Research Article

The Endovascular Options For Management of Superficial Femoral Artery Osteal Occlusions

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Abstract

Background: Endovascular intervention is now the primary line of treatment for patients with critical limb ischemia. Nevertheless, endovascular experts face several obstacles with these treatments due to the existence of broad multilevel lesions, osteal lesions, and lengthy and entire chronic occlusive lesions.

Aim of this work: Evaluation the different endovascular techniques of management the superficial femoral artery osteal lesions in cases with critical limb ischemia or incapacitating claudication.

Patients and Methods: This is a prospective study of 55 patients who presented to Beni Suef University Hospitals' vascular surgery unit between January 2020 and December 2021. Patients with symptomatic atherosclerotic occlusive disease of the osteal region of SFA are included in the research.

Results: Technical success was done in 92.7% of cases. Figure (4) shows that;the mean hospital stay of cases in this study was 1.53 ± 0.81 days with range (1.0 – 4.0).Follow up at 1 and 3 months revealed that; patency was kept in 51 (100%), 49 (96.07%) and 40 (78.43%) of all technical successful cases in one, three and six months respectively.

Conclusion: Endovascular treatments show promising prospects as treatment options for SFA atherosclerotic occlusive disorders, particularly when osteal lesions are present. Endovascular intervention techniques, facilities, and expertise have greatly improved, resulting in a high technical success rate and a high proportion of lower limb patency in CLI patients.

Key words: Superficial femoral artery, critical limb ischemia, atherosclerosis, limb patency.

Introduction

Patients with lower limb peripheral arterial disease (PAD) complain of functional limitations caused by claudication, rest discomfort, and tissue integrity loss in their lower limbs. Lower limb revascularization operations for limb ischemia have increased dramatically in recent years due to ageing populations, and the number of patients with atherosclerotic risk factors has also increased.[1]

Cases of critical limb ischemia (CLI) caused by severe atherosclerotic occlusive lesions of the infra-inguinal arteries are increasing in the population, necessitating increased clinical awareness. In previous decades, open surgical revascularization methods were the major line of care for limb salvage; nevertheless, the morbidity and death rate in these procedures was high.[2]

Endovascular procedures have been shown to be equally effective as open surgical therapies in terms of limb salvage and patient survival.[3]

Sub-intimal angioplasty procedures play an important role in the treatment of CLI

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patients. Because of the success of sub-intimal angioplasty procedures in limb salvage, they are an excellent first-line treatment for lengthy and/or completely chronic occlusive lesions of the SFA.[4]

Endovascular surgeons who treat patients with severe lower limb ischemia may face lengthy lesions, multi-level disease arteries, or completely chronically occlusive lesions, particularly in the superficial femoral artery (SFA). SFA chronic complete occlusions (CTOs), particularly in the ostial segment, provide the most difficult operator task.[5]

Endovascular experts are frequently the first to catheterize osteal SFA CTO lesions utilising both guiding catheters and hydrophilic guide wires. Common reasons of technical failure include the inability to engage the CTO cap or create a sub-intimal dissection plane. The majority of procedures is either abandoned or preceded using the sub-intimal dissection approach by operators trained in the use of genuine lumen re-entry devices. Although there are some evident advantages to sub-intimal dissection, a true lumen CTO crossing is unquestionably preferable since it is less difficult and tedious and has a reduced risk of procedural problems.[6]

The difficulty to stay intraluminal; while traversing the CTO lesions and re-entering the real lumen; are the primary causes of technical failure. These operations may also result in vessel rupture, intima dissection, or the formation of arteriovenous fistulas.[7]

Standard procedures employing the cross over and antegrade approaches fail to bridge complete superficial femoral artery occlusions in 15% to 25% of patients. After a failed cross-over catheterization, the trans-popliteal artery procedure might be performed as a secondary strategy in certain circumstances. This approach can also be used to catheterize lengthy superficial femoral artery occlusions with no obvious patent proximal stump.[8] The purpose of this study is to assess the feasibility, patency, and clinical effectiveness of several procedures for bridging the superficial femoral artery osteal blockage in patients with severe limb ischemia or incapacitating claudication.

Patients and Methods

Study design and participants

This is a prospective study of 55 patients who presented to Beni Suef University Hospitals' vascular surgery unit between January 2020 and December 2021. Patients with symptomatic atherosclerotic occlusive disease of the osteal region of SFA are included in the research.

Criteria of inclusion and exclusion

All patients must have CLI in lower limb, presenting with incapacitating claudication, osteal SFA lesions (no stump or stump < 1 mm) that determined by arterial duplex, CT arteriography or direct angiography, fitness for the procedure clinically and laboratory.

Our study excludes patients who meet the following criteria: Cases with lifestyle non limiting claudication, acute ischemia of the lower limb, Non salvageable lower limbs requiring primary major amputations, SFA lesions associated with arterial-venous malformation, SFA lesions associated with aneurysmal dilatation, Connective tissue disorders or immunological disease, Contraindications of contrast injection as sensitivity or renal impairment, Patient refusal.

History and Investigations

Detailed and careful history taking was done for all cases. Meticulous general examination of all cases included vital signs, bilateral carotid arteries pulse examination and auscultation for bruit, groin examination. Ultra-careful local lower limb examination included pulse, temperature, capillary circulation, sensations, motor power, inter-digital infection, ulcers and gangrene.Routine laboratory investigations as complete blood count, renal functions tests, hepatic functions

tests, coagulation profile, blood glucose levels and lipid profile.

Arterial scanning of lower limb tests were done either CTA or duplex scanning before the procedure, ECHO for cardiac diseased cases. X ray foot was required only for cases of foot ulcers, infection or gangrene.

Operative details

Preoperative preparation

All cases signed an approved informed consent. clopidogrel 300 mg was taken by the case at the night of the intervention.The cases were positioned in the supine position. Local anesthetic, Xylocaine 2% was used for local anesthesia of puncture sites.

Procedural preparations and details

The initial arterial accesses were obtained via the contra-lateral CFA using crossover sheaths.Angiography was done to confirm data obtained by pre procedural investigations using nonionic low osmolar contrast diluted to 50% with normal saline.Intraluminal technique was the initial technique for crossing SFA osteal lesions,sub-intimal technique was the next step.Angioplastyballoon catheter was selected for proper diameter and length. Self-expanding nitinol stents were inserted in the indicated cases.The endpoint of the intervention was unrestricted forward contrast flow through the managed SFA without evidence of significant (more than 30%) residual stenosis.

Postoperative status

Postoperative status was evaluated by; Clinical success as regaining of pulse, revascularization warmness, edema and improvement of rest pain, angiographic patency and Technical failure.

Follow up

Follow up was at 1 and 3 months or when new complaints arise by clinical examination and imaging studies.

Ethical consideration

The ethical and scientific committee of Beni-Suef University's faculty of medicine accepted the study. All cases signed an approved informed consent. Also, they were made fully aware about the intervention steps, expected benefits, risks, alternative interventions and possible complications.

Statistical analysis

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0**.** **(**Armonk, NY: IBM Corp**)** Qualitative data were described using number and percent. Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation, median and interquartile range (IQR). Significance of the obtained results was judged at the 5% level.

Results and Discussion

Atherosclerotic peripheral arterial disease is a growing public health burden as it's usually followed by different significant morbidities and high risk of mortality. The management of these cases is multifactorial and a challenge to the vascular surgeons. Endovascular interventions is main way for revascularization as it is associated with marked decreasing in-hospital morbidity, mortality, length of stay, and financial burden when compared with open surgery.[9]

Management of osteal significant lesions of the SFA was usually represented a relative contraindication to endovascular options. Nowadays, huge improvement in endovascular techniques and tools give the endovascular specialists the ability to manage these cases by variable procedures with promising results.[10]

Our study was performed on 55 cases with symptomatic PAD due to osteal SFA lesions to evaluate the different endovascular

techniques of management regarding the feasibility, and clinical success.

Figure (1) shows that;According to Fontaine classification, stage IV were the most common presentation of the cases in this study by 29 (52.73%) cases, followed by stage III by 18 cases (32.7%) and lastly stage IIB cases were only 8 cases (14.5%).

The presentation of cases in our study is varying between Fontaine stages IIB, III and IV. The distribution of these presentations is 14.5%, 32.7%, and 52.7% respectively. The distribution of presentations was 44%, 20%, 36% respectively by Eleissawy et al., [11]. The study bySingh et al.,[12], it was 11%, 56% and 33% respectively. Also, distribution of presentations was 6.6%, 32.1% and 61.3% respectively by Patel et al.,[13].

Figure (2) shows that;According to TASC II classification, TASC II B were the most common cases by 40%, followed by TASC II D by 21.8% of cases and TASC II C cases by 20%. TASC II a cases were the least common by 18.2% only.

In this study, all cases have osteal SFA lesions. We are classifying the lesions according to the TASC II classification. There are 10 cases (18.2%) TASC II A, 22 cases (40%) TASC II B, 11 cases (20%) TASC II C and 12 cases (21.8%) TASC II D. When this classification applied by Patel et al., [13], they reported 7%, 18%, 35% and 40% respectively. Vossen et al., [14] reported 33%, 51%, 11% and 5% respectively.

Figure (3) shows that;the technical success were approved in 51 (92.7%) of the studied cases. Technical failure among our cases happened in 4 (7.3%) cases only. Figure (4) shows that;Lower limb pulse examination after the procedure revealed that 39 (70.9%) cases regained their pedal pulse, 12 (21.8%) cases regained only popliteal pulse and in 4 (7.27%) had no regaining of distal pulse due to technical failure.

Technical failure was due to failure of crossing the osteal SFA occlusive lesions by antegrade or retrograde techniques. These 3 cases had bypass surgery later on. The technical failure of 4th case was due to failure or re-entry procedure after sub-intimal procedure.Technical success is defined as continuous arterial patency to the SFA without any obvious flow-limiting lesions (residual stenosis more than 30% or flow limiting dissection) or major extravasation. In our study, 51 cases (92.7%) have successful technical intervention. On the other hand, 4 cases (7.3%) are failed. The technical success rate was 83.3%, 96.3% and 100% by Ismail [15],Bildirici, et al.,[16] and Fujihara et al.,[17] respectively.

Figure (4) shows that;the mean hospital stay of cases in this study was 1.53 ± 0.81 days with range (1.0 – 4.0).

In 2021, Hamdy Hassan and his coworkers.[18] reported that the mean hospital stay was 1.6±0.35. While in 2018, Doshi and his coworkers [13]reported that the mean hospital stay was 3 days (1-7). That is similar

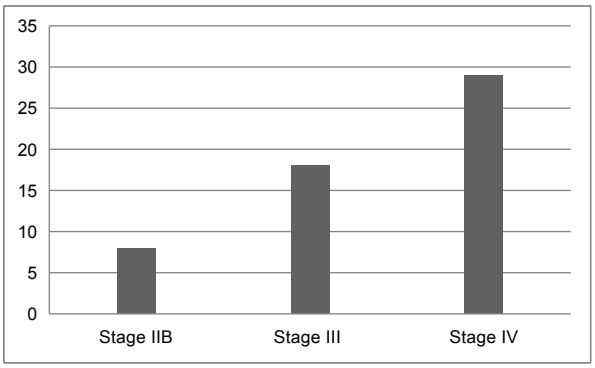

Figure (1): Distribution of the studied cases according to presentation

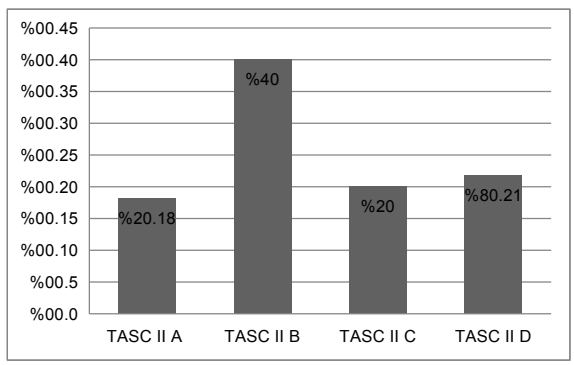

Figure (2): Distribution of the studied cases according to TASC II classification.

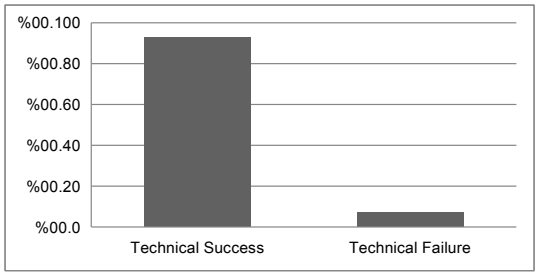

Figure (3): Distribution of the studied cases according to technical success.

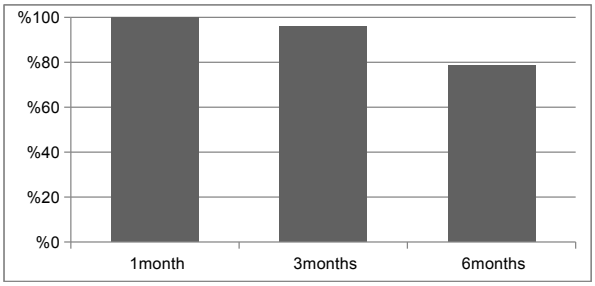

Figure (5):Distribution of the studied cases according to Post procedural patency follow-up.

to the mean hospital stay in our study which is 1.53 ± 0.81.

Figure (5) shows that;Regular and careful follow up was scheduled for all cases in this study at one, three and six months after the procedure. The patency was kept in 51 (100%), 49 (96.07%) and 40 (78.43%) of all technical successful cases in one, three and six months respectively.

During the follow up of the studied cases, the patency was kept in technical successful cases at one, three and six months in 100%, 96.07% and 87.43% of cases respectively. These results agree with results of similar studies as El Yamany et al., [19] recorded that the patency rate was 100%, 91% and 86% at one, three and six months respectively. Also, Abd El Fatah et al., [20] recorded that the patency rate in their study was 100%, 82% and 78% at one, three and six months respectively.

Conclusion

Sub-intimal angioplasty is technically avail-able, safe, and giving promising revascular-ization of the SFA with almost same results as intra-luminal angioplasty. Also, sub-intimal angioplasty is associated with significant decreasing in morbidities

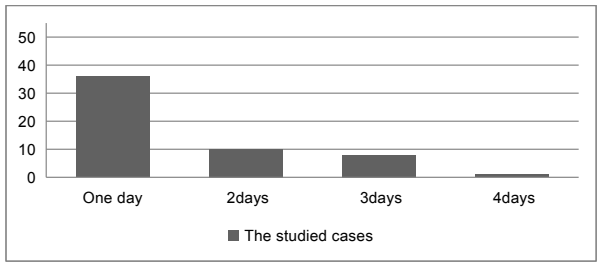

Figure (4): Distribution of the studied cases according to hospital stay.

and mortalities. On the other hand, sub-intimal angioplasty are providing most CLI cases marked long term patency rate so, sub-intimal angioplasty is a preferable option by endovascular specialists to manage cases with long and/or calcified SFA lesions including osteal lesions.

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Source of funding: Self

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