amputations were performed: (Table 1)

1) 18 minor (12 toes, 6 forefoot)
2) 8 major (4 leg, 4 thigh)

3.7.5. Mortality

A total of 15 deaths (17.4%) were recorded after 15 months of follow-up

Main causes:

1) Myocardial infarction: 4
2) Heart failure: 2
3) Stroke: 1
4) Acute renal failure: 1
5) Unknown cause: 7

3.7.6. Correlation Analysis

1) *Cardiovascular risk factors/history and risk of complications*

Among cardiovascular risk factors, only ischemic heart disease was correlated with complications ($p = 0.001$) (Table 2).

2) *Clinical stage and risk of death*

There was no correlation between clinical stage and risk of death ($p > 0.05$),

Pearson chi^2 (3) = 7.4052 P-value = 0,06 (Table 2).

3) *Cardiovascular risk factors and risk of death*

Hypertension ($p = 0.028$) was the main cardiovascular risk factor associated with mortality (Table 2).

Table 2. *Correlation analysis.*

Cardiovascular risk factors/history and risk of complications					
Risk factors		**Number of complications**			**P-value**
		0	**1**	**2**	
Hypertension	Yes	73,36	20	3,64	0,697
	No	83,87	12,9	3,23	
Smoking	Yes	83,33	16,67	0	0,652
	No	77,94	17,65	4,41	
Alcohol consumption	Yes	83,33	16,67	0	0,886
	No	78,75	17,5	3,75	
Ischemic heart disease	Yes	50	0	50	0,001
	No	79,27	17,07	3,66	
Diabetes type	Type 1	75	25	0	0,864
	Type 2	79,27	17,07	3,66	
Diabetes duration (years)	< 5	75	25	0	0,123
	6 - 10	66,67	13,33	20	
	11 - 15	92,31	7,69	0	
	16 - 20	78,26	21,74	0	
	21 - 30	80	20	0	
	>30	80	20	0	

Cardiovascular risk factors and risk of death				
Risk factors		**Death**		**P-value**
		Yes	**No**	
Hypertension	Yes	28,26	71,74	0,028
	No	7,14	92,86	
Smoking	Yes	31,25	68,75	0,217
	No	17,24	82,76	
Alcohol consumption	Yes	50	50	0,128
	No	18,57	81,43	
Ischemic heart disease	Yes	50	50	0,289
	No	19,44	80,56	
Diabetes type	Type 1	50	50	0,128

Cardiovascular risk factors and risk of death				
Risk factors		Death		P-value
		Yes	No	
	Type 2	18,57	81,43	
	< 5	5,88	94,12	
Diabetes duration (years)	6 - 10	25	75	0,054
	11 - 15	30,77	69,23	

Clinical stages of PAD and risk of death			
Stages	Death		P-value
	Yes	No	
Stage IIb	0	100	
Stage III	42,86	57,14	0,06
Stage IV	17,74	82,26	

3.7.7. Survival

Survival curve analysis showed a median post-angioplasty death time of 36 days.

At this observation point, 79 patients (91.8%) were still alive.

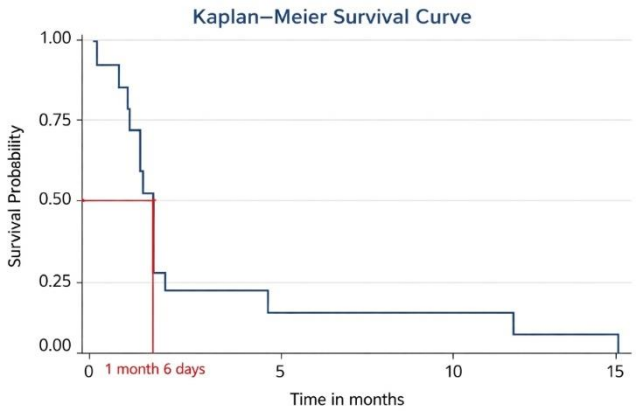

Figure 2. *Survival curve.*

4. Discussion

Distal angioplasty now occupies a central role in the management of chronic limb-threatening ischemia (CLTI) in diabetic patients, due to the predominance of infrapopliteal, diffuse, and calcified lesions in this population [1, 2]. Our study confirms this profile, with an overwhelming majority of patients classified as stage IV according to Leriche and Fontaine (84.88%), reflecting a late diagnosis—an expected situation in low-resource settings where delayed consultation, self-medication, and limited access to specialized care worsen the prognosis [3, 5].

From an epidemiological standpoint, the mean age of 66 years and the female predominance observed in our cohort are consistent with global trends showing an increasing prevalence of PAD among diabetic women, likely related to prolonged exposure to risk factors and historical underrepresentation in screening programs [5, 13]. The mean duration of diabetes (14.3 years) is a major element, as long-standing diabetes is strongly correlated with the progression of medial calcification, microangiopathy, and neuropathy—three factors that aggravate ischemia severity and delay wound healing [7, 14].

Paraclinical data from our study confirm the multivessel and distal nature of the lesions, with predominant involvement of the tibial and peroneal arteries, as described in major international series [9]. The presence of incompressible arteries in 18.6% of cases reflects medial calcification, a hallmark of diabetic arteries, which complicates ABI interpretation and may mask the true severity of ischemia [9]. This particularity justifies complementary assessment with the toe-brachial index (TBI), particularly when ABI is unreliable because of medial arterial calcification, together with vascular imaging (Doppler ultrasound, CT angiography) for an accurate assessment of distal perfusion [4].

From a technical perspective, distal angioplasty was performed under local anesthesia in 96.5% of cases, in line with current recommendations aimed at reducing anesthetic risks in frail, multimorbid patients [15]. Antegrade puncture, used in 98.8% of cases, is the preferred access route for infrapopliteal interventions, as it provides better device stability and more precise navigation in distal segments. The predominant use of 3 mm balloons reflects adaptation to the small caliber of tibial arteries, consistent with international standards [16].

The immediate results of our study show a relatively low rate of per-procedure complications, with 10.47% residual stenosis and 9.3% arterial dissections. These figures are comparable to those reported in European and Asian series, where infrapopliteal dissections range from 5% to 15% depending on lesion complexity [13, 17]. The improvement in postoperative ABI demonstrates the hemodynamic effectiveness of revascularization, even in the context of complex and calcified lesions.

The primary healing rate (60.81%) observed in our study is encouraging and consistent with international data reporting healing rates between 50% and 70% after distal angioplasty in diabetic patients [10, 18]. The mean healing time of 4 months is also comparable to international series, where complete healing generally occurs between 3 and 6 months. However, healing remains strongly influenced by the quality of the distal run-off, the presence of infection, nutritional status, and multidisciplinary management—factors that are often difficult to optimize in African settings [19, 20].

The major amputation rate (9.3%) observed in our study is lower than that reported in several African cohorts, where it may exceed 20% [21, 22]. This suggests that distal angioplasty, even in resource-limited settings, allows for significant limb salvage. However, the overall amputation rate (30.2%) remains high, reflecting the severity of initial lesions, the frequent presence of associated infections, and delays in management. This finding highlights the importance of early screening, strengthened therapeutic education, and multidisciplinary care involving diabetologists, infectious disease specialists, surgeons, and podiatrists.

The mortality rate of 17.4% is concerning but consistent with data showing that diabetic patients with critical ischemia have a high risk of cardiovascular death in the months following revascularization [22, 23]. In our series, hypertension was significantly associated with mortality ($p=0.026$), consistent with observations that overall cardiovascular burden is a major determinant of prognosis [1, 5]. The median survival of 36 days underscores the extreme fragility of this population [24].

Finally, the absence of correlation between clinical stage and mortality in our study may be explained by the homogeneity of the population, largely dominated by the most severe stages, limiting statistical variability. This finding has also been reported in other series where the severity of comorbidities outweighs clinical classification in predicting prognosis [7, 25].

Overall, our results confirm that distal angioplasty is an effective revascularization strategy in resource-limited settings, but its success depends heavily on comprehensive management of the diabetic patient, early diagnosis, and optimization of cardiovascular risk factors.

5. Conclusion

Distal angioplasty represents an essential revascularization strategy for diabetic patients presenting with severe lower-limb ischemia. In our series, it resulted in significant hemodynamic improvement, satisfactory wound-healing rates, and limb salvage in most of cases, despite the severity of lesions and the high prevalence of comorbidities. The outcomes obtained confirm the feasibility and effectiveness of this approach even in a resource-limited setting.

However, the high mortality observed highlights the cardiovascular fragility of this population. It underscores the importance of comprehensive management integrating strict control of risk factors, early screening for PAD, and optimization of postoperative follow-up. Delayed access to care, associated infections, and medial calcification remain major obstacles to achieving optimal outcomes.

The development of multidisciplinary pathways dedicated to diabetic foot care, improved access to vascular imaging, and wider dissemination of endovascular techniques are essential levers for improving patient prognosis. Distal angioplasty must therefore be integrated into a global strategy of prevention, revascularization, and follow-up to sustainably reduce the risk of amputation and mortality among diabetic patients.

6. Recommendations

The findings of this study highlight the need for earlier detection of peripheral arterial disease in diabetic patients and the implementation of structured multidisciplinary care pathways dedicated to diabetic foot management. Optimizing cardiovascular risk control, standardizing revascularization protocols, and reinforcing postoperative follow-up are essential to improve functional outcomes and reduce mortality.

From a research standpoint, prospective multicenter studies, evaluation of angiosome-guided strategies, analysis of early mortality predictors, and the establishment of a national diabetic foot registry represent key avenues for advancing knowledge and adapting therapeutic strategies to the realities of resource-limited settings.

Abbreviation

PAD	Peripheral Arterial Disease
CLTI	Chronic Limb-Threatening Ischemia
ABI	Ankle-Brachial Index
TBI	Toe-Brachial Index
CT	Computed Tomography

BTK	Below-The-Knee
PTA	Percutaneous Transluminal Angioplasty
7F	7 French (Introducer Size)
MM	Millimeter
IIb / III / IV	Leriche & Fontaine Clinical Stages

Author Contributions

Ndeye Fatou Sow: Funding acquisition, Project administration, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing

Abdoul Aziz Thiaw: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Writing-original draft

Magaye Gaye: Methodology, Software, Validation, Visualization

Papa Adama Dieng: Formal Analysis, Validation, Visualization

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Conte MS, Bradbury AW, Kolh P, White JV, Dick F, Fitridge R, et al. Global vascular guidelines on the management of chronic limb-threatening ischemia. *Eur J Vasc Endovasc Surg*. 2019; 58(1 Suppl): S1-S109. e33. https://doi.org/10.1016/j.ejvs.2019.05.006

[2] Ferraresi P, Giurato L, et al. Long-term outcomes after angioplasty of isolated below-the-knee arteries in diabetic patients with critical limb ischaemia. *Eur J Vasc Endovasc Surg*. 2009; 37(3): 336-342. https://doi.org/10.1016/j.ejvs.2008.12.001

[3] Armstrong DG, Boulton AJM, Bus SA. Diabetic foot ulcers and their recurrence. *N Engl J Med*. 2017; 376(24): 2367-2375. https://doi.org/10.1056/NEJMra1615439

[4] Hinchliffe RJ, Forsythe RO, Apelqvist J, et al. Guidelines on diagnosis, prognosis, and management of peripheral artery disease in patients with foot ulcers and diabetes (IWGDF 2019 update). *Diabetes Metab Res Rev*. 2020; 36(S1): e3276. https://doi.org/10.1002/dmrr.3276

[5] Atun R, Davies JI, Gale EAM, et al. Diabetes in sub-Saharan Africa: from clinical care to health policy. Lancet Diabetes Endocrinol. 2017; 5(8): 622-667. https://doi.org/10.1016/S2213-8587(17)30181-X

[6] Farber A, Menard MT, Conte MS, Kaufman JA, Powell RJ, Choudhry NK, et al. Surgery or Endovascular Therapy for Chronic Limb-Threatening Ischemia. N Engl J Med. 2022; 387(25): 2305-2316. https://doi.org/10.1056/NEJMoa2207899

[7] Jones WS, Dolor RJ, Hasselblad V, et al. Comparative effectiveness of endovascular and surgical revascularization for patients with critical limb ischemia: a systematic review. J Am Coll Cardiol. 2012; 60(22): 2140-2147. https://doi.org/10.1016/j.jacc.2012.08.1017

[8] Katsanos K, Kitrou P, Spiliopoulos S, et al. Comparative effectiveness of plain balloon angioplasty, bare metal stents, drug-coated balloons, and drug-eluting stents for the treatment of infrapopliteal artery disease: systematic review and Bayesian network meta-analysis of randomized controlled trials. *J Endovasc Ther*. 2016; 23(6): 851-863. https://doi.org/10.1177/1526602816671740

[9] Faglia E, Dalla Paola L, Clerici G, et al. Peripheral angioplasty as the first-choice revascularization procedure in diabetic patients with critical limb ischemia: prospective study of 993 consecutive patients. Eur J Vasc Endovasc Surg. 2005; 29(6): 620-627. https://doi.org/10.1016/j.ejvs.2005.02.035

[10] Shin CS, Yoo KC. Predictive factors of wound healing and limb salvage after successful below-the-knee endovascular angioplasty in patients with diabetic foot ulcer: a retrospective study. Medicina (Kaunas). 2025; 61(2): 277. https://doi.org/10.3390/medicina61020277

[11] Bekele F, Chelkeba L, Fekadu G. Risk factors and outcomes of diabetic foot ulcers in patients attending a tertiary care hospital in Ethiopia: a prospective observational study. BMC Endocr Disord. 2020; 20: 2. https://doi.org/10.1186/s12902-019-0467-4

[12] Ameh EA, Mshelbwala PM, Sabiu L, et al. Pattern and outcome of diabetic foot lesions in a Nigerian tertiary hospital. Niger J Clin Pract. 2020; 23(6): 814-820. https://doi.org/10.4103/0300-1652.108900

[13] Brodmann M, Wissgott C, Holden A, Staffa R, Zeller T, Vasudevan T, et al. Treatment of infrapopliteal post-PTA dissection with Tack implants: 12-month results from the TOBA-BTK study. Catheter Cardiovasc Interv. 2018; 92(1): 96-105. https://doi.org/10.1002/ccd.27568

[14] Soga Y, Iida O, Hirano K, et al. Mid-term outcomes after endovascular therapy for infrapopliteal artery disease in patients with critical limb ischemia. *J Vasc Surg*. 2010; 52(5): 1161-1167. https://doi.org/10.1016/j.jvs.2010.05.108

[15] Dhanoa D, Baerlocher MO, Benko AJ, Benenati JF, Kuo MD, Dariushnia SR, et al. Position statement on noninvasive imaging of peripheral arterial disease by the Society of Interventional Radiology and the Canadian Interventional Radiology Association. *J Vasc Interv Radiol*. 2016; 27(7): 947-951. https://doi.org/10.1016/j.jvir.2016.03.049

[16] Lyden SP. Endovascular tibial interventions. Semin Vasc Surg. 2009; 22(4): 241-248. https://doi.org/10.1053/j.semvascsurg.2009.10.003

[17] Giles KA, Pomposelli FB, Hamdan AD, Blattman SB, Panossian H, Schermerhorn ML. Infrapopliteal angioplasty for critical limb ischemia: relation of TransAtlantic InterSociety Consensus class to outcome in 176 limbs. *J Vasc Surg*. 2008; 48(1): 128-136. https://doi.org/10.1016/j.jvs.2008.02.068

[18] Hossny AM, Eldesouky MS, Abdellatif MA. Angiosome-based revascularization for diabetic foot ulcer. *Int Surg J*. 2019; 6(10): 3474-3479. https://doi.org/10.18203/2349-2902.isj20194219

[19] Pereira MG, Vilaça M, Pedras S, Vedhara K, Dantas MJ, Machado L, et al. Wound healing and healing process in patients with diabetic foot ulcers: a survival analysis study. *Diabetes Res Clin Pract*. 2023; 198: 110623. https://doi.org/10.1016/j.diabres.2023.110623

[20] Jeffcoate W, Boyko EJ, Game F, Cowled P, Senneville E, Fitridge R. Causes, prevention, and management of diabetes-related foot ulcers. *Lancet Diabetes Endocrinol*. 2024; 12(7): 472-482. https://doi.org/10.1016/S2213-8587(24)00102-3

[21] Chalya PL, Mabula JB, Dass RM, Mbelenge N, Ngayomela IH, Chandika AB, et al. Surgical management of diabetic foot ulcers: a Tanzanian experience. *BMC Res Notes*. 2011; 4: 365. https://doi.org/10.1186/1756-0500-4-365

[22] Faglia E, Clerici G, Clerissi J, Gabrielli L, Losa S, Mantero M, et al. Early and five-year outcomes of diabetic patients with critical limb ischemia after successful peripheral angioplasty. *Eur J Vasc Endovasc Surg*. 2005; 30(2): 164-171. https://doi.org/10.1016/j.ejvs.2005.03.015

[23] Iida O, Nakamura M, Yamauchi Y, Kawasaki D, Yokoi Y, Yokoi H, et al. Endovascular therapy for patients with critical limb ischemia: clinical efficacy and prognostic factors for limb salvage and survival. *Circ J*. 2011; 75(3): 712-720. https://doi.org/10.1253/circj.CJ-10-0903

[24] Farber A, Eberhardt RT. The current state of critical limb ischemia: a systematic review. *JAMA Surg*. 2016; 151(11): 1070-1077. https://doi.org/10.1001/jamasurg.2016.2018

[25] Aboyans V, Ricco JB, Bartelink MEL, et al. 2017 ESC Guidelines on the diagnosis and treatment of peripheral arterial diseases. *Eur Heart J*. 2018; 39(9): 763-816. https://doi.org/10.1093/eurheartj/ehx095