ORIGINAL ARTICLE

DOI: 10.67076/cmj.2026.v4n1.02
J Cau Med Sci 2026;4(1):7-12

Features of Peripheral Artery Atherosclerosis in Patients with Diabetes

Samir Mehdiyev

Department of Therapy, Azerbaijan State Advanced Training Institute for Doctors named after A. Aliyev, Baku, Azerbaijan

ABSTRACT

The study involved 528 patients with type 2 diabetes mellitus and examined the relationship between ankle-brachial index and cardiovascular disease risk factors and other indicators. It was found that the average ankle-brachial index was >0.9 in different antidiabetic treatment groups. In those with inadequate glycemic control, signs of peripheral atherosclerosis were observed more frequently. Blood circulation in the lower extremities was mainly of the trunk type, in the subcompensation stage, the incidence of critical stenosis towards the distal region increased and decompensation occurred. Ankle-brachial index ≤0.9 and severity of stenosis in the lower extremities segments were observed more often in patients with hypertension. Increased microalbuminuria accelerated the process of atherosclerosis in peripheral arteries.

Keywords: Type 2 diabetes mellitus, ankle-brachial index, peripheral artery disease

INTRODUCTION

Peripheral arterial damage is considered one of the most common complications in patients with type 2 diabetes mellitus (2DM) [1,6]. One of the subclinical signs indicating damage to the lower limb arteries in patients with diabetes is the ankle-brachial index (ABI) [1,7,8]. This indicator <0.9 is considered a marker not only of peripheral arterial disease, but also of other target organ damage in 2DM patients [1,3,4,5]. It has been proven that in each geographical region there are characteristic clinical and epidemiological features of organ damage, including peripheral atherosclerosis, in this group of patients [2,3,4,5,8]. Without examining these data, it is impossible to adequately conduct secondary prevention measures in patients with diabetes. Taking these into account, our goal was to study the relationship between ABİ, a subclinical sign of peripheral atherosclerosis, and risk factors for cardiovascular diseases and other indicators in the Azerbaijani population of 2DM.

MATERIALS AND METHODS

The study involved 528 2DM patients aged 30-69 (301 from Baku, 227 from the regions of the republic). Patients underwent examinations using the "ARIC" questionnaire. Glycohemoglobin (HbA1c) <7% was considered a sign of adequate glycemic control, and HbA1c≥7% was considered a sign of poor control. The level of microalbumin (MAU) in urine collected during the day was considered a pathology when it was 30-300 mg/dl. ABI is considered an objective method for detecting chronic ischemia of the lower extremities. This index was sonographically measured as the ratio of systolic arterial pressure at the level of the posterior femoral artery and the posterior greater trochanteric artery to the same indicator in the brachial artery. ABI≤0.9 indicated the presence of peripheral arterial disease, 0.7-0.9 was assessed as mild, 0.4-0.7 as moderate, and <0.4 as severe stenosis.

RESULTS OF THE STUDY

The average ABI in patients was 1.061±0.009 (0.6-1.8). Although symptoms of atherosclerosis of the lower limb arteries were found with a fairly high frequency (66.7%), only 27.2±1.4% of patients had ABI<0.9, and 72.8±2% had ABI≥0.9. Sonographically, the stenosis of peripheral arterial vessels varied between 20-90%, the average indicator and severity of atherosclerotic stenosis increased towards the periphery, the maximum indicators were recorded in the knee-ankle segment was obtained (table 1). In the hip-thigh segment, blood flow was main in 98.7±1.3% of patients, collateral in 1.3±1.3%, in the thigh-knee segment, main in 97.4±1.8% of patients, collateral in 2.6±1.8%, and in the knee-ankle segment, main

Address for Correspondence: PhD, Assoc. Prof. Dr. Mehdiyev Samir Khasay, Department of Therapy, Azerbaijan State Advanced Training Institute for Doctors named after A. Aliyev, Baku, Azerbaijan
E-mail: samirmehdiyev1966@gmail.com **ORCID ID:** 0000-0001-5970-0456
Received: 15.07.2025 **Accepted:** 25.03.2026 **Publication Date:** 30.04.2026

Cite this article as: Mehdiyev S. Features of Peripheral Artery Atherosclerosis in Patients with Diabetes. J Cau Med Sci. 2026;4(1):7-12

Copyright© 2026 The Author. Published by Azerbaijan Gastroenterology and Invasive Endoscopy Society.
This is an open access article under the Creative Commons Attribution-Attribution-NonCommercial 4.0 (CC BY-NC 4.0) International License.

in 96.1±2.2% of them, collateral in 3.9±2.2%. In all 3 segments of peripheral arteries, blood circulation was found to be in the compensated stage in 18.4±4.4% of patients, in the hip-thigh and thigh-knee segments in 81.6±4.4%, in the knee-ankle segment in 76.3±4.9% of patients, and in the knee-ankle segment in 5.3±2.6% of patients, in the decompensation stage.

Table 1. Average indicators and structure of stenosis of the lower peripheral arteries

Parameters	HTS (n=76)		TKS (n=76)		KAS (n=76)	
M±m (min - max)	41.1±1.2 (25-65)		44.1±1.5 (20-80)		49.7±1.9 (20-90)	
Degree	25-40%	45-65%	25-45%	50-80%	20-50%	55-90%
Frequency	40 52.6±5.7%	36 47.4±5.7%	38 50.0±5.7%	38 50.0±5.7%	47 61.8±5.6%	28 38.2±5.6%

Note: *HTS - hip-thigh segment, HKS - thigh-knee segment, KAS - knee-ankle segment.*

According to the survey and objective examination, the symptoms of atherosclerosis of the lower limb vessels were more common in patients living in the regions than in Baku (77.1% vs 58.8%, respectively, p<0.001).

On the background of monotherapy with metformin and sulfonylurea drugs, ABIs were higher than in untreated patients (p<0.05), while during insulin treatment, ABId and ABIs were lower than in the group treated only with diet (p<0.01), and ABIs were lower than in the group treated only with diet (p<0.05) (table 2).

Table 2. Characteristics of ABI depending on treatment tactics

Groups \ Parameters	ABİd	ABİs
Untreated	1.079±0.036 (0.8-1.3)	1.145±0.032 (1-1.4)
Diet	1.168±0.061** (0.8-1.7)	1.150±0.044 (0.7-1.4)
Biguanide	1.067±0.046 (0.8-1.8)	1.053±0.045 (0.6-1.8)
Sulfonylurea drugs	1.091±0.019 (0.7-1.6)	1.082±0.019 (0.6-1.5)
Insulin therapy	1.025±0.018 (0.6-1.4)	1.017±0.017 *^^ (0.6-1.6)
Combination therapy	1.056±0.013* (0.7-1.6)	1.062±0.015 (0.6-1.7)

Note: *The difference between diet therapy: ^^ - p<0.01. ABİd - right ankle-brachial index, ABİs - left ankle-brachial index (here and in table 3).*

On the background of insulin monotherapy, only ABIs differed compared to those receiving diet therapy and those not receiving treatment (p<0.01 and p<0.05, respectively), while 33.6±4.3% of patients on the background of insulin therapy and 6.3±6.1% during diet therapy had ABI<0.9, while no such patients were found in the untreated group (χ^2=5, p<0.05 and χ^2=6.73, p<0.01). In patients receiving combined hypoglycemic therapy, only ABId was lower than in the diet therapy group (p<0.05), while ABIs were higher than in the untreated group (λ^2=5.03, p<0.05). Among the treatment tactics, the highest

rate of ABI<0.9 (34.3±4.3%) was observed on the background of insulin therapy, and the lowest rate (9.9±7.2%) was observed in those receiving diet therapy alone.

As can be seen from Table 3, approximately 2/5 of those with poor glycemic control had ABI≤0.9 during objective examination, which indicated a significant impairment of peripheral blood circulation in them. During decompensation of diabetes, sonographically, blood flow in all segments of the lower extremities was mainly of the main type, with more severe stenoses noted. Regardless of the level of glycemic control, approximately 1/5 of the patients had blood circulation compensation in the hip-thigh and thigh-knee segments, 4/5 were in the subcompensation stage, and 1/5 of the patients with poor glycemic control had simultaneous decompensation of blood circulation in the knee-ankle segment. As can be seen, stenosis of the arterial vessels to the periphery and impairment of blood flow in these areas were more significant.

Table 3. Characteristics of lower limb vascular parameters depending on glycemic control

Parameters	Gradation	Hb1c ≥7%	Hb1c < 7%	p (Kruskal-Wallis)
Atherosclerosis of lower limb vessels (according to the survey)	Yes	213 61.7±2.6%	45 55.5±5.5%	p=0.305
	No	132 38.3±2.6%	36 44.4±5.5%	
ABİs	>0,9	189 56.8±2.7%	63 80.8±4.5%	<0.001
	≤0,9	144 43,2±2,7%	15 19,2±4,5%	
ABİd	>0,9	207 62.2±2.7%	66 84.6±4.1%	<0.001
	≤0,9	126 37.8±2.7%	12 15.4±4.1%	
Hip-thigh segment (blood flow pattern)	Main	144 98.0±1.2%	42 100.0±0.0%	p=0.351
	Collateral	3 2.0±1.2%	0	
Hip-thigh segment (stenosis - %)	25-40%	72 49.0±4.1%	21 50.0±7.7%	p=0.907
	45-65%	75 51.0±4.1%	21 50.0±7.7%	
Hip-thigh segment (blood flow disorder)	Compensation	30 20.4±3.3%	9 21.4±6.3%	p=0.885
	Subcompensation	117 79,6±3,3%	33 78,6±6,3%	
	Decompensation	0	0	
Thigh-knee segment (blood flow pattern)	Main	144 98.0±1.2%	42 100.0±0.0%	p=0.351
	Collateral	3 2.0±1.2%	0	
Thigh-knee segment (stenosis - %)	25-45%	42 27.5±3.6%	24 57.1±7.6%	<0.001
	50-80%	111 72.5±3.6%	18 42.9±7.6%	

Table 3. Continued				
Thigh-knee segment (blood flow disorder)	Compensation	30 20.4±3.3%	9 21.4±6.3%	p=0.885
	Subcompensation	117 79.6±3.3%	33 78.6±6.3%	
	Decompensation	0	0	
Knee-ankle segment (blood flow pattern)	Main	144 98.0±1.2%	42 100.0±0.0%	p=0.351
	Collateral	3 2.0±1.2%	0	
Knee-ankle segment (stenosis - %)	20-50%	36 23.5±3.4%	24 57.1±7.6%	<0.001
	55-90%	117 76.5±3.4%	18 42.9±7.6%	
Knee-ankle segment (blood flow disorder)	Compensation	18 12.2±2.7%	15 35.7±7.4%	<0.001
	Subcompensation	102 69.4±3.8%	27 64.3±7.4%	
	Decompensation	27 18.4±3.2%	0	

Based on the survey and objective examination, atherosclerosis of the lower limb vessels was detected in 53.8±4.9% of normotensive patients, while in patients with hypertension this indicator was 69.8±2.2% (p=0.002).

As can be seen from Table 4, the average ABI indicators in patients with hypertension were also significantly lower than in patients with normotensive patients, while perfusion in the peripheral arteries of the lower extremities deteriorated 2-3 times. It should be noted that stenosis of peripheral arteries was observed in approximately 1/3 of patients suffering from hypertension. Despite the fact that the severity of stenosis in all segments of the lower extremities was higher than in patients with normotensive blood pressure, this difference did not reach statistical significance.

Table 4. Characteristics of peripheral vascular pathology indicators depending on the level of hypertension				
Parameters	Gradation	≥140/90 mm Hg	<140/90 mm Hg	p (Kruskal- Wallis)
ABI (s)	n M±m (95% Cİ)	410 1.038±0.010 (0.6-1.8)	101 1.151±0.020 (0.6-1.7)	0,001 p (Fisher)
ABİ (s), %	≤0,9	122 29.8±2.3	15 14,9±3,5	0.001
	>0,9	288 70.2±2.3	86 85.1±3.5	
ABI (d)	n M±m (95% Cİ)	410 1.037±0.010 (0.6-1.8)	101 1.160±0.019 (0.7-1.6)	0,001 p (Fisher)

Table 4. Continued				
ABİ (d), %	≤0,9	129 31.5±2.3	10 9,9±3,0	0.001
	>0,9	281 68.5±2.3	91 90.1±3.0	
Stenosis in the hip-thigh segment (%)	n M±m (95% Cİ)	56 42.1±1.3 (30-60)	20 38.0±2.8 (25-65)	0.138 p (Fisher)
Stenosis in the thigh-knee segment (%)	n M±m (95% Cİ)	56 45.2±1.6 (20-80)	20 41.3±3.3 (25-75)	0.240 p (Fisher)
Stenosis in the knee-ankle segment (%)	M±m (95% Cİ)	56 51.4±2.2 (20-90)	20 44.8±3.6 (25-80)	0.127 p (Fisher)

Note: *Cİ – confidence interval.*

MAU was more common in patients with atherosclerosis of the lower extremities. As the severity of MAU increased, the frequency of peripheral atherosclerosis increased, and this pathology was detected in 90% of patients with MAU of 300 mg/dl. The frequency of sonographic signs of stenosis of the lower extremities was highest in patients with MAU of 300 mg/dl, and the increase in the frequency of MAU was more pronounced in the periphery (table 5).

Table 5. Relationship between MAU and indicators						
Parameters	Gradation	MAU (mg/dl)				p (Kruskal- Wallis)
		0	30	100	300	
Atherosclerosis of the lower extremities (based on questionnaire and objective examination), n (%)	No	116 (37.4)	40 (28.0)	6 (22.2)	2 (12.5)	0.032
	Yes	194 (62.6)	103 (72.0)	21 (77.8)	14 (87.5)	
Stenosis in the thigh-knee segment, (%)	M±m (95% Cİ)	46 45.5±1.8 (42.0-49.1)	23 41.3±2.9 (35.3-47.3)	3 40.0±10.0 (-3.0-83.3)	2 55.0±5.0 (-8.5-118.5)	0.336 p (Fisher)
Stenosis in the knee-ankle segment, (%)	M±m (95% Cİ)	46 51.0±2.3 (46.3-55.6)	23 46.3±3.6 (38.8-53.8)	3 46.7±16.7 (0.0-118.4)	2 72.5±2.5 (40.7-104.3)	0.176 p (Fisher)

DISCUSSION OF THE RESULTS OF THE STUDY

It has been established that ABI is considered a serious risk factor for cardiovascular diseases, along with subclinical damage to peripheral artery disease [2,3]. As can be seen, the frequency of detection of peripheral artery disease based on questionnaire and objective examination in our population was quite high (66.7%), and ABI≤0.9 was determined in 27.2% of patients. The frequency of occurrence of peripheral atherosclerosis in patients sonographically varied in a fairly wide range (20-90%), and stenosis indicators in the periphery increased even more (40-60%), and the circulatory system in the distal region was in the stage of decompensation.

Signs of peripheral atherosclerosis were more often detected in diabetic patients living in the regions, which can be attributed to the inadequate antidiabetic, antihypertensive, antithrombotic, etc. treatment tactics used by them.

It is known that target organ damage in diabetic patients is often asymptomatic or has few symptoms. Therefore, routine determination of ABI, which is a subclinical indicator in the assessment of peripheral atherosclerosis, is of great importance [1,2,6,7].

A comprehensive approach to the management of peripheral artery disease in patients with diabetes is necessary. Thus, in

addition to adequate antihyperglycemic treatment, optimal antihypertensive, lipid-lowering and antiplatelet therapy is of great importance. In our population, HbA1c control, antihypertensive, lipid-lowering and antiplatelet treatments were not adequate in various antidiabetic treatment groups. Therefore, ensuring the participation of doctors from other specialties in the team, in addition to endocrinologists, in the treatment of patients with diabetes is of great importance.

In our population, symptoms of peripheral vascular disease were more common in those with poor glycemic control, which can be associated with the spread of the atherosclerotic process. Symptoms of peripheral atherosclerosis had varying degrees of severity in all segments of the lower extremities, which can be considered one of the processes that accelerate the development of the "diabetic foot" syndrome in these patients in the future [2].

In our study, signs of peripheral atherosclerosis were detected in 69.8% of patients with hypertension and 53.8% of patients with normotensive disease by questionnaire and objective examination. The incidence of peripheral atherosclerosis was also higher in patients with hypertension than in patients with normotensive disease by sonography [8]. In our population, hypertension accelerated the occurrence of stenosis in all segments of the lower extremities.

According to the data, there is also a reciprocal relationship between ABI and diabetic nephropathy [7,13]. In the patients participating in the study, as MAU increased, signs of peripheral atherosclerosis accelerated.

CONCLUSIONS

1. ABI can be considered a predictor of cardiovascular diseases in the Azerbaijani population with 2DM.
2. ABI screening should be performed regularly in patients with 2DM to assess peripheral artery disease and other target organ damage.

Ethics

Informed Consent: A written informed consent has been granted from the patient.

AI statement: No Artificial Intelligence (AI) application was used in the preparation of this study.

Footnotes

Authorship Contributions

M.S.: Data collections, study design, analysis, and interpretation, writing the article, critical revision of the article, and literature review.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

REFERENCES

1. Harsha M. Sensitivity and specificity of pulse oximetry and ankle brachial index for screening asymptomatic peripheral vascular diseases in type 2 diabetes mellitus // J. Assoc. Physicians India, 2022, No. 70(4), p. 11-12.
2. Ming-Chi Y., Yu-Yao H., Sheng-Hwu H. et al. Ankle-brachial index is independently associated with cardiovascular outcomes and foot ulcers in Asian patients with type 2 diabetes mellitus //Front Endocrinol., 2021, No. 18(12), p. 752995; doi: 10.3389/fendo.2021.752995
3. Fengze N., Jiaan H., Hui C., Xinhua H. Predictive value of abnormal ankle-brachial index in patients with diabetes: A meta-analysis // Diabetes Res. Clin. Pract., 2021, No. 174, p. 108723; doi: 10.1016/j.diabres.2021.108723
4. Khadijeh M., Afshin M., Zahra Y. et al. Correlation between ankle-brachial index and microalbuminuria in type 2 diabetes mellitus //Iran J. Kidney Dis., 2013, No. 7(3), p. 204-9.
5. Hirokatsu N., Kiyohiko T., Midori D. et al. The association of cardio-ankle vascular index and ankle-brachial index with macroangiopathy in patients with type 2 diabetes mellitus //J. Atheroscler. Thromb., 2019, No. 26(7), p. 616-623; doi: 10.5551/jat.45674
6. Giovanni S., Rosaria C., Eugenio R. et al. The ankle-brachial index for assessing the prevalence of peripheral artery disease and cardiovascular risk in patients with type 2 diabetes mellitus // Nutr. Metab. Cardiovasc. Dis., 2023, No. 33(3), p. 560-567; doi: 10.1016/j.numecd.2022.11.019
7. Lia A.C., Marc C.C., Anna P. et al. Levels of ankle-brachial index and the risk of diabetes mellitus complications // BMJ Open Diabetes Res. Care, 2020, No. 8(1), p. e000977; doi: 10.1136/bmjdrc-2019-000977
8. Badaruddoza D., Manpreet K., Sonia C., Rohit K. Cardiovascular risk factors and distributions of the ankle-brachial index among type 2 diabetes mellitus patients // Int. J. Hypertens., 2012, p. 485812; doi: 10.1155/2012/485812