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Review Article

The Effect of Endovascular Revascularization on Ankle Brachial Index (ABI) Value in Patients with Peripheral Artery Disease: A Systematic Review

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Abstract:

Background: Peripheral arterial disease (PAD) is the presence of a lesion that decreases the flow of arteries that supply blood to the limbs. In a study involving Asian countries including Indonesia in 2006, the prevalence of peripheral arterial disease was 9.7%. Endovascular revascularization is one of the treatment options for patients with PAD. One of the criteria for assessing PAD patients can be seen from the Ankle Brachial Index (ABI) value.

Objective: To determine the effect of endovascular revascularization on ABI value in patients with PAD. **Methods:** This study uses a systematic review approach, collecting data from previous studies. Data were collected from the UI library database, PubMed NCBI, and Science Direct. The article search method uses the characteristics of PICO (Population, Intervention, Comparison, Outcome), then compiled using the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) method.

Results: From 24 research articles that were reviewed, there were significant increases in the mean value of ABI when compared between pre-treatment and post-treatment, which were more than 0.10. Additionally, in several studies that were followed up on patients for a period of time to assess patency and restenosis, the mean value of ABI decreased to less than 0.15. Types and technologies of endovascular revascularization used in the 24 studies were also varied.

Conclusion: There were significant increases in the ABI value in patients who received endovascular revascularization. So, when viewed from the ABI value, this treatment is effective. Further studies with data from the clinical improvement of patients or patients receiving bypass surgery are still needed to discover the appropriate treatment method for patients with PAD.

Keywords: Endovascular, Revascularization, Ankle Brachial Index

Introduction:

Peripheral arterial disease (PAD) is the presence of a lesion that decreases the flow of arteries that supply blood to the limbs. The clinical presentation of this disorder arises as a consequence of reduced perfusion to the affected extremity [1]. In patients older than 40, atherosclerosis is the leading cause of PAD. Other causes are thrombosis, embolism, vasculitis, fibromuscular dysplasia, entrapment, adventitious cystic disease, and trauma [2].

The number of PAD cases in 2000 and 2010 in high-income countries and LMICs (Low, and Middle-Income Countries, including Indonesia) were estimated according to age and the sex distribution of the population. Over 10 years, the number of cases worldwide is expected to increase by about a quarter to around 200 million, but with a relatively higher increase in LMICs (29%) than in high-income countries (13%) [3]. In the international study, A Global Atherothrombosis Assessment (AGATHA) by the European Society of Cardiology which involved Asian countries, including Indonesia in 2006, the prevalence of peripheral arterial disease was 9.7% [4].

PAD can involve the aorta or the iliac, femoral, popliteal, and tibia-peroneal arteries. Claudication is a symptom in which there is fatigue and leg pain during activity. Patients with severe PAD may experience pain at rest in the leg [1]. Obstructive lesions are more common in the lower extremities, and therefore symptoms are most often felt in the lower extremities. In PAD, symptoms can be found in the form of reduced or absent pulses in the distal extremities, bruits heard in narrowed arteries, muscle atrophy, and in the more severe stages, hair loss, thick nails, smooth and shiny skin, decreased skin temperature, and pallor or cyanosis can also be found. Ulcers or gangrene may appear in patients with critical limb ischemia [2].

Hypertension, diabetes, dyslipidemia, active and passive smokers, history of cardiovascular disease, chronic kidney disease, lifestyle, dietary habits, history of cancer radiation therapy, and psychosocial factors are risk factors for PAD. Ankle-Brachial Index (ABI) measurements were performed on patients grouped by gender and age, where patients experienced symptoms and had risk factors for PAD. Therapy can be in the form of pharmacological therapy, and/or revascularization (including endovascular intervention and open bypass surgery) [5].

Endovascular revascularization for claudication includes balloon dilation (angioplasty), stents, and atherectomy. The goal of endovascular revascularization in CLI is to supply blood flow to the extremity in at least one patent artery which will help reduce ischemic pain and contribute to wound healing while maintaining a functional limb. Meanwhile, in ALI, for limbs that require immediate action (category IIa and IIb ALI), revascularization must be carried out immediately (within 6 hours) [6]. Clinical assessment, calculation of Ankle Brachial Index (ABI) values, and imaging demonstrate successful management of patients with PAD [7].

Knowledge and information about endovascular revascularization and its effect on the value of the Ankle Brachial Index (ABI), which is used as one of the criteria for the successful treatment of patients with Peripheral Arterial Disease (PAD), can be used as a reference for consideration in choosing an effective treatment for patients with Peripheral Arterial Disease (PAD). In addition, there are still very few studies on effective management and evaluation of revascularization outcomes in Peripheral Arterial Disease (PAD) patients in Indonesia, so it still requires a lot of development in the future.

Methods:

Eligibility Criteria:

Data collection was carried out by collecting data from previous research. The article search method uses the PICO characteristics (Population, Intervention, Comparison, Outcome). The characteristics of the population are Peripheral Arterial Disease (PAD) patients. Intervention, namely management in the form of endovascular intervention without comparison or other interventions (comparison), so that the results (outcomes) are obtained in the form of Ankle Brachial Index (ABI) values.

In this study, the selected articles met the following criteria: 1) The study was conducted on Peripheral Arterial Disease (PAD) patients; 2) Research published within the last five years, from 2015 to 2020; 3) The study included data on the Ankle Brachial Index (ABI) values of patients who received treatment in the form of endovascular revascularization, which included pre-operative ABI values (before revascularization procedures) and post-operative ABI values (after revascularization procedures).

Search Strategy:

The data for this study were obtained from the UI library database, PubMed NCBI, and Science Direct. The research articles collected were sorted by year of publication, from 2015 to 2020. The following medical topics heading (MeSH) phrases, either alone or in various combinations, were included in the search: endovascular, revascularization, intervention, ankle-brachial index, peripheral artery disease, critical limb ischemia, and stent. Manual searches of relevant studies were also carried out.

Data Processing and Analysis:

The data are in the form of previous research articles that have been collected, then managed using the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) method. In all research articles that have been collected, Identification, Screening, Eligibility, and Include have been carried out to get articles that meet the inclusion criteria. Data that have been collected are then analyzed descriptively. To assess the quality of the research methodology, the authors used a tool, Mixed Methods Appraisal Tools (MMAT) Version 2018, for the non-randomized quantitative group, the cohort study.

Result:

Overview of Literature Searching:

A literature search was carried out by collecting articles from three databases, namely the library UI, PubMed NCBI, and Science Direct. From the three databases, 1,301 articles were found in the initial search with details on the UI library database of the 1 article, PubMed NCBI of 167 articles, and Science Direct of 1,133 articles. Then from the 1,301 articles, after eliminating duplicate articles, the remaining 1,298 articles were obtained. Then the articles were re-evaluated by reading the titles and abstracts, 1,235 articles were found whose titles and abstracts did not match so 53 articles remained. After evaluating articles based on inclusion and exclusion criteria, in the final results, 24 study articles were found that met the inclusion criteria and could be included in this Systematic Review.

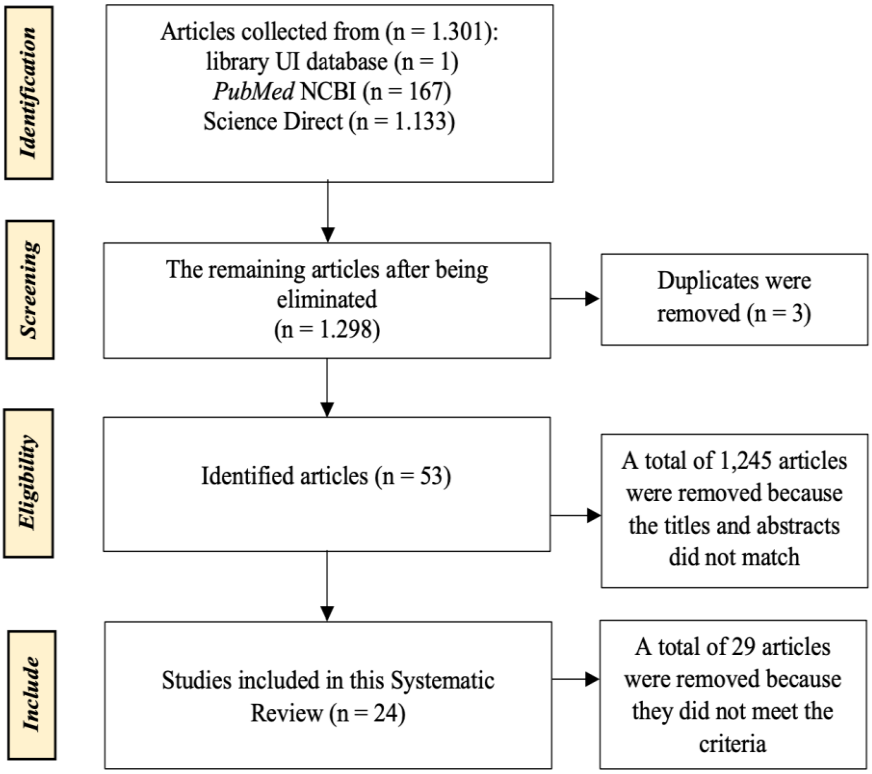

Figure 1. *Preferred Reporting Items for Systematic Review and Meta-Analysis* (PRISMA) flowchart of the literature selection

Study Characteristics

The types of studies that met the inclusion criteria were all prospective and retrospective cohorts. The year of research publication is from 2015 to 2020, with details of 4 articles in 2015, 5 articles in 2016, 2 articles in 2017, 2 articles in 2018, 2 articles in 2019, and 9 articles in 2020. The research was conducted at one or more institutions from various countries, with the research subjects being Peripheral Arterial Disease (PAD) patients.

For assessing the quality of the research methodology, the authors used a tool, namely the Mixed Methods Appraisal Tools (MMAT) Version 2018, for the non-randomized quantitative group, the cohort study.

Table 1. Study Analysis Results

Author, Year	Sample	Endovascular Revascularization Type	The average *Ankle Brachial Index* (ABI)		
			Pre-Operative	**Post-Operative**	**Difference**
Ariefa Adha Putra (2015) [8]	Peripheral Artery Disease Patients at the Department of Surgery RSCM, Jakarta who received endovascular revascularization for the period 1 August 2013 - 31 August 2014 (n = 16)	PTA (n = 15) and PTA + *stenting* (n = 1)	0.700 ± 0.118 (n = 16) (p = 0.001)	0.844 ± 0.127 (n = 16) (p = 0.001)	0.144
Brescia, et.al (2015) [9]	53 patients with 59 limbs with symptomatic femoropopliteal lesions in the period April 2010 – December 2011 (n = 53)	*Angioplasty* and *stenting* used Supera *stent* (*interwoven nitinol stents*)	0.58 ± 0.20 (n = 48, 42 men and 6 women, 54 limbs) (p = .00004)	0.77 ± 0.18 (N = 48, 42 men and 6 women, 54 limbs) (p = .00004)	0.19
Metzger, et.al (2015) [10]	27 patients who received third-generation Angioplasty of the superficial femoral artery in a center, the period June 2013 – May 2014 (n = 27)	Third generation *Angioplasty*, *superflexible nitinol stents*	0.35 ± 0.1	0.75 ± 0.2	0.40
Papakostas, et.al (2015) [11]	48 patients (56 limbs) who received endovascular therapy as a result of Chronic Total Occlusions (CTO) of the Iliac Arteries in a 4 year period at 2 vascular surgery centers in Greece (n = 48)	Recanalization without assistive devices with primary stenting	0.43 ± 0.12	0.89 ± 0.11	0.46
Han, et.al (2016) [12]	287 patients consisting of 190 men and 97 women were in the DURABILITY II TRIAL and were followed up for 3 years	Protege EverfLex NitInol STent System II, with lesions of the superficial femoral and proximal	Women: 0.64 (n = 97) Men: 0.65	After 3 years follow up Women: 0.85	Women: 0.21

	(n = 287)	popliteal arteries	(n = 190) (p < 0.05)	(n = 97) Men: 0.92 (n = 190) (*p* = 0.03)	Men: 0.27
Yokoi, et.al (2016) [13]	907 patients from 95 institutions in Japan for the period May 2012 – February 2013, with a total of 1,075 lesions who received 1,861 stents (n = 907)	Drug-Eluting Stents (DES): paclitaxel-coated Zilver PTX stent in superficial femoral artery	0.63 ± 0.18 (974 lesions) (p < 0.01)	Post operative: 0.90 ± 0.16 (691 lesions) After 12 months follow up: 0.86 ± 0.17 (824 lesions) (p < 0.01)	Post operative: 0.90 ± 0.16 (691 lesions) After 12 months follow up: 0.86 ± 0.17 (824 lesions)
Schmidt, et.al (2016) [14]	Femoropopliteal lesions in 288 limbs (n = 260) and follow up for 2 years period May 2009 – January 2012 (n = 260)	Drug-coated Balloon (DCB) in complex femoropopliteal lesions	0.56 ± 0.22 (p < 0.05)	Post operative: 0.89 ± 0.16 After 1 year follow up: 0.88 ± 0.16 (245 lesions) After 2 years follow up: 0.80 ± 0.24 (233 lesions) (p < 0.05)	Post operative: 0.33 After 1 year follow up: 0.32 (245 lesions) After 2 years follow up: 0.24 (233 lesions)
Lammer, et.al (2016) [15]	35 subjects with symptomatic claudication (n = 35)	The drug-eluting bioresorbable vascular scaffold (BVS) containing Everolimus involves the external iliac and superficial femoral arteries.	0.75 ± 0.14	Post operative: 0.99 ± 0.13 After 6 months follow up: 0.99 ± 0.13 After 12 months follow up: 0.98 ± 0.15 After 24 months follow up: 0.96 ± 0.16	Post operative: 0.24 After 6 months follow up: 0.24 After 12 months follow up: 0.23 After 24 months follow up:

					0.21
Bosiers, et.al (2016) [16]	138 patients from 13 clinics (n = 138)	Tack-Optimized Balloon Angioplasty (TOBA) In the superficial femoral artery and popliteal artery	0.68 ± 0.18 (n = 130) (p < .0001)	After 30 days: 0.99 ± 0.16 (n = 128) After 12 months: 0.94 ± 0.15 (n = 122) (p < .0001)	After 30 days: 0.31 (n = 128) After 12 months: 0.26 (n = 122)
Van Haren, et.al (2017) [17]	10 high-risk patients (8 men and 2 women) for aortobifemoral bypass, but were finally given therapy with endovascular technique, with TASC D aortoiliac occlusive disease and age range 50 – 69 years period March 2009 – July 2011 (n = 10)	Endologix Powerlink unibody bifurcated endograft (Endologix, Irvine, Calif)	0.42 ± 0.22 and 0.41 ± 0.08 on the left and right legs (p = .012) pada kaki kiri dan (p = .002) pada kaki kanan	0.95 ± 0.25 and 1.00 ± 0.12 on the left and right legs (p = .012) on the left legs and (p = .002) on the right legs	0.53 (on the left legs) 0.59 (on the right legs)
Taurino, et.al (2017) [18]	74 cases in patients who received profundoplasty during the period March 2005 – October 2015 (n = 74)	Profundoplasty (Endarterectomy and patch angioplasty) of the deep femoral artery (in 18 cases, hybrid therapy with iliac artery)	0.36 ± 0.17 (n = 74) (p < 0.001)	0.57 ± 0.20 (n = 74) (p < 0.001)	0.21
Kaushal, et.al (2018) [19]	52 limbs of 52 patients (35 men and 17 women) with infrainguinal Critical Limb Ischemia (CLI) period 2009 – 2016 (n = 52)	Subintimal arterial flossing with antegrade-retrograde intervention procedure (if antegrade access fails, then it is combined with retrograde) and 19 patients used adjunctive stents	0.54 ± 0.25 (n = 52) (*p* = .03)	0.77 ± 0.25 (n = 52) (*p* = .03)	0.23
Ji, et.al (2018) [20]	102 patients (60 men and 42 women) with Fontaine IV ischemia period January 2011 – May 2013 (n = 102)	Infrapopliteal angiosome-targeted angioplasty (47 directly using this technique, and 55 not using the angiosome concept, indirect revascularization) with balloon catheter	0.16 ± 0.06 (n = 102) (*p* < 0.05)	After 18 ± 11 months follow up: 0.84 ± 0.10 (n = 102) (*p* < 0.05)	0.68
Shimada, et.al (2019) [21]	67 symptomatic patients with 73 limbs (n = 67)	Cutting Balloon Angioplasty (CBA) for de novo femoropopliteal artery in chronic total	0.52 ± 0.12 (p < 0.0001)	0.80 ± 0.15 (p < 0.0001)	0.28

		occlusive disease			
Liao, et.al (2019) [22]	32 patients with arterial in-stent restenosis during the period June 2016 – July 2017 (n = 32)	Combination of Rotarex Thrombectomy with Drug-Coated Balloon (DCB) angioplasty	0.45 ± 0.14 n = 29 (p < 0.05)	After 12 months follow up: 0.84 ± 0.12 n = 29 (p < 0.05)	0.39
San Norberto, et.al (2020) [23]	46 patients with 50 limbs from November 2013 – December 2014 (n = 46)	Supera stent in symptomatic atherosclerotic disease of the popliteal artery	0.38 ± 0.37 (n = 46) (p < 0.05)	After 12 months follow up: 0.63 ± 0.46 (p = 0.014) After 24 months follow up: 0.66 ± 0.39 (p = 0.023) After 36 months follow up: 0.74 ± 0.46 (p = 0.029) (n = 46)	After 12 months follow up: 0.25 After 24 months follow up: 0.28 After 36 months follow up: 0.36
Huntress, et.al (2020) [24]	32 patients with Critical Limb Ischaemia (CLI) and 40 tibialis who were revascularized (n = 32)	Tibial revascularization with Coronary drug-eluting stent (DES) in the infrapopliteal artery	0.57 ± 0.26 (*p* = 0.03)	0.97 ± 0.26 (*p* = 0.03)	0.40
Lai, et.al (2020) [25]	44 patients with 44 femoropopliteal lesions during the period August 2014 – March 2018 (n = 44)	Drug-Coated Balloon (DCB) in femoropopliteal lesions (chronic total occlusion plus > 10 cm)	0.33 ± 0.40 (n = 44) (*p* = 0.002)	After 1 year follow up: 0.67 ± 0.37 (n = 44) (*p* = 0.002)	0.34
Desai, et.al (2020) [26]	186 patients with Rutherford 4+ CLI criteria for the 2016 – 2019 period (n = 186)	Combined atherectomy with Drug-Eluting Stents (DES)	0.49 ± 0.21 (n = 186) (p < 0.001)	Post operative: 0.74 ± 0.22 After 1 year *follow up*: 0.74 ± 0.23 (n = 186) (p < 0.001)	Post operative: 0.25 After 1 year *follow up*: 0.25
Yusuf Kuserli and Ali Aycan Kavala	93 patients with chronic total occlusion of the superficial femoral artery	Balloon dilatation via retrograde popliteal access (RPA) of the superficial	0.63 ± 0.08 (p < 0,001)	0.90 ± 0.06 (p < 0,001)	0.27

(2020) [27]	(n = 93)	femoral artery			
Ponukumati, et.al (2020) [28]	53 patients at an institution for the period 2015 – 2018 (n = 53)	Rotational atherectomy with drug-coated balloon angioplasty (DCBA) for superficial femoral artery lesions	0.54 ± 0.035 (n = 53) (p < .001)	0.90 ± 0.031 (n = 53) (p < .001)	0.36
Chan, et.al (2020) [29]	315 patients (198 men) with 360 feet and a median age of 78 years (range 46 – 100 years) period October 2011 – October 2018 (n = 315)	Non-drug-eluting angioplasty and helical interwoven nitinol stent (Supera stent) on the femoropopliteal	0.58 ± 0.18 (n = 315)	0.87 ± 0.16 (n = 315)	0.29
Angle, et.al (2020) [30]	276 patients with de novo lesions of the superficial femoral artery (n = 276)	Misago peripheral stent in the superficial femoral artery	0.70 ± 0.10 (n = 276) (p < .001)	After 30 days post operative: 0.98 ± 0.20 (n = 276) (p < .001)	0.28
Gowing, et.al (2020) [31]	51 patients with 63 limbs for the period 1 January 2010 – 15 November 2017 (n = 51)	Hybrid Retrograde iliofemoral endarterectomy with stents to the external iliac artery	0.42 ± 0.25 (n = 51) (p < 0.001)	0.73 ± 0.27 (n = 51) (p < 0.001)	0.31

Discussion:

Diagnosis of Peripheral Arterial Disease (PAD)

Peripheral arterial disease (PAD) is the presence of a lesion that decreases the flow of arteries that supply blood to the limbs. The diagnosis of Peripheral Artery Disease (PAD) mainly uses Ankle-Brachial Index (ABI) values. The Ankle-Brachial Index (ABI) is the ratio of systolic blood pressure measured at the ankle compared to the brachial artery. The normal ABI value is >1, while the ABI value <0.9 is a diagnostic criterion for PAD. PAD can be asymptomatic or have intermittent symptoms, up to pain at rest. An ABI value of <0.5 was obtained in patients with severe PAP and critical limb ischemia [1]. Meanwhile, for the category of ABI values according to AHA/ACC, 2016, abnormal values are <0.90, borderline ranges from 0.91 – 0.99, normal ranges from 1.00 – 1.40, and noncompressible >1.40 [6].

After comparing the explanation of the diagnostic criteria for Peripheral Artery Disease (PAD) in terms of the Ankle-Brachial Index (ABI) value, with the results that have been obtained from the analysis of the studies used in this systematic review, the average value of the Ankle-Brachial Index (ABI) of all these studies met the diagnostic criteria for Peripheral Artery Disease, namely below 0.90, where 9 of the 24 studies consisted of studies by Metzger et.al, Papakostas et.al, Van Haren et.al, Taurino et.al, Ji et.al, Liao et.al, San Norberto et.al, Lai et.al, and Gowing et.al. al have the average Ankle-Brachial Index (ABI) value below 0.5, indicating that they are included in the severe PAD category and the patients required immediate revascularization [10,11,17,18,20,22,23,25,31].

Management of Peripheral Artery Disease (PAD) by Endovascular Revascularization

In this study, the authors used criteria from The Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC) II 2007, and references for additional recommendations from the Guidelines for the Management of Peripheral Arterial Disease (PAP) prepared by the AHA/ACC 2016 and European Society of Cardiology (ESC) in 2017 [5,6,32]. However, most of the studies reviewed in this systematic review, both from the period the sample was taken and the time the research was published were conducted before 2016 (for the 2016 AHA/ACC management guidelines) and 2017 (for the 2017 ESC management guidelines). This indicates that these studies did not use the recommendations from the two management guidelines.

For this type of endovascular revascularization technology using nitinol stents used in the studies of Brescia et.al, Metzger et.al, Han et.al, and Chan et.al [9,10,12,29]. This type of stent is chosen for arteries that are often exposed to external pressure because they can expand and can return to their initial configuration after being compressed [7].

Studies using Drug-Coated Balloons (DCB) are studies by Schmidt et.al, Liao et.al, Lai et.al, and Ponukumati et.al [14,22,25,28]. Meanwhile, research using a Drug-Eluting Stent (DES) was Yokoi et.al's study with a paclitaxel-coated Zilver PTX stent [13] and Desai et.al [26]. Research conducted by Lammer et.al used a drug-eluting bioresorbable vascular scaffold (BVS) containing Everolimus [15]. Drug-Coated Balloon delivers fast and homogeneous delivery of antiproliferative drugs to the vessel wall through a lipophilic matrix without the use of permanent implants and shows the development of long-term patency, so many have made it the choice [5,33]. Drug-Eluting Stent (DES) was chosen because it has bioactive agents or drugs that can be used to prevent stent restenosis due to thrombosis which is its advantage [34]. Meanwhile, Bioresorbable Stents are stents that dissolve after installation. Bioresorbable Stents are different from mechanical stents, where mechanical stents change arterial compliance and cause an inflammatory response at the implanted stent site, thus triggering restenosis and thrombosis [7].

Studies using atherectomy as adjunctive therapy were Desai et.al [26] and Ponukumati et.al [28], where atherectomy is an adjunctive or alternative therapy that is usually used in conjunction with angioplasty procedures and has shown the development of long-term patency [5,7].

The study conducted by Kaushal et.al used adjunctive stents in 19 patients and also used the antegrade-retrograde Subintimal Arterial Flossing technique, which if the antegrade technique fails, then a retrograde technique can be an option [19]. This technique uses flossing guide wires to connect the antegrade and retrograde subintimal tracts simultaneously, then the subintimal tracts are dilated by balloon angioplasty with or without stent implantation [34].

Ji et al's study used the concept of Angiosome-targeted infrapopliteal angioplasty where the benefit of this concept itself is for therapy in Critical Limb Ischaemia (CLI) patients, and where blood supply is utilized as much as possible [20,35]. This is consistent with the study where the study sample was a patient with the Fontaine IV criteria and when viewed from the average value of the Ankle Brachial Index (ABI) it is also included in the critical severe PAP category, namely 0.16 ± 0.06.

Specifically for the study of Van Haren, et.al, in high-risk patients receiving aortobifemoral bypass, revascularization was performed on the aortoiliac [17]. This is following the management guidelines from ESC, 2017 where endovascular strategies in aortoiliac occlusive lesions should be considered in long and/or bilateral lesions with severe comorbidities [5].

Evaluation of Ankle Brachial Index (ABI) Values in Peripheral Artery Disease Patients

Clinical assessment, calculation of Ankle Brachial Index (ABI) values, and imaging demonstrate successful management of patients with PAD [7]. When viewed from the value of the Ankle Brachial Index (ABI), an increase of at least 0.10

is evidence that there has been increased perfusion to the arteries that are in the distal extremities [36]. In addition, a sign of success from the therapy given is if the Ankle Brachial Index (ABI) value is above the baseline and does not decrease >0.15 maximum from the value achieved after the procedure [37].

The studies reviewed in this systematic review showed that there was a significant increase in the average Ankle Brachial Index (ABI) value from before the endovascular revascularization procedure was performed to after the endovascular revascularization procedure was performed, with an increase of more than 0.10.

In addition, several studies that compared the average Ankle Brachial Index (ABI) value after a recent endovascular revascularization procedure with the average Ankle Brachial Index (ABI) value after follow-up for a certain period, such as the study by Yokoi et. al [13], Schmidt et. al [14], and Lammer et.al [15], found a decrease in the average Ankle Brachial Index (ABI) value but less than 0.15. Other studies carried out several follow-ups on patients within a certain period (just looked at the average ABI value after that period, that is, after the endovascular revascularization procedure had been carried out for a long time), then compared the average Ankle Brachial Index (ABI) value in some time such as Bosiers et.al [16] and San Norberto et.al [23], also found no decrease in the average Ankle Brachial Index (ABI) value of more than 0.15. Follow-up of patients in these studies can aim to assess stent patency and the incidence of restenosis, which is one of the criteria for the effectiveness of endovascular revascularization.

Meanwhile, when should the Ankle Brachial Index (ABI) value be reviewed after an endovascular revascularization procedure, whether after a new procedure has been completed or after a certain period, no treatment guide contains recommendations, including the management guidelines from the AHA/ACC 2016 and ESC 2017 The results of the treatment evaluation in terms of the average Ankle Brachial Index (ABI) score show that the endovascular revascularization treatment was successful and proved to be effective.

This study has shown the effectiveness of endovascular intervention therapy by explaining the various types of endovascular revascularization and their benefits, and the results of evaluating ABI values in patients with PAD over time to assess the occurrence of stent restenosis.

The limitations of this study are there is no analysis regarding the effectiveness of endovascular revascularization therapy in terms of ABI values as well as by looking at the patient's clinical development and there is no data available to compare ABI values between patients who received endovascular intervention and patients who received bypass surgery.

Conclusion:

This study shows that revascularization management in the form of endovascular intervention significantly increases the Ankle Brachial Index (ABI) value in Peripheral Arterial Disease (PAD) patients. Based on the results of evaluating the Ankle Brachial Index (ABI) value, revascularization in the form of endovascular intervention is an effective treatment for patients with Peripheral Arterial Disease (PAD). We hope that future studies will be able to compare ABI values with patients who received bypass surgery and evaluate the clinical development of patients who received endovascular intervention procedures and bypass surgery.

Disclaimer: This paper has not been published or presented before.

Conflict Of Interest: None to declare.

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