LOCUS JOURNAL: Research & Devotion
Volume 4 No. 8 August 2025
E-ISSN 2829-7334| P-ISSN 2829-5439
Hompage: https://locus.rivierapublishing.id/index.php/jl

Comparison of *ABI, TBI, TOE Pressure,* and *Ankle Pressure* Examinations in PAD Patients, Before and After *Angioplasty* with and without Type 2 DM at RSCM

Mohammad Nazril Rizki*, Raden Suhartono, Herqutanto
Universitas Indonesia
Email: mnazrilrizki@gmail.com*, rsuhartono_md@yahoo.com, hqtanto@gmail.com

Abstract:
Diabetes Mellitus (DM) exacerbates peripheral artery disease (PAD) and can affect the diagnostic accuracy of the ankle-brachial index (ABI) due to arterial calcification. Alternative examinations such as *toe-brachial index* (TBI), *toe pressure* (TP), and *ankle pressure* (AP) require evaluation to compare their effectiveness *post-angioplasty in* PAD patients with and without DM. This study aims to compare the changes in the values of these four parameters before and after angioplasty in both groups of patients. Method. This retrospective cohort study involved 78 PAD patients (39 with DM, 39 without DM) at Cipto Mangunkusumo Hospital. Hemodynamic parameters (ABI, TBI, AP, TP) were measured 24 hours before and after angioplasty. Bivariate analysis and linear regression are used to assess changes and their predictive factors. Post-angioplasty, all parameters showed significant improvement in both groups. However, the delta differences between groups were only significant in ABI and AP, not in TBI and TP. Preangioplasty parameter values were the main predictors of the magnitude of post-operative changes ($p<0.001$), while age had only a significant effect on delta TBI and TP. Conclusion. Angioplasty significantly improved ABI, TBI, TP, and AP values in PAD patients with and without type 2 DM. There was a significant difference between the delta parameters of ABI and AP in both groups after angioplasty. The value of the clinical parameters of preangioplasty had an effect on the delta value of each parameter, while age only affected the change in TBI and TP. The finding that TBI and TP did not show *significant delta* differences between the DM and non-DM groups implied that these two parameters were more robust and less affected by the condition of diabetes, making them worthy of consideration as a more reliable assessment tool, particularly in diabetic populations at risk of arterial calcification.

Keywords: Peripheral Artery Disease, angioplasty, diabetes mellitus

Correspondence: Mohammad Nazril Rizki
Email: mnazrilrizki@gmail.com

INTRODUCTION

Peripheral Artery Disease (PAD) is one of the clinical manifestations of systemic atherosclerosis that affects the lower extremities and causes arterial blood flow disorders. PAD is characterized by symptoms such as intermittent claudication, ulcers that are difficult to heal, and ischemia of the limbs that can lead to amputation (Janssen & van Silfhout, 2020). Risk factors for PAD are very similar to other cardiovascular diseases, especially coronary heart disease, and include diabetes mellitus (DM), hypertension, hyperlipidemia, smoking, obesity, old age, and a family history of cardiovascular disease (Yagyu et al., 2020; Tavintharan et al., 2009; Criqui & Aboyans, 2015). Atherosclerosis as the pathophysiological basis of PAD develops as a result of various processes, including loss of arterial elasticity, pathological platelet aggregation, endothelial dysfunction, and microcirculatory disorders caused by oxidative stress and chronic inflammation (Yagyu et al., 2020; Criqui & Aboyans, 2015). Chronic hypertension causes activation of the renin-angiotensin-aldosterone (RAAS) system and decreased endothelial vasodilation function, while smoking and hyperlipidemia cause platelet activation, decreased nitric oxide production, and endothelial cell damage (Yagyu et al., 2020; Criqui & Aboyans, 2015; Aroor et al., 2013).

Type 2 DM is one of the factors that contributes significantly to progressivity and worsens PAD output. Chronic hyperglycemia in DM causes pericyte damage, impaired regulation of growth factors such as VEGF, and microcirculatory dysfunction that leads to tissue hypoxia and pathological neovascularization (Mascarenhas et al., 2014). PAD in type 2 DM patients is more diffuse and affects more distal arteries such as the tibial and peroneal arteries, in contrast to the pattern in non-diabetic patients (Jude et al., 2010). In addition, DM patients with PAD have a higher risk of developing critical limb ischemia (CLI), lower limb amputation, and mortality due to impaired wound healing and low vascular regeneration capacity. Some studies show that hyperglycemia worsens post-ischemic recovery, even though patients have good glycemic control (Mascarenhas et al., 2014; Dokun et al., 2014). Other studies show that patients with type 1 DM actually have an earlier and more severe risk of amputation than type 2 DM despite the lower prevalence (Fadini et al., 2020; Dokun et al., 2014; Fitridge et al., 2020).

Various imaging modalities have been developed to detect PAD early, including imaging techniques such as doppler ultrasound (DUS), magnetic resonance angiography (MRA), and computed tomography angiography (CTA), to physical-based non-invasive examinations such as ankle-brachial index (ABI), toe-brachial index (TBI), ankle pressure (AP), and toe pressure (TP) (Yagyu et al., 2020; Janssen & van Silfhout, 2020; Liu et al., 2021; Ruzsa et al., 2021). ABI is the most commonly used method because it is simple, inexpensive, and non-invasive, with a value of <0.9 considered an indicator of PAD22. However, in DM patients, especially those who experience arterial calcification due to diabetic nephropathy or advanced age, ABI values can give false results due to lack of arterial elasticity when compressed (Fitridge et al., 2020; Fox et al., 2015; Jain et al., 2020). On the other hand, TBI is relatively unaffected by arterial calcification, making it more accurate in detecting PAD in diabetic populations24. Similarly, ankle and toe pressure measurements are often used as a

complement or alternative when ABI results are inconclusive, particularly in patients with incompressible arteries.

Beyond its potential, there are doubts about the validity of ABI, TBI, AP, and TP tests in detecting PAD in type 2 DM patients compared to the non-diabetic population. Given that the pathophysiology of PAD in patients with and without DM has several differences, especially regarding the anatomical distribution of occlusion, vascular response to ischemia, and long-term clinical outcomes, it is necessary to evaluate the accuracy and validity of non-invasive examinations that have been the diagnostic standard (Cang et al., 2021). Therefore, the purpose of this study was to compare changes in ankle-brachial *index* (ABI), *toe-brachial index* (TBI), *ankle pressure* (AP), and *toe pressure (TP) before and after angioplasty in patients with peripheral artery disease (PAD) with and without type 2* diabetes mellitus. The results of the study are expected to provide a basis for the selection of the most appropriate screening method for the diabetic population, as well as improve early detection, targeted treatment, and prevention of further complications in PAD patients.

RESEARCH METHODS

This study is an analytical observational study with a retrospective cohort design conducted at Dr. Cipto Mangunkusumo Hospital. This study aimed to evaluate changes in the values of hemodynamic parameters—ABI, TBI, AP, and TP—before and after angioplasty using conventional ballooning (POBA) in patients with peripheral artery disease (PAD), as well as to compare the differences in delta response values between PAD patients with and without type 2 diabetes mellitus. The current gold standard method for peripheral perfusion assessment is transcutaneous oxygen pressure ($TCpO_2$); however, due to limited availability of tools and costs, parameters such as ABI, TBI, AP, and TP are more widely used in clinical practice in Indonesia. Therefore, the study wanted to see to what extent changes in the value of these parameters might reflect improvements in perfusion after angioplasty, particularly when compared between the diabetic and non-diabetic groups.

Place and Time of Research

This research will take place during June 2025, after receiving ethical approval from the FKUI medical ethics committee. This study uses secondary data obtained from the medical records of PAD patients undergoing angioplasty at Dr. Cipto Mangunkusumo Hospital. All samples will be examined 2 times: pre-angioplasty (within 24 hours before the angioplasty procedure) and post-angioplasty (24 hours after the angioplasty procedure).

Population Research, Sampling Techniques, and Large Sample

The target population in this study is all peripheral artery disease (PAD) patients who undergo angioplasty, either with or without diabetes mellitus (DM). The affordable population is PAD patients with and without DM who undergo angioplasty management at Dr. Cipto Mangunkusumo Hospital, Jakarta. The study sample consisted of patients from affordable populations who met the inclusion criteria and did not meet the exclusion criteria.

Sample inclusion criteria included: (1) adult patients (>18 years) with a diagnosis of PAD who underwent *the plain old balloon angioplasty* (POBA) procedure at Cipto Mangunkusumo Hospital, and (2) patients who had never undergone angioplasty therapy before. Exclusion criteria consisted of: (1) the patient's refusal to participate, (2) the surgical history of open

surgery for PAD, (3) incomplete data, (4) the diagnosis of nonsclerotic PAD, (5) autoimmune disease, (6) failure of the angioplasty procedure, and (7) patients who had stented. In addition, a *drop-out criterion* is set if the patient refuses re-examination during monitoring (*loss to follow-up*).

Sampling was carried out by *consecutive sampling* technique, which is by including all patients who met the inclusion criteria and did not meet the exclusion criteria in order until the minimum number of samples for each group (DM and non-DM) was met. All selected samples were then divided into two groups based on DM status. After that, an anamnesis, an explanation of the research, and a written *informed consent* were carried out . The approved sample then underwent a pre-action clinical examination (ABI, TBI, *ankle pressure*, *toe pressure*) at the Vascular Surgery Polyclinic. All samples are then subjected to the angioplasty procedure, and the patient who fails will be excluded. Monitoring was carried out for 24 hours post-procedure by performing the same anamnesis and clinical examination. All data from the study results were recorded in the hospital's electronic medical records, which were then used as a secondary data source for analysis.

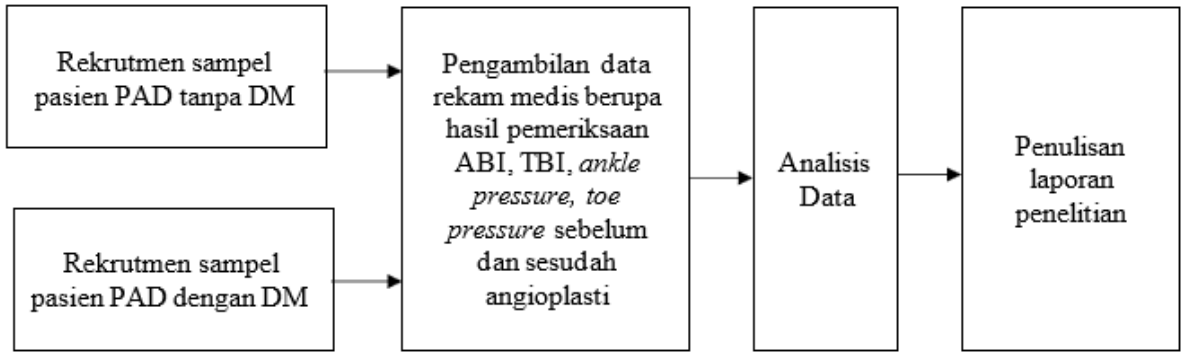


Figure 1. Research flow

Data analysis will be carried out through 3 stages:

1. Descriptive analysis. The descriptive analysis began with the measurement of the normality of the data distribution using the Saphiro-Wilk method. Data with normal distribution ($p>0.05$ value) will be reported in mean±SD form while data with abnormal distribution will be reported in median (min-max). Categorical form data will be reported in n (%).
2. Bivariate analysis. Bivariate analysis was performed to find differences between variables in the DM and non-DM groups. Bivariate analysis was performed using paired T-tests if the data distribution is normal and Wilcoxon test if the data distribution is abnormal. For categorical data, the analysis was carried out using the Chi-square technique. The $p<0.05$ value is considered significant. All results will be reported in the table.
3. Multivariate analysis. Multivariate analysis was performed to see the relationship between age, sex, and baseline values of clinical parameters to delta of the clinical parameters themselves. The analysis will be carried out using linear regression techniques. The $p<0.05$ value is considered significant. The p-value and B-value will be reported in the table. Multicollinearity analysis will also be performed by calculating the VIF value. The VIF value of <5 is considered to have no multicollinearity value.

RESULTS AND DISCUSSION

Patient Characteristics

A total of 39 PAD patients with type 2 DM and 39 PAD patients without DM were included in the study. Based on the results of the calculation of data normality, all data has a normal distribution. The mean age of the sample was 61.1±8.6 years with the non-DM group having a higher average age than the DM group (66.1±7.5 vs. 56.1±6.6). Male patients were more likely to be included than men (75.6% vs. 24.4%), but the chi-square test showed no difference between the DM and non-DM groups. Pre-action WIFI status also showed that the majority of patients had W3, I3, and Fi2 statuses. In the DM group, the Fi2 group has a larger proportion than the other groups while in the non-DM group, the Fi1 has a larger proportion. The mean age compared to using the T test was not matched and there was a significant difference between the DM and non-DM groups ($p<0.001$). The location of the lesions also differed significantly in the DM and non-DM groups ($p<0.001$).

Delta Predictor Factors Clinical Parameters

Linear regression tests were performed to see the effect of age, sex, and baseline values on delta of clinical parameters. All parameter deltas are affected by their respective baseline values. In addition, the age factor only had an influence on the variables TBI and TP. The R2 values of the regression of □ABI, □TBI, □AP, and □TP were 0.82, 0.473, 0.823, 0.297, respectively. The full results of the analysis can be seen in Table 1.

Table 1. Predictor of delta clinical parameters (n=78)

Variable	B-value	S.E	p-value	VIVID
		□ABI		
Age	-0,001	0,002	0,681	1,39
Gender = Woman	-0,19	0,028	0,492	1,80
ABI preangioplasty	-0,549	0,034	**<0.001***	1,37
		□TBI		
Age	-0,005	0,001	**<0.001***	1,40
Gender =	0,026	0,025	0,306	1,31
Woman				
TBI preangioplasty	-0,768	0,092	**<0.001***	1,09
		□AP		
Age	-0.157	0,235	0,505	1,84
Gender = Female	-5,285	4,01	0,192	1,35
AP Preangioplasty	-0.557	0,034	**<0.001***	1,43
(mmHg)				
		□TP		

Age	-0.624	0,225	**0,007***	1,39
Gender =	0,735	4,368	0,867	1,31
Woman				
TP preangioplasty	-0.567	0,098	**<0.001***	1,11
(mmHg)				

*Significant difference (p<0.05 value) S.E=Standard error, VIF=*variable influence factor*
Source: Primary data processed, 2025

Peripheral Artery Disease (PAD) is a form of atherosclerosis that affects the lower limbs, with the prevalence increasing with age and cases of diabetes mellitus (DM). Studies show that PAD patients with DM tend to be younger (average 56.1 years) than those without DM (66.1 years). The findings suggest that DM accelerates the process of atherosclerosis due to chronic hyperglycemia, oxidative stress, endothelial dysfunction, and long-term inflammation that leads to early arterial damage (Bahri et al., 2023; Martinez & Zahra, 2022). In addition, the male sex was more common than female, although there was no difference in proportion between the DM and non-DM groups.

PAD patients with DM tend to have more complex lesions. Based on WiFi scores, 71.8% of DM patients had moderate lesions (score 2), higher than the non-DM group (56.4%). This suggests that wounds in DM patients are more difficult to heal due to impaired blood flow due to microangiopathy, peripheral neuropathy, and tissue damage due to chronic hyperglycemia. Complex wounds also increase the risk of infection and worsen the prognosis of healing, thus requiring multidisciplinary treatment (Poznyak et al., 2020; Katakami, 2018). The ischemic component showed that the majority of patients, both DM and non-DM, had moderate to severe ischemia (scores of 2 and 3), in the absence of a mild score (0 or 1). This indicates that all subjects have significant blood flow disorders, which is the basis for performing angioplasty. Although the difference in proportions is not large, DM patients tend to have heavier lesions and spread in the distal vessels (Bahri et al., 2023). In the leg infection component, 61.5% of DM patients had a score of 2 (severe infection), much higher than the non-DM group (23.1%). These infections often involve deep tissues such as muscles and bones, requiring intensive care and risking minor amputations. Chronic hyperglycemia exacerbates this condition by lowering the function of the immune system, making infections in the legs more difficult to control (Banday et al., 2020).

The distribution of arterial lesion locations showed that DM patients were more likely to have lesions in the distal segment or BTK, which was 69.2%, compared to only 25.6% in the non-DM group. In contrast, the non-DM group had more lesions in the femoropopliteal artery (74.4%). These findings are consistent with the literature that states that DM is closely related to diffuse and multilevel lesions of small blood vessels. Small-diameter and stiff distal BTK lesions due to calcification make angioplasty more difficult, with a lower technical success rate and a higher risk of restenosis (Indonesian Endocrinology Association, 2021; Soyoye et al., 2021).

Changes in hemodynamic values before and after angioplasty are important indicators of the success of the intervention. In this study, ABI values increased significantly in both groups. In the DM group, the ABI increased from 0.97 to 1.05, while in the non-DM group it increased from 0.42 to 0.83. Although the DM group had a higher initial score, the non-DM group showed a greater absolute improvement. This is likely due to the predominance of lesions in the femoropopliteal artery in the non-DM group, which are anatomically larger and more accessible during the angioplasty procedure, so the results of the improvement are more pronounced. This increase in ABI indicates a restoration of blood flow to the large arteries of the lower extremities, which is important in improving the ischemic status of the tissues.

In addition to ABI, TBI also showed significant improvements in both groups. In the DM group, the TBI increased from 0.45 to 0.82, while in the non-DM group it increased from 0.36 to 0.74. This TBI improvement shows that angioplasty not only improves macrovascular blood flow, but also has a noticeable impact on microperfusion in distal areas, such as the toes. TBI is especially important in DM patients, as it is more sensitive in detecting ischemia in non-compressible arteries due to calcification, and its improvement provides prognostic value to wound healing and amputation prevention.

AP pressure has also increased. In the non-DM group, the pressure increased from 62.1 mmHg to 123.2 mmHg, showing a drastic improvement. Meanwhile, in the DM group, the pressure increased from 143.8 mmHg to 155.9 mmHg. The high initial pressure in the DM group is likely affected by calcification of the media arteries (Mönckeberg sclerosis) that makes the arteries non-compressible, so that the pressure appears normal even though the tissue perfusion is actually poor. Therefore, the interpretation of ankle pressure in DM patients should be done with caution and should be accompanied by additional parameters such as TBI and toe pressure.

TP also experienced a significant increase post-angioplasty. In the DM group, the pressure increased from 66.3 mmHg to 122.8 mmHg, while in the non-DM group it increased from 52.7 mmHg to 109.5 mmHg. Toe pressure reflects microcirculatory perfusion more accurately, especially in patients with PAD and DM. This improvement suggests that angioplasty successfully improves blood flow to the tissues of the extremities, which is crucial in preventing recurrent wounds and the risk of minor amputations.

A comparison of all parameters in the DM and non-DM groups showed that the values of ABI and AP could be affected by DM conditions while the TBI and TP assessments were not affected by DM conditions. This indicates that TBI and TP examinations are more stable regardless of the vascular condition of the patient being examined. This corresponds to TBI and TP measurements that are less affected by arterial calcification–which often leads to false-negative results in ABIs–and reflect important microcirculatory perfusion in diabetic feet with severe vasculopathy. In addition, the values of TBI and TP have high reliability with intraclass correlation coefficient (ICC) values between 0.88–0.93.

In addition, TBI and TP show higher predictive accuracy in wound healing and amputation risk, have a greater positive likelihood ratio than ABI in predicting diabetic foot complications, and show diagnostic performance comparable to or superior to ABI, especially

in patients with arterial stiffness due to diabetes (Hyun et al., 2014; Indonesian Association of Cardiovascular Specialists, 2016).

The study showed that the effectiveness of angioplasty varied depending on the location of the lesion and the status of diabetes. In DM patients, a significant increase in ABI occurred only in femoropopliteal lesions, while BTK lesions showed no significant changes. This reflects the difficulty of improving blood flow in the distal segment due to the small size of the arteries, calcification, and the complexity of the lesions. However, TBI and toe pressure remained significantly increased at both sites, suggesting improvement in microperfusion even though macrovascular flow did not change much.

In contrast, in non-DM patients, all parameters (ABI, TBI, and TP) were significantly improved in both femoropopliteal and BTK. This shows a better response to angioplasty, likely due to the simpler morphology of the lesion. These findings confirm that DM patients have their own challenges in PAD therapy, so a more careful and comprehensive approach is needed, including the selection of appropriate techniques and intervention tools.

Multivariate analysis showed that age had an influence on delta TBI and TP, with a B value indicating that the higher the age, there would be an increase in the lower TBI and TP values. Furthermore, the value of the preangioplasty parameter has a significant negative influence on predicting the delta value of the parameter itself. This shows that the higher the value of these clinical parameters, the smaller the delta that will occur after angioplasty. This can happen because low clinical parameter values indicate a higher degree of greater arterial occlusion so patients of that group will benefit more from the angioplasty procedure. These findings are supported by several previous studies that suggest that there is better physiological improvement in patients with severe ischemia, because blood flow restoration has a greater clinical impact than patients with a relatively good vascular index before the procedure (Parwani et al., 2023; van Reijen et al., 2019).

Although the study found an increase in perfusion parameters after angioplasty, there were some limitations. The study did not evaluate direct clinical outcomes such as wound healing, amputation, or patient quality of life, even though these aspects were the primary goal of PAD therapy. Therefore, follow-up studies with long-term follow-up are urgently needed to link these findings to real clinical benefits. Other limitations are the small sample size and the absence of stratification based on angioplasty techniques, the type of device used, and adherence to post-intervention therapy. These factors may affect the results and should be considered in future studies.

However, the strength of this study lies in its comprehensive approach, by comparing the delta of vascular parameters before and after action in patients with and without DM, and considering the location of the lesion. This approach provides a detailed picture of the physiological response post-angioplasty and can be the basis for the development of more personalized clinical protocols. With these results, it is recommended that the evaluation of the success of angioplasty should not rely solely on ABI, especially in DM patients with distal lesions. The use of TBI and toe pressure is important to accurately assess tissue perfusion and guide subsequent clinical decisions.

CONCLUSION

Based on the results of the study, it can be concluded that angioplasty significantly increased the values of all non-invasive hemodynamic parameters—ABI, TBI, AP, and TP—in PAD patients, both with and without type 2 diabetes mellitus, thus meeting the study objective of comparing changes in these parameters. However, there was a difference in response between the two groups, where delta ABI and AP showed significant differences, while delta TBI and TP did not, indicating that TBI and TP were more stable indicators and were not affected by diabetes status. These findings make an important contribution to the selection of post-intervention diagnostic tools, where TBI and TP should be the mainstay parameters, particularly in diabetic populations with suspicion of arterial calcification. For future research, longitudinal studies with long-term clinical outcomes—such as ulcer healing rates, amputations, and quality of life—are needed to confirm the prognostic superiority of TBI and TP and evaluate their impact on more personalized and effective clinical management of PAD patients.

REFERENCES

Abraham, A. T., Mojaddedi, S., Loseke, I. H., & Bray, C. (2024, June 12). Hypertension in patients with peripheral artery disease: An updated literature review. Cureus.

Aday, A. W., & Matsushita, K. (2021, June 11). Epidemiology of peripheral artery disease and polyvascular disease. Circulation Research, 128(12), 1818–1832.

Aroor, A. R., DeMarco, V. G., Jia, G., Sun, Z., Nistala, R., Meininger, G. A., et al. (2013). The role of tissue renin-angiotensin-aldosterone system in the development of endothelial dysfunction and arterial stiffness. Frontiers in Endocrinology, 4, 161.

Bahri, S. L., Darmaningrat, C. I. A. A., Putra, I. W. M., Adzuba, K. K., Paramita, L. K. D. L., Alfarisi, M. D., et al. (2023, December 29). Complications of diabetes mellitus: A review article. Green Medical Journal, 5(3), 128–136.

Banday, M. Z., Sameer, A. S., & Nissar, S. (2020, October 4). Pathophysiology of diabetes: An overview. Avicenna Journal of Medicine, 10(4), 174–188.

Behrooz, L., Abumoawad, A., Rizvi, S. H. M., & Hamburg, N. M. (2023, April 28). A modern-day perspective on smoking in peripheral artery disease. Frontiers in Cardiovascular Medicine, 10, 118–126.

Berchiolli, R., Bertagna, G., Adami, D., Canovaro, F., Torri, L., & Troisi, N. (2023, April 4). Chronic limb-threatening ischemia and the need for revascularization. Journal of Clinical Medicine, 12(7), 2682.

Cang, Z. Q., Xu, Y., Wang, M., Xu, M. N., & Yuan, S. M. (2021, October). Anterior tibial artery injury is not the contraindication of medial plantar flap: Digital subtraction angiography evidence and clinical application. Journal of Plastic, Reconstructive & Aesthetic Surgery, 74(10), 2512–2518.

Criqui, M. H., & Aboyans, V. (2015, April 24). Epidemiology of peripheral artery disease. Circulation Research, 116(9), 1509–1526.

Dokun, A. O., Chen, L., Lanjewar, S. S., Lye, R. J., & Annex, B. H. (2014, March 1). Glycaemic control improves perfusion recovery and VEGFR2 protein expression in diabetic mice following experimental PAD. Cardiovascular Research, 101(3), 364–372.

Fadini, G. P., Spinetti, G., Santopaolo, M., & Madeddu, P. (2020, January). Impaired regeneration contributes to poor outcomes in diabetic peripheral artery disease. Arteriosclerosis, Thrombosis, and Vascular Biology, 40(1), 34–44.

Fitridge, R., Chuter, V., Mills, J., Hinchliffe, R., Azuma, N., Behrendt, C., et al. (2024, March 19). The intersocietal IWGDF, ESVS, SVS guidelines on peripheral artery disease in people with diabetes and a foot ulcer. Diabetes/Metabolism Research and Reviews, 40(3).

Fitridge, R., Pena, G., & Mills, J. L. (2020, March 22). The patient presenting with chronic limb-threatening ischaemia: Does diabetes influence presentation, limb outcomes and survival? Diabetes/Metabolism Research and Reviews, 36(S1).

Fox, C. S., Golden, S. H., Anderson, C., Bray, G. A., Burke, L. E., de Boer, I. H., et al. (2015, September 1). Update on prevention of cardiovascular disease in adults with type 2 diabetes mellitus in light of recent evidence: A scientific statement from the American Heart Association and the American Diabetes Association. Diabetes Care, 38(9), 1777–1803.

Golledge, J. (2022, July 7). Update on the pathophysiology and medical treatment of peripheral artery disease. Nature Reviews Cardiology, 19(7), 456–474.

Hackler, E. L., Hamburg, N. M., & Solaru, K. T. W. (2021). Racial and ethnic disparities in peripheral artery disease. Circulation Research, 128(12), 1913–1926.

Hardman, R., Jazaeri, O., Yi, J., Smith, M., & Gupta, R. (2014, November 14). Overview of classification systems in peripheral artery disease. Seminars in Interventional Radiology, 31(4), 378–388.

Hennion, D. R., & Siano, K. A. (2013, September 1). Diagnosis and treatment of peripheral arterial disease. American Family Physician, 88(5), 306–310.

Hicks, C. W., Canner, J. K., Mathioudakis, N., Sherman, R., Malas, M. B., Black, J. H., et al. (2018, October). The Society for Vascular Surgery Wound, Ischemia, and foot Infection (WIfI) classification independently predicts wound healing in diabetic foot ulcers. Journal of Vascular Surgery, 68(4), 1096–1103.

Hinchliffe, R. J., Forsythe, R. O., Apelqvist, J., Boyko, E. J., Fitridge, R., Hong, J. P., et al. (2020, March 20). Guidelines on diagnosis, prognosis, and management of peripheral artery disease in patients with foot ulcers and diabetes (IWGDF 2019 update). Diabetes/Metabolism Research and Reviews, 36(S1).

Hiramoto, J. S., Katz, R., Weisman, S., & Conte, M. (2014, March 24). Gender-specific risk factors for peripheral artery disease in a voluntary screening population. Journal of the American Heart Association, 3(2).

Horváth, L., Németh, N., Fehér, G., Kívés, Z., Endrei, D., & Boncz, I. (2022, July 12). Epidemiology of peripheral artery disease: Narrative review. Life, 12(7), 1041.

Hyun, S., Forbang, N. I., Allison, M. A., Denenberg, J. O., Criqui, M. H., & Ix, J. H. (2014, August). Ankle-brachial index, toe-brachial index, and cardiovascular mortality in persons with and without diabetes mellitus. Journal of Vascular Surgery, 60(2), 390–395.

Jain, N., Agarwal, M. A., Jalal, D., & Dokun, A. O. (2020, August 31). Individuals with peripheral artery disease (PAD) and type 1 diabetes are more likely to undergo limb amputation than those with PAD and type 2 diabetes. Journal of Clinical Medicine, 9(9), 2809.

Janssen, E. R. I., & van Silfhout, L. (2020, August). Duplex ultrasound may predict the best level of lower limb amputation in patients with chronic limb-threatening ischemia: A retrospective observational cohort study. Annals of Vascular Surgery, 67, 403–410.

Jude, E. B., Eleftheriadou, I., & Tentolouris, N. (2010, January 8). Peripheral arterial disease in diabetes—A review. Diabetic Medicine, 27(1), 4–14.

Katakami, N. (2018). Mechanism of development of atherosclerosis and cardiovascular disease in diabetes mellitus. Journal of Atherosclerosis and Thrombosis, 25(1), 27–39.

Kuramoto, D. A. B., Zanin, L. F. S., Flumignan, R. L. G., Flumignan, C. D. Q., Reicher, M. E., Correia, R. M., et al. (2023). Smoking cessation for peripheral arterial disease: Systematic review protocol. Revista do Colégio Brasileiro de Cirurgiões, 50(1).

Lempesis, I. G., Varrias, D., Sagris, M., Attaran, R. R., Altin, E. S., Bakoyiannis, C., et al. (2023, May 27). Obesity and peripheral artery disease: Current evidence and controversies. Current Obesity Reports, 12(3), 264–279.

Liu, Y., Han, Y., Guan, M., Cai, Y., Wang, W., Chen, H., et al. (2021, August 18). Added value of femoral artery atherosclerosis for determining severity of white matter lesion by carotid atherosclerosis: A magnetic resonance imaging study. Acta Radiologica, 62(8), 1112–1121.

Marbach, J., Almufleh, A., Soh, D., & Chong, A. (2020). Peripheral artery disease: Current diagnosis and management. British Journal of Cardiology, 27, 1–10.

Mascarenhas, J. V., Albayati, M. A., Shearman, C. P., & Jude, E. B. (2014, March). Peripheral arterial disease. Endocrinology and Metabolism Clinics of North America, 43(1), 149–166.

Martinez, L., & Zahra, T. (2022, April 25). Chronic complications of diabetes. EMJ Diabetes, 10(1), 45–51.

Olin, J. W., & Sealove, B. A. (2010, July). Peripheral artery disease: Current insight into the disease and its diagnosis and management. Mayo Clinic Proceedings, 85(7), 678–692.

Parwani, D., Ahmed, M. A., Mahawar, A., & Gorantla, V. R. (2023, June 11). Peripheral arterial disease: A narrative review. Cureus, 15(6), e12345.

PERHIMPUNAN DOKTER SPESIALIS KARDIOVASKULAR INDONESIA. (2016). Panduan praktik klinis (PPK) dan clinical pathway (CP) penyakit jantung dan pembuluh darah.

Perkumpulan Endokrinologi Indonesia. (2021). Pedoman pengelolaan dan pencegahan diabetes mellitus tipe 2 di Indonesia. PB PERKENI.

Poznyak, A., Grechko, A. V., Poggio, P., Myasoedova, V. A., Alfieri, V., & Orekhov, A. N. (2020, March 6). The diabetes mellitus–atherosclerosis connection: The role of lipid and glucose metabolism and chronic inflammation. International Journal of Molecular Sciences, 21(5), 1835.

Ruzsa, Z., Csavajda, Á., Nemes, B., Deák, M., Sótonyi, P., Bertrand, O. F., et al. (2021, April 12). Distal radial artery access for superficial femoral artery interventions. Journal of Endovascular Therapy, 28(2), 255–261.

Salm, J., Ikker, F., Böhme, T., Noory, E., Beschorner, U., Kramer, T. S., et al. (2024, December 20). Clinical outcomes in patients with chronic limb-threatening ischemia and infected ulcers following endovascular therapy are pathogen dependent: A single-center experience from 2012 to 2021. Vascular Medicine, 29(6), 700–706.

Schramm, K., & Rochon, P. (2018, March 5). Gender differences in peripheral vascular disease. Seminars in Interventional Radiology, 35(1), 9–16.

Shu, J., & Santulli, G. (2018, August). Update on peripheral artery disease: Epidemiology and evidence-based facts. Atherosclerosis, 275, 379–381.

Signorelli, S. S., Marino, E., Scuto, S., & Di Raimondo, D. (2020, June 20). Pathophysiology of peripheral arterial disease (PAD): A review on oxidative disorders. International Journal of Molecular Sciences, 21(12), 4393.

Soyoye, D. O., Abiodun, O. O., Ikem, R. T., Kolawole, B. A., & Akintomide, A. O. (2021, June 15). Diabetes and peripheral artery disease: A review. World Journal of Diabetes, 12(6), 827–838.

Tavintharan, S., Cheung, N., Lim, S. C., Tay, W., Shankar, A., Tai, E. S., et al. (2019). [Detail artikel perlu dilengkapi, tidak lengkap di sumber Anda].

van Reijen, N. S., Ponchant, K., Ubbink, D. T., & Koelemay, M. J. W. (2019, September). Editor's choice – The prognostic value of the WIfI classification in patients with chronic limb-threatening ischaemia: A systematic review and meta-analysis. European Journal of Vascular and Endovascular Surgery, 58(3), 362–371.

Wang, J. C., & Bennett, M. (2012, July 6). Aging and atherosclerosis. Circulation Research, 111(2), 245–259.