MCBU SBED
MANİSA CELAL BAYAR ÜNİVERSİTESİ SAĞLIK BİLİMLERİ ENSTİTÜSÜ DERGİSİ
MANISA CELAL BAYAR UNIVERSITY JOURNAL OF INSTITUTE OF HEALTH SCIENCE
ISSN: 2147-9607

ARAŞTIRMA MAKALESİ
RESEARCH ARTICLE
CBU-SBED, 2020, 7(3): 395-400

Endovascular Therapy of Peripheral Arterial Disease Involving Iliac Artery and Distal Lower Extremity Arteries

İliak Arter ve Alt Ekstremite Periferik Arter Hastalıklarında Endovasküler Tedavi

Süleyman Sürer[1*], Yüksel Beşir[2], Orhan Rodoplu[3], Omer Tetik[4]

[1]Dışkapı Yıldırım Beyazıt Training and Research Hospital, Department of Cardiovascular Surgery, Ankara, Turkey
[2]Izmir Katıp Çelebi University, Department of Cardiovascular Surgery, Izmir, Turkey
[3]Medicana Kadiköy Hospital, Istanbul, Turkey
[4]Manisa Celal Bayar University, Department of Cardiovascular Surgery, Manisa, Turkey
e-mail: drsuleyman1@hotmail.com
ORCID: 0000-0002-2012-9114
ORCID: 0000-0003-2059-5155
ORCID: 0000-0003-2711-6866
ORCID: 0000-0003-4471-2686
*Sorumlu Yazar / Corresponding Author: Sorumlu Yazar: Süleyman Sürer [1]

Gönderim Tarihi / Received: 06.06.2020
Kabul Tarihi / Accepted: 17.09.2020
DOI: 10.34087/cbusbed.748516

Öz

Giriş ve Amaç: Periferik arter hastalıklarının tedavisinde konvansiyonel cerrahi yaklaşımlara ek olarak endovasküler tedavi yöntemi giderek daha fazla kullanılmaktadır. Bu çalışma, periferik arter hastalığında kullandığımız endovasküler tedavi yöntemlerini değerlendirmeyi amaçlamaktadır.

Gereç ve Yöntemler: Endovasküler yöntemle tedavi edilen hastaların yirmi dördü retrospektif olarak analiz edildi. Hastaların 19' unda aralıklı klodikasyon, 4'ünde istirahat ağrısı, bilateral popliteal arter anevrizması olan bir hastada da, diz eklemlerinin arkasında ağrı vardı. Yirmi hasta erkek ve 4'ü kadındı. Yaş ortalaması 55,26± 10,95 (38-81) yıl idi. Fontaine Evrelendirmesi' ne göre klinik değerlendirme yapıldı. Hastalar ayak bileği-brachial arter indeksi (ABI), bilateral alt ekstremite arteriogramları ve Doppler muayeneleri ile işleme alındı. Endovasküler tedavi uygulanan hastaların 10' unda TASCII-A, 5'inde TASCII-B ve 9' unda da TASCII-C lezyonları vardı. Tüm hastalar arteriyel doopler taraması ile takip edildi.

Bulgular: Onbir hastaya Bioabsorbable stent kondu. Üç hastaya balon anjiyoplasti yapıldı. Üç hastada nitinol stent uygulandı. Altı hastaya subintimal ilerlenip gerçek lümende balon anjiyoplasti yapıldı. Bilateral popliteal ve sağ anterior tibial arter anevrizması olan 1 hastaya kaplı stent greft ile anevrizma onarımı yapıldı. Olguların %100'ünde hemodinamik başarı sağlandı. Preoperatif 0,67±0,13 (0,4-0,95) ve bir yıl sonra 0,94±0,07 (0,8-1) ABI analizi istatistiksel olarak anlamlı bulundu ($p<0,05$).

Sonuç: Tüm hastalarda işlem sonrası erken dönemde başarı sağlandı. Postoperatif dönemde hasta semptomları belirgin olarak düzeldi ve postoperatif klinik takipte sorun olmayan hastalar tam olarak tedavi edilmiş bir şekilde taburcu edildi. Hastaların takibi sırasında damarsal bir problem görülmedi.

Anahtar Kelimeler: Alt ekstremite iskemisi, periferik vasküler hastalık, stenoz, stentler, subintimal anjiyoplasti

Abstract

Objective: Methods of endovascular therapy have been increasingly used in addition to conventional surgical approaches in the treatment of peripheral arterial diseases. This study aims to evaluate to the endovascular treatment methods that we use in patients with peripheral arterial disease.

Materials and Methods: We retrospectively analyzed twenty-four of patients were treated with endovascular method. Nineteen of the patients had intermittent claudication, 4 had rest pain and one patient with bilateral popliteal artery aneurysms had pain at the back of bilateral knee joints. Twenty patients were male and 4 were female. The mean age was was 55,26± 10,95(38-81) years. Evaluations included clinical assesment according to Fontaine stages. Doppler examinations with ankle-brachial index (ABI) and bilateral lower extremity arteriograms. Ten of the patients who

underwent endovascular therapy had a lesion in TASCII-A group, 5 had a TASCII-B lesion, and TASCII-C lesions were present in 9 patients. All patients were followed prospectively with arterial duplex scan.
Results: Bioabsorbable stent was implanted in 11 patients. Balloon angioplasty was performed in 3 patients. A self-expandable nitinol stent was deployed in 3 patients. Subintimal balloon angioplasty was performed in 6 patients. An aneurysm repair was performed with stent graft in 1 patient who had bilateral popliteal and right anterior tibial artery aneurysms. Initial technical and hemodynamic success was achieved in 100% of cases. Preoperative 0,67±0,13 (0,4-0,95) and after one year later 0,94±0,07 (0,8-1) analysis for ABI revealed statistically significant ($p<0,05$).
Conclusion: Urgent success was achieved in all patients. Patient symptoms were markedly improved at the postoperative period and the patients with event-free postoperative clinical course were discharged with complete recovery. No vascular problems were observed during the follow-up of the patients.
Key words: Lower limb ischemia, peripheral vascular disease, stenosis, stents, subintimal angioplasty

1.Introduction

Methods of endovascular therapy have been increasingly used in addition to conventional surgical approaches in the treatment of peripheral arterial diseases.
Endovascular therapy for peripheral arterial disease has offered a less invasive, safe, and simpler method for many patients suffering this disease. However, it has not been used extensively in clinical practice, perhaps because of its learning curve as advocated by some authors. Despite similar short-term success rates of both endovascular therapy and surgery for peripheral artery disease, surgery clearly outperforms catheter-based therapies in long-term patency of affected arteries. Nevertheless, patients enjoy a lower patient morbidity and mortality associated with percutaneous transluminal angioplasty (PTA) procedure. Management algorithm for lower-extremity vascular lesions and endovascular options have become the first-line therapy for Trans-Atlantic Inter-Society Guidelines (TASC) class A, B and complex TASC C and even TASC D lesions [1,2].
This study aims to investigate for procedural and clinical outcomes in the endovascular treatment methods with severe occlusive lesions of iliac or peripheral arterial diseases.

2.Material and Methods

After approval of the local ethics committee, we retrospectively analyzed 24 of patients treated with endovascular method in a one year period. The study population consisted of twenty males (84%) and four females (16%). The mean age was 55,26± 10,95 (range 38-81) years. Patients were compared by demographic data, common risk factors for atherosclerosis, and comorbidities. Risk factors and comorbidities consisted smoking, hyperlipemia, hypertension, coronary artery disease, diabetes mellitus, chronic obstructive pulmonary disease and chronic renal failure (Tablo 1).

Within this study population of 24 patients, 23 limbs were treated for varying degrees of ischemia as follows: 19 of the patients (79,5%) had intermittent claudication (category 3), 4(16,4%) had ischemic rest pain (category 4), 1 (4%) for tissue loss (categories 5 and 6) and one patient (4 %) with bilateral popliteal artery aneurysms had pain at the back of bilateral knee joints. After intraoperative angiography, 24 arterial lesions underwent percutaneous transluminal angioplasty (common iliac, 4; external iliac, 5; common femoral, 4; superficial femoral, 10; popliteal, 1). We performed our interventions in angiography unit which is used by cardiology department. We used hybrid procedure to five patients which has TASC D lesion. We applied right distal type (infra popliteal) femoro-popliteal bypass for three patient and for two we applied distal type (supra popliteal) left femoro-popliteal bypass procedure.

Table 1. Demographic characteristics

		n (%)
Sex (n, %)	Man	20(87,2)
	Woman	4(12,8)
Age (year)		55,26±10,95
Weight (kilogram)		71,14±12,39
Height (meter)		1,682±0,067
BMI		25,08±3,442
Diabetes (n, %)		5(20,8)
Hypertension (n, %)		10(41,6)
Colesterol (n)		9(37,5)
Triglyceride (n, %)		8(33,3)
HDL low (n, %)		12(50)
Smoking (n, %)		16(66,6)
Obesity (n, %)		2(8,2)
Acetylsalicylic acid (n, %)		8(33,3)
Silostazol (n, %)		5(20,8)
Clopidogrel (n, %)		3(12,3)
Antilipidemic drug (n, %)		7(29,1)
Fontaine (n, %) classification	3	10(41,6)
	4	14(58,3)
Heredite (n, %)		5(20,8)
Coronary artery disease (n, %)		11(45,8)
Myocardial infarction (n, %)		7(29,1)
Coronary-Stent (n, %)		5(20,8)
CABG (n, %)		3(12,3)
COPD (n, %)		6(24,6)
Chronic renal failure (n, %)		1(4,1)
Focal gangrene (n, %)		3(12,3)
Minor Amputation (n, %)		1(4,1)

BMI: body mass index. CABG: coronary artey bypass grafting, COPD: cronic obstructive pulmonary disease.

We used vena safena magna in a 3 patient and PTFE graft in 2 patients. Subintimal balloon angioplasty failed with TASCII-C lesions of 2 patients who were excluded from the study. One of these patients underwent urgent infragenual femoropopliteal bypass using a saphenous graft and the other supragenual femoropopliteal bypass using a PTFE graft. After successful recanalization, all patients received the combination of aspirin 100 mg/day and either clopidogrel 75 mg/day or cilostazol 200 mg/day for at least 1 year.

Statistical Analysis

All patients' data were collected using SPSS version 9.5 (SPSS Inc, Chicago, IL). Mann Whitney U and Wilcoxon Signed Rank test were used to evaluate clinical and hemodynamic improvement by comparing the mean ABI before and after the procedures. A p value <0 .05 was considered significant.

3. Results

Nine of the patients who underwent endovascular therapy had TASC-A, 5 patients TASC-B and 9 patients TASC-C types of lesions. Subintimal balloon angioplasty failed with TASC-C lesions in 2 patients who were excluded from the study. One of these patients underwent urgent infragenual femoropopliteal bypass using a saphenous graft and the other supragenual femoropopliteal bypass using a PTFE graft. Procedural morbidity (<24 hours) and mortality related to endovascular interventions was not occurred. Bioabsorbable stents, self-expandable nitinol stents, balloon angioplasty, and subintimal balloons were used for treatment. Bioabsorbable stent was implanted in 11 patients (Figure1a, 1b).

Balloon angioplasty was performed in 3 patients. A self-expandable nitinol stent was deployed in 3 patients. Subintimal balloon angioplasty was performed in 6 patients (Fig.2a, 2b)

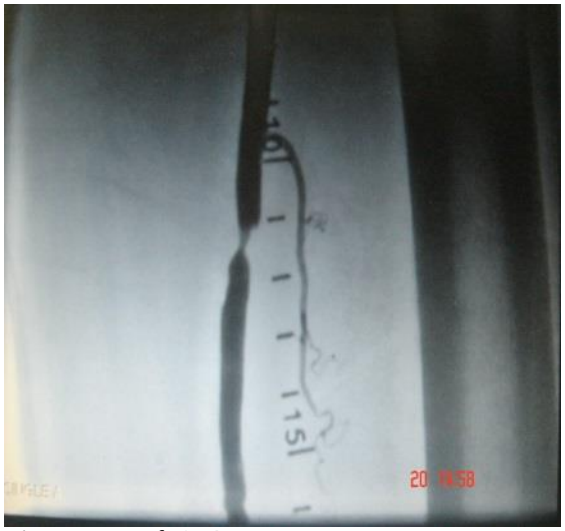


Figure 1a. Left SFA stenosis

Fig1b. After biodegradable stent imlantation

Figure 2a. Left SFA occlusion

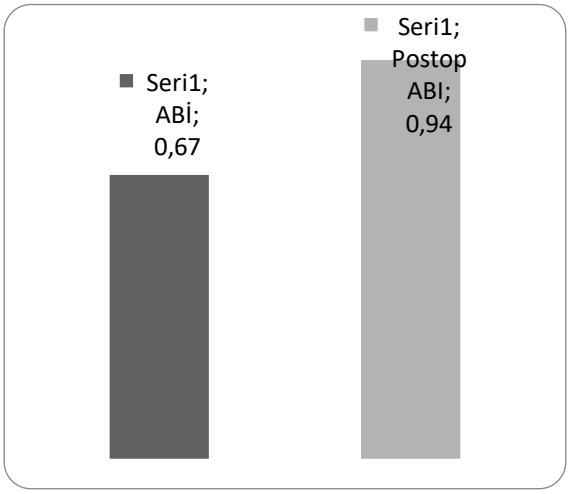
Figure 2b. After subintimal ballon angioplasty

Figure 3a: Left popliteal artery aneurysm

Figure 3b. After stent graft imlantation

An aneurysm repair was performed with stent graft in 1 patient who had bilateral popliteal and right anterior tibial artery aneurysms (Fig.3a, 3b).

Major and minor complications related to the procedure was not occurred Preoperative 0,67±0,13 (0,4-0,95) and after one year later 0,94±0,07 (0,8-1) analysis for ABI revealed statistically significant ($p<0,05$) (Figure 4). Urgent success was achieved in all patients.



Wilcoxon Signed Rank analysis

Figure 4. The mean ABI before and 1 year later.

4. Discussion

Endovascular therapies may sometimes not provide patients with any benefit due to various factors, either alone or more likely in combination, including location, extension and severity of artery lesion, run-off status, plantar arch integrity, calcification, diabetes, infection, gangrene.

This study aims to investigate for procedural and clinical outcomes in the endovascular treatment methods with severe occlusive lesions of iliac or peripheral arterial diseases. Twenty-four of patients were treated with endovascular method in our clinic in a one year period. Symptoms of these patients were markedly improved at the postoperative period and the patients with event-free postoperative clinical course were discharged with complete recovery. No vascular problems were observed during the follow-up of the patients.

Intervention for lower extremity arteries has usually been used to relieve claudication or critical limb ischemia (CLI). Percutaneous transluminal angioplasty and stenting have increasingly been taken into account by vascular surgeons and progressively more qualitative and quantitave procedures have been performed in the last decade. PAD classification recommended by the TASC Working Group is based on the disease's anatomical location (aorta-iliac, femoropopliteal, or infrapopliteal) and its severity (type A, B, C, or D) [3]. Vascular surgeons have been increasingly interested and gained significant experience in percutaneous transluminal angioplasty and stenting procedures.

PAD can be diagnosed either simply by ABI or, more commonly, noninvasive vascular examinations in the last ten years. The available test for ascertaining the location, extent, and consequences of PAD include duplex ultrasound, imaging studies such as computed tomo-graphic angiography or magnetic resonance angiography, and catheter-based angiogram. Type A/B lesions are mainly treated by endovascular therapy, while type C/D lesions are rather treated via open surgery. As expected, type B/C lesions are intermediary lesions amenable by both endovascular therapy and surgery, depending on several factors including surgical risk, physician preference, and the expected longevity of each intervention [4]. Two of our patients with TASCII-C lesions that subintimal balloon angioplasty failed to be treated, were excluded from the study. One of them underwent urgent infragenual femoropopliteal bypass using a saphenous vein graft and the other had undergone supragenual femoropopliteal bypass using a PTFE graft.

PAD is most commonly and objectively defined by an ankle-brachial index (ABI) of less than 0.90 at rest [3,7]. Preoperative and after one year later analysis for ABI revealed statistically significant ($p<0,05$) in our patients. PAD may manifest itself by either intermittent claudication (IC) or chronic critical limb ischemia (CLI), although it may also be totally asymptomatic [4-6]. Endovascular treatment of peripheral arterial disease may be hampered by long, diffusely calcified, and totally occluded lesions. TASC Working Group, based on the outcomes of 1264 procedures in 4 separate studies, reported an initial success rate of 95% and a 5-year durability rate of 61%, with only an average complication rate of 3.6% for PTA in iliac artery disease [1]. We successfully performed suboptimal balloon dilatation in two patients with TASC C lesion.

PAD is considered a manifestation of a more widespread atherosclerotic process involving whole body, and thus such patients are accepted to be members of the first and four major statin benefit groups, as suggested by the American College of Cardiology/American Heart Association (ACC/AHA) guidelines for treatment of blood cholesterol issued in 2013 [8]. Digital subtraction angiography is still required for diagnostic and therapeutic purposes as well as in the preoperative planning stage. As for patients scheduled for hybrid infrainguinal revascularization, one must be vigilant for iliac disease that is present in a majority of patients. Hybrid revascularization can be preferred in extensive lesions involving common femoral artery and SFA. The other limb can also be salvaged at the same procedure by the same technique if it is technically feasible. Hybrid revascularization is ideal for patients suffering SFA lesions of TASC A or B in combination with severe infrageniculate disease. We used hybrid procedure in five patients which had TASC D lesion in cathether laboratory. We applied right distal type (infra popliteal) femoro-popliteal bypass for three patient and for two we applied distal type (supra popliteal) left femoro-popliteal bypass procedure. We used vena safena magna in a 3 patient and PTFE graft in 2 patients.

Restenosis rates associated with stent use have traditionally dwindled around 20-25% although latest series with drug eluting stents have reported short-term restenosis rates as low as 10%. These results supported the effectiveness of drug eluting balloons in treatment of PAD. Despite ongoing advances, however, restenosis rates in excess of 50% have been reported by some series in a period as short as 6 months [9,10].

The BASIL trial randomized 452 subjects to either angioplasty first or surgery first and followed them between 1999 and 2004. Amputation-free survival was the primary endpoint. The groups were similar to a large extent, with only the therapy cost being greater in surgery-first group about one third by 1 year [11]. Endovascular intervention performed worse than surgery in long stenosis and severely calcified segments [12]. (BASIL) trial grouped the enrolled subjects into 2 groups, namely the surgery and endovascular therapy groups, depending on the initially performed therapeutic intervention. The subjects required to have severe and symptomatic infrainguinal disease that was amenable to both techniques. At the end of the study, both approaches were associated with similar outcomes of overall survival and amputation-free survival at 2 years [11]. Restenosis secondary to neointimal hyperplasia has a major limitation to the endovascular treatment of PAD. Combined application of subintimal balloon biodegradable stent and nitinol stent can rise patency rates, on the other hand in-stent restenosis maintain to reduce technical success.

This study suggested that endovascular therapy for symptomatic limb arterial disease is a viable alternative to surgery in selected subjects with atherosclerotic iliac artery stenosis. It has a number of additional advantages of endovascular treatment of peripheral limb arteries, such as reduced anesthesia requirement, limited invasiveness, cost effectiveness and short hospital length of stay.

Declaration of conflicting interests

The authors declared no conflict of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

References

1. Dormandy, J, Rutherford, RB, Management of peripheral arterial disease (PAD), TransAtlantic Inter-Society Consensus (TASC). Journal of Vascular Surgery, 2003, 31, 1-296.
2. Amanvermez Şenarslan, D, Yıldırım, F, Tetik, Ö, Evaluation of Early and Mid-term Results of TEVAR Procedures with Various Etiology, *Celal Bayar University Journal of Science*, 2019 ,6(4), 283-288.
3. Chisci, E, Perulli, A, Iacoponi, F, Setacci, F, de Donato, G, Palasciano, G et al, Benefit of revascularisation to critical limb ischaemia patients evaluated by a patientoriented scoring system, *European Journal of Vascular and Endovascular Surgurgery*, 2012, 43, 540-7.
4. Norgren, L, Hiatt, WR, Dormandy JA, Nehler, MR, Harris, KA, Fowkes, FG, TASC II Working Group, Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II), *Journal of Vascular Surgery*, 2007,45, 5–67.
5. Go, AS, Mozaffarian, D, Roger, VL et al, American Heart Association Statistics Committee and Stroke Statistics Subcommittee, Executive summary: heart disease and stroke statistics – 2014 update: a report from the American Heart Association, *Circulation*, 2014,129(3),399–410.
6. Giles, KA, Pomposelli, FB, Spence, TL et al, Infrapopliteal angioplasty for critical limb ischemia: relation of TransAtlantic InterSociety Consensus class to outcome in 176 limbs, *Journal of Vascular Surgery*, 2008, 48(1), 128–136.
7. Selvin, E, Marinopoulos, S, Berkenblit, G et al, Meta-analysis: glycosylated hemoglobin and cardiovascular disease in diabetes mellitus, *Annals of Internal Medicine*, 2004,141(6),421–431.
8. Stone, NJ, Robinson, JG, Lichtenstein, AH et al, 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines, *Circulation*, 2014,129(25),1–45.
9. Owens, CD, Ho, KJ, Kim, S, et al, Refinement of survival prediction in patients undergoing lower extremity bypass surgery: stratification by chronic kidney disease classification, *Journal of Vascular Surgery*, 2007, 45,944-952.

10. Heidland, UE, Heintzen, MP, Michel, CJ, Strauer, BE, Risk factors for the development of restenosis following stent implantation of venous bypass grafts, *Heart*, 2001,85,312-317.
11. Adam, DJ, Beard, JD, Cleveland, T et al, Bypass versus angioplasty in severe ischaemia of the leg (BASIL): multicentre, randomised controlled trial, Lancet, 2005, 366(9501),1925-1934.
12. Taylor, SM, York, JW, Cull, DL, Kalbaugh, CA, Cass, AL, Langan, EM. Clinical success using patient-oriented outcome measures after lower extremity bypass and endovascular intervention for ischemic tissue loss, *Journal of Vascular Surgery*, 2009,50(3),534–541.