



ORIGINAL ARTICLE

The Retrograde Approach As an Alternative for Failed Antegrade Access for Difficult Below the Knee Chronic Total Occlusions

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ABSTRACT

Background: Critical limb ischemia occurs when the blood flow to the leg is insufficient to maintain the metabolic requirement of the tissue in the resting state. **Objectives:** This study was to describe the technical aspects of the retrograde approach as an alternative for failed antegrade access for difficult below the knee chronic total occlusions. **Patients & Methods:** This study was conducted as retrospective and prospective interventional study that included 18 patient with CLI of deferent ages and sex who were admitted to the department of vascular surgery at Zagzaig university Hospitals. **Results:** we can deduce the major predictive values of technical and clinical success related to endovascular intervention which were lesion characteristics represented in its length and nature, picture of presentation and co-morbid conditions. **Conclusions:** Retrograde tibiopedal approach can be used safely as a bailout to increase the technical success rate and limb salvage for failed antegrade recanalization of popliteal and infrapopliteal arterial occlusions. **Keywords:** Retrograde Approach, Knee Chronic Total Occlusions

INTRODUCTION

Critical limb ischaemia (CLI) needs straight line blood flow to the foot for adequate revascularization. Five-year follow up on CLI revascularization with either an endovascular or open surgery-first approach showed that both methods had equivalent limb salvage rates and amputation-free survival in properly selected cases [1].

Success rate for endovascular treatment of infra-popliteal stenosis is up to 100% but failure rate for occlusion-type lesions ranges from 20 to 40% [2-4].

Iyer and Colleagues reported successful recanalization of long tibial chronic total occlusion (CTO) for tissue loss using a hybrid procedure of below knee angioplasty and open retrograde access was the first to described this open exposure of pedal vessels

and subsequent direct open puncture of pedal arteries as an alternative approach for failed percutaneous antegrade access [5].

The technical success of antegrade or retrograde approach angioplasty for revascularizing lower limb vessels is determined by factors such as lesion length, calcification, distal vessel run off and operator experience. Although subintimal crossing of below the knee CTO lesions is a useful technique, it is associated with major complications. Inability to re-enter the true lumen after subintimal passage and extension of the subintimal passage beyond the occluded segment, compromises collateral vessels and restricts potential surgical bypass targets [6,7].

The retrograde approach usually offers a higher success rate of crossing the CTO lesion

because the distal atheroma cap is often softer in composition^[8].

The CTO lesions of less than a year old are usually composed of soft cholesterol laden foam cells lesions and those that are more than one year old are usually composed of fibrocalcific iron and hemosiderin deposits thus forming the “hard plaque” variety^[8].

Walker et al. showed that retrograde pedal access after a failed antegrade approach was successful in 96% of patients (Rutherford 4-6 with occlusive disease) and those with vessel diameters >1.5 mm^[9].

Open approach is usually attempted as a last resort by many endovascular surgeons. However procedural time, contrast and radiation usage could have been cut short in cases where the distal target vessels pose a technical challenge for approach via a percutaneous method^[9].

AIM OF THE WORK

The aim of this study for evaluate the technical aspects of the retrograde approach as an alternative for failed antegrade access for difficult below the knee chronic total occlusions.

PATIENTS AND METHODS

This study was conducted as retrospective and prospective interventional study that included 18 patients with CLI of deferent ages and sex who were admitted to the department of vascular surgery at Zagzaiq university Hospitals.

Written informed consent was obtained from all participants and the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

These patients were scheduled for below the knee angioplasty and followed up from the beging of March 2018 till the September 2018.

Inclusion criteria:

1. Patients with chronic critical ischemia of the lower limb (Rutherford categories 4, 5 & 6) with CTO in:
 - o Popliteal occlusion.
 - o Infra popliteal occlusion
- After failure of endovascular (antegrade) technique.
2. Presence of collateral distal refilling of at least one of the foot vessels
3. Patients understand the nature of the procedure and provide written informed consent before enrollment in the study.

Exclusion criteria:

1. Patients with infected chronic leg ulcers near the puncture site.
2. Patients with unsalvageable limb or threatening infections.

All patients were followed up to the endpoints of limb salvage, patency rate, major amputation or deaths at the end of the follow up period. The patients were followed up monthly with assessment of pulse, ABI and clinical features of improvement regarding upward shift in Rutherford scale.

Limb salvage was considered if the ulcer/gangrenous segment had healed completely or if at the end of the follow up period, the ulcer persisted but with a significant reduction in size and progression of the healing process.

Further Intermittent debridement was performed as dictated by the wound status either as an outpatient procedure or in the operating room. Foot counseling and appropriate offloading footwear were advised to all patients to help early ambulation.

Retrograde tibiopedal approach can be used safely as a bailout to increase the technical success rate and limb salvage for failed antegrade recanalization of popliteal and infrapopliteal arterial occlusions. Moreover, we can deduce the major predictive values of technical and clinical success related to endovascular intervention which were lesion characteristics represented in its length and nature, picture of presentation and co-morbid conditions (Fig 1, S1,2,3).

STATISTICAL ANALYSIS

All analysis was performed with the Statistical Package for the Social Sciences (SPSS), version 20.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

Table (1) shows that the age of the studied patients ranged from 36 to 82 years with mean 64.39 years. Regarding sex 61.1% were male. Table (2) shows that 88.9% of the studied patients had DM, 77.8% had HPT and 55.6% were smoker. Regarding comorbidity 72.2% of the studied patients had other diseases

most frequent IHD (66.7%). Table (3) showed that most of patients underwent the study were Rutherford (5) while there is no significant different between the patients percentage. Table (4) show that 61.1% of the studied group had run off at ATA and 38.9% had in PTA. Table (5) showed that most of patients underwent the study were TASC (B) while there is no significant different between the patients percentage. Table (6) showed that at the end of procedure 15 of patients retained pulse 83% while 3 patient had no palpable pulse 17%.

Table (1): Demographic data of the studied patients

Variable	(n=18)	
Age : (year)		
Mean ± SD	64.39 ± 10.39	
Range	36 - 82	
Variable	No	%
Sex:		
Female	7	38.9
Male	11	61.1

Table (2): History of the studied patients

Variable	(n=18)	
	No	%
Risk factor and Comorbidity		
DM	16	88.9
HPT	14	77.8
Smoking	10	55.6
IHD	12	66.7
COPD	1	5.6
Renal insufficiency	2	11.1
Stroke	2	11.1

Table (3): Clinical data among the studied patients

Patients presentation		(n=18)	
		No	%
Rest pain	Rutherford (4)	6	33.3
Ulcer	Rutherford (5)	8	44.4
Tissue loss	Rutherford (6)	4	22.2

Table (4): The patient crural vessel (Run off) which underwent retrograde angioplasty

	(n=18)	
	No	%
Run off:		
ATA	11	61.1
PTA	7	38.9

Table (5): TASC classification among the studied patient

TASC classification	(n=18)	
	No	%
TASC A	5	27
TASC B	7	38
TASC C & D	6	33

Table (6): Pulse follows up among patients who had palpable clinical pedal pulse. (n=15 of the 18 patients): Follow up

	Number of patients still having pulse out of the 38	Percentage out of 15 patients	Percentage out of the 18 patients
2 weeks	15	100%	83%
3 months	13	86%	72%
6 months	7	46%	38%

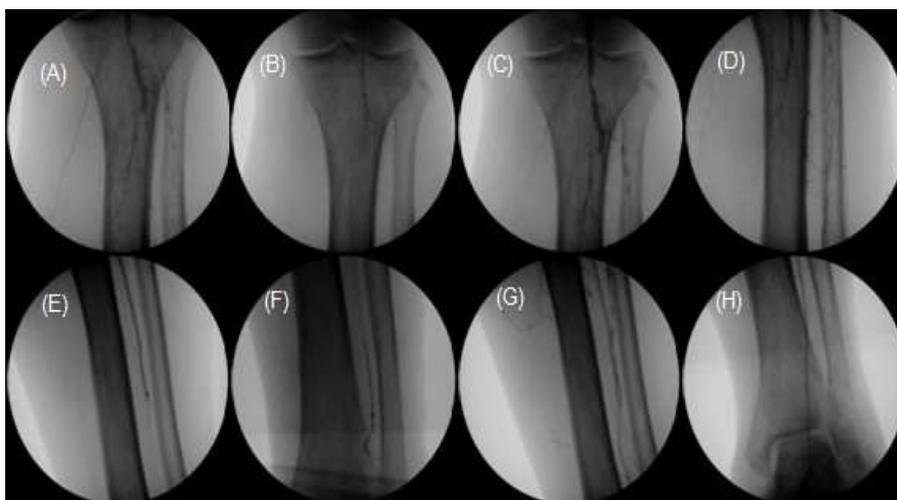


Fig. 1. (A) injected contrast from antegrade sheath showing stenosis at junction of popliteal artery behind (P2) and below the knee (P3) with near total occlusion of the 3 tibial vessels. (b) 0.014 wire supported by balloon at P3. (C)& (D) Injected contrast from the balloon showing proximal part of peroneal artery and reformation of lower ATA. (E) & (F) antegrade balloon dilatation of peroneal artery. (G) & (H) Injected contrast from the balloon showing recanalization of the peroneal artery.

DISCUSSION

Critical leg ischemia (CLI) leads to significant morbidity and mortality and to the consumption of considerable health and social care resources in developed and developing countries^[10].

If the critical limb ischaemia is not revascularized, Up to 40% of extremities with ischemic non healing ulcers, gangrenous digits or rest pain may require a major amputation within 6 months of onset^[11].

Bypass surgery using outflow vessels in the distal ankle and foot is considered the

standard of care in patients with critical limb ischaemia due to below knee vessel disease^[12].

However it needs a good vein conduit and at least one open foot artery, and is associated with 0.9% perioperative mortality, 3% myocardial infarction or acute congestive heart failure, and 6.6% early reoperation for graft thrombosis, postoperative bleeding or infection^[13].

For these reasons, infrapopliteal PTA is currently proposed as the primary treatment for critical limb ischaemia^[14].

Antegrade interventions fail in 10-40% of cases. So, retrograde tibio-pedal approach was described as a bailout technique. Retrograde approach success may be due to much more nearer distance between access and CTO giving the guiding wire and supporting balloon more pushability, less fibrosis and calcification of the distal cap of CTO and avoiding passage of the guide wire through collaterals arising caudally just proximal to the lesions ^[15].

Our technical success rate was 72.2%, lower than (100%) of Fusaro et al. ^[16] and (86%). This lower success rate may be due to our learning curve and more advanced Rutherford category of our patients as our patients were categories 4, 5 and 6, while their categories 3, 4 and 5 (part of their patients were claudicant and no patients with gangrene).

During follow up period, the limb salvage rate was 72.2 % (13 of 18 patients), while Bazan et al. ^[15] found at a mean follow-up of 17.1 ± 10.3 months, the limb salvage rate was 77% (10 of 13 patients) and Gandini et al. ^[17] found the limb-salvage rate was 83% at 6-month follow-up. Our strategy was to decrease trauma to the access vessel by avoiding introducing the sheath itself, like first group of Gandini et al. ^[17] by only using the dilator part to exchange the wire, like or completely sheathless by inserting the long 0.018 inch guide wire directly through the micropuncture needle, like Fusaro et al. ^[16] And we had no significant access site complications like previous authors and most of literature apart from acute occlusion of access vessel in one patient of the first group of that required urgent pedal bypass. In the other successful 8 patients, we extracted the wire from the antegrade femoral sheath without using a snare kit, by guiding the wire into the tip of a straight catheter inserted from the antegrade sheath, like Spinosa et al. ^[3] that differs from ^[16-18] who used a snare kit.

CONCLUSION

Retrograde tibio-pedal approach can be used safely as a bailout to increase the technical success rate and limb salvage for failed

antegrade recanalization of popliteal and infrapopliteal arterial occlusions.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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None declared

Figures (S1-S3) are shown in the online supplement

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