Endovascular treatment of chronic total occlusion of the iliac artery

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Introduction
Recent results for intraluminal endovascular interventions for aortoiliac occlusive disease were published with an acceptable long term primary and secondary patencies. Although aortobifemoral bypass is still considered the gold standard for treatment of iliac artery CTOs, the procedure carries a mortality rate of 4.4% and a major complication rate of 12.1%. The aim of the study is to determine which type of patient with iliac CTO and which technique is more suitable for endovascular treatment.

Methods
It is a prospective study of 40 patients with symptomatic chronic atherosclerotic lower limb ischemia with isolated (CTO) iliac disease. According to the TASC-II classification, there were 14 patients with TASC type B lesions, 4 patients with TASC type C, and 22 patients with TASC D.

Results
Technical success was as 100% and was achieved by completion angiography, and clinical assessment of distal pulsations.

Conclusion
Endovascular treatment for iliac artery occlusive disease can be considered an alternative to open surgery for TASC-II B,C,D (CTO) disease, especially in surgically unfit patient, or who refuse surgical intervention.

Keywords:
iliac CTO, kissing stents, routine stenting, transbrachial approach

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Introduction

Percutaneous revascularization of the common iliac artery (CIA) and external iliac artery (EIA) with or without stents is a well-established, minimally invasive technique and has supplanted aortofemoral bypass for the majority of patients who have symptomatic iliac atherosclerosis Mousa *et al*. [1]. As the population develops more comorbidities, fewer patients will be considered an acceptable risk for open revascularization. As endovascular techniques have advanced, these techniques have been used for increasingly ill patients [2]. Kashyap *et al*. [2] published results for intraluminal endovascular interventions for aortoiliac occlusive disease with a primary patency rate of 74% at 3 years and a secondary patency of 95% at 3 years. Although the bulk of the literature details the use of endovascular techniques for iliac stenoses, there has been a paucity of studies addressing iliac artery chronic total occlusion (CTO). There are several technical options for accessing (transbrachial, transfemoral) and crossing (intraluminal, subintimal) of iliac CTO lesions, in addition to primary stenting versus selective stenting [2].

Aim of the study

The aim of this study is to establish certain criteria that can enable identification of patients with iliac CTO who may be more suitable for endovascular treatment and to determine which technique is more suitable for manipulation of certain lesions.

Methods

Patients

This is a prospective study of 40 patients with symptomatic chronic atherosclerotic lower limb ischemia with isolated (CTO) iliac disease. This study was carried out at Kasr-Alainy Hospital during the period from October 2012 to October 2014. Patients with iliac artery stenosis, acute embolism, thrombosis, dissection, arteritis, or those with an associated abdominal aortic aneurysm or associated other atherosclerotic lesions

in the lower limb arterial tree such as femoropopliteal lesions were excluded. All patients are evaluated for their demographics, risk factors, clinical presentation, and indication of intervention.

Preoperative evaluation

In addition to routine laboratory tests, all patients were evaluated by duplex and CT-angiography, and classified according to the Trans-Atlantic Inter-Society Consensus (TASC-II) classification into B, C, and D.

Operative technique

All patients were adequately well hydrated before and after the procedure and prepared with a loading dose of four tablets of 75 mg clopidogrel the day before the procedure.

All cases were performed in the endovascular suite; arterial access was obtained through the contralateral femoral artery or the left brachial artery for initial diagnostic angiography. The lesion was then approached through an ipsilateral retrograde approach or through a contralateral crossover technique. The brachial approach was reserved for patients with difficulty in crossing proximal or ostial occlusion by a contralateral approach or in bilateral iliac lesions. Heparin was administered routinely after placement of a working sheath.

In most cases, a hydrophilic stiff or a soft-tip 0.035-inch Gluidewire (Terumo Interventional systems, USA) was used in combination with an angled catheter such as a Rim or Burn catheter for negotiation of the lesion. The catheter was used to engage and direct the wire toward the lesion.

Balloon angioplasty was performed in all cases for predilatation. The balloon diameter ranged between 6 and 7 mm and balloon length ranged between 60 and 100 mm. Inflation pressure ranged between 8 and 12 atm and inflation time ranged between 30 and 60 s.

Routine stenting was performed in all patients. All stents were self-expandable, except in two cases, where we used balloon-mounted stents (for ostial occlusions); stent size ranged between 6 and 8 mm and length between 60 and 120 mm.

All patients were discharged on 150 mg aspirin and 75 mg clopidogrel daily for 3 months. The study was approved by the ethical committee of our institute.

Follow-up

Clinical follow-up was performed at 1, 6, and 12 months by evaluation of symptoms such as pain improvement or recurrence, progress of ulcer healing, appearance of a line of demarcation of gangrenous tissues, and assessment of both lower limb pulsations; also, aortoiliac duplex ultrasound studies were carried out for five patients as clinical evaluation alone was not sufficient.

Results

Between October 2012 and October 2014, 40 patients with iliac CTO underwent iliac artery angioplasty. Of these, 36 patients were men and four patients were women; 30 of these patients presented with incapacitating claudication (75%), and six patients presented with rest pain (15%), and four patients presented with tissue loss (10%) (two patients with non = healing ulcer and another two patients with dry gangrene).

According to the TASC-II classification, 14 patients had TASC type B lesions, four patients had TASC type C, and 22 patients had TASC D.

TASC B: either unilateral CIA occlusion (Fig. 1) or unilateral EIA occlusion not involving the common femoral artery (Fig. 2) and/or the internal iliac artery.

TASC C: unilateral EIA occlusion involving common femoral artery and/or internal iliac artery (Figs 3 and 4).

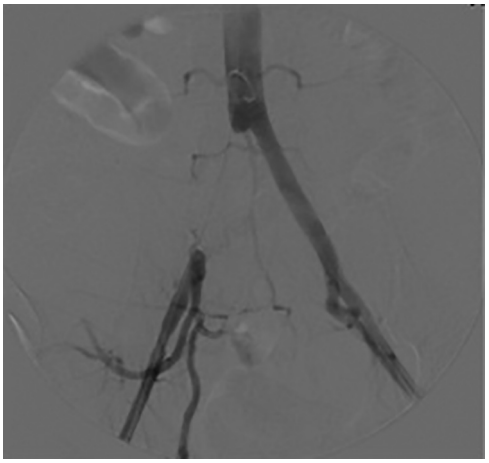
TASC D: CIA occlusion extending to EIA (Figs 5 and 6).

The bilateral retrograde femoral approach was used in 12 patients (Fig. 7), whereas the contralateral femoral approach alone was used in six patients (Fig. 8); the left brachial approach was used in six patients (Fig. 9), whereas the combined brachial and femoral approach was used in 16 patients (Fig. 10).

Balloon angioplasty was performed in all cases for predilatation. The balloon diameter ranged between 6 and 7 mm and balloon length ranged between 60 and 100 mm. Inflation pressure ranged between 8 and 12 atm. Inflation time ranged between 30 and 60 s.

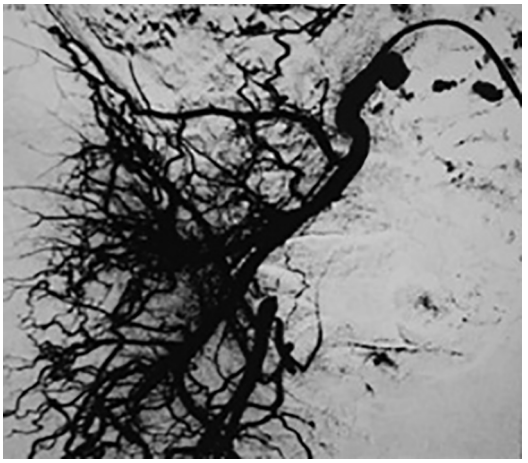
Routine stenting was performed in all patients. Kissing stents were applied in 14 cases: because of flush unilateral CIA occlusion in 10 cases (Fig. 11) (by a combined brachial and retrograde femoral approach in six cases and by a bilateral retrograde femoral approach in four cases) and because of bilateral lesions in four cases (Fig. 12) (two cases were managed by a combined brachial and retrograde femoral approach and the other two cases were managed by a bilateral retrograde femoral approach). Unilateral stenting (Fig. 13) was performed in the remaining 26 cases.

Figure 1



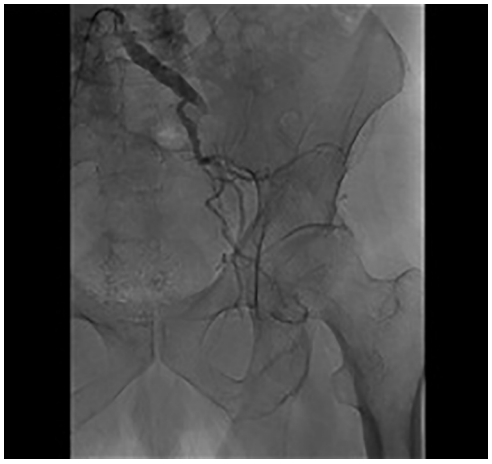
Common iliac artery occlusion.

Figure 2



Unilateral external iliac artery occlusion.

Figure 3

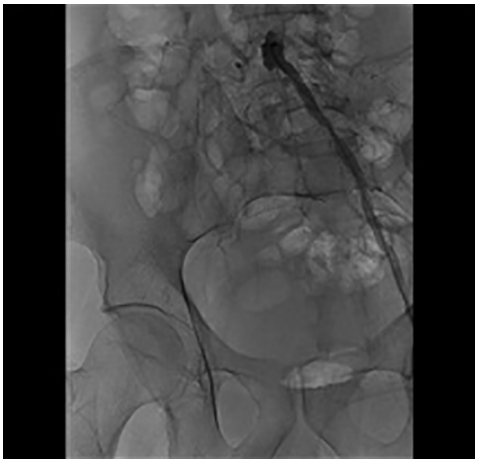


Unilateral external iliac artery occlusion.

Figure 4

Internal iliac artery proximal lesion.

Figure 5

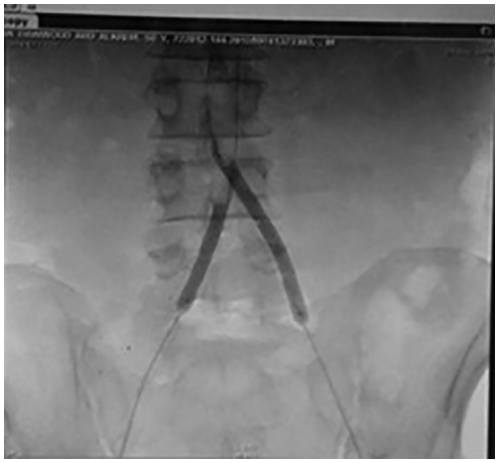


Right common iliac artery occlusion to external iliac artery.

Figure 6

Left common iliac artery occlusion to external iliac artery.

Figure 7

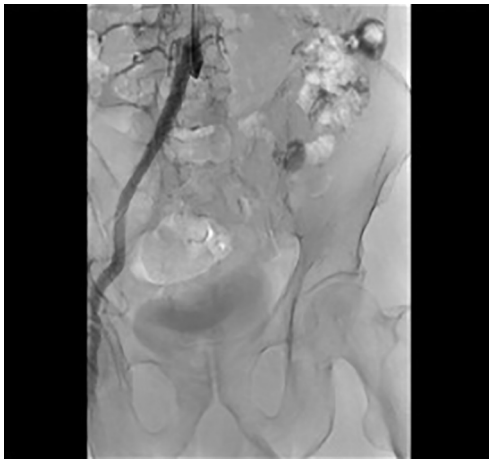


Bilateral retrograde approach.

Figure 8

Contralateral approach.

Figure 9

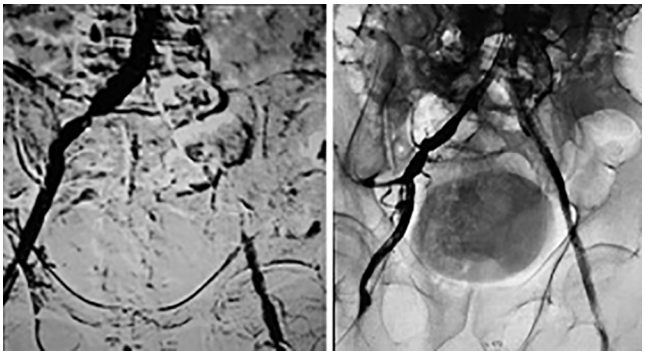


Left brachial approach.

Figure 10

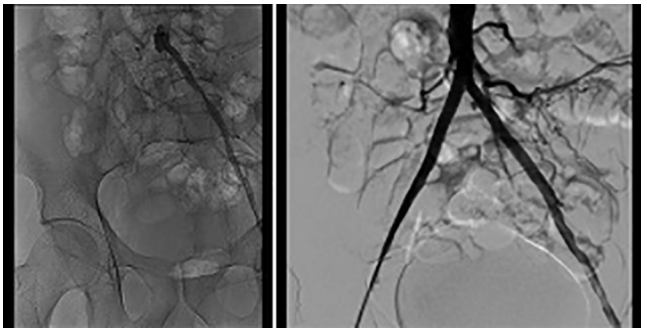
Combined approach.

Figure 11



Angioplasty for unilateral common iliac artery occlusion.

Figure 12



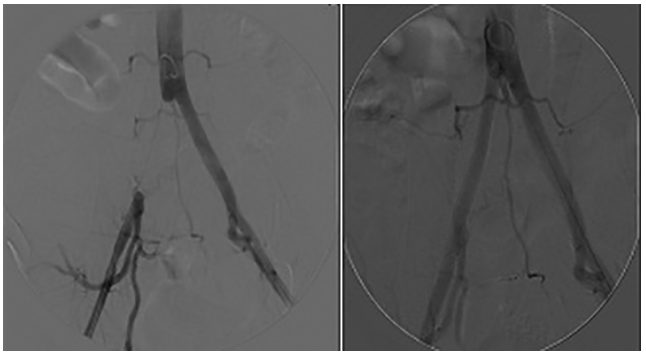
Angioplasty for bilateral iliac lesions.

Technical success (<30% stenosis on completion angiography) was 100% and was confirmed by clinical assessment of distal pulsations.

Morbidity

One patient developed brachial thrombosis after sheath removal, which was managed, and three patients developed groin hematoma that was managed conservatively.

Figure 13



Unilateral stenting for right common iliac artery occlusion.

Mortality

There was no mortality related to the intervention.

Patency rate

The primary patency rate at 12 months was 92.5%.

Discussion

Anatomical indications for endovascular therapy for iliac artery disease have been expanded even to complex lesions after TASC was revised to TASC-II [3]. However, several challenging endovascular therapy issues still remain when treating patients with complex iliac artery disease. One such issue is the technical difficulty of recanalization, particularly in getting the guidewire to cross the lesion in CTO. Another issue may be long-term patency after successful recanalization.

The age distribution in the current study reflects a higher prevalence of aortoiliac occlusive disease with increasing age, mean age 60 years (youngest 45 years and oldest 75 years of age), which is in agreement with most of the literature, being comparable with the result of De Roeck *et al*. [4] and Balzera *et al*. [5], where the mean age of the patients was between 59 and 60 years, range 45 to 75 years.

In the current study, ~90% of all patients were men, which was markedly higher than that reported in the literature of 45–68% [4,5].

Koizumi *et al*. [6] indicated that the initial success rate was inferior in TASC-II type B and D lesions compared with TASC-II type A lesions. Ozkan *et al*. [7] reported that successful recanalization was slightly less frequent (85%) in CIA occlusion without stump or with a stump length less than 1 cm, although successful recanalization was achieved in 95% of patients who had CIA occlusion with a stump length of more than 1 cm or who had EIA occlusion. Suh *et al*. [8] reported that technical success was 100% in 110 patients with asymmetric complex aortoiliac lesions and primary patency at 3 years was 89% for the single-stent group and 87% for the kissing stent group. In the present study, initial success was achieved in 100% of patients even in those with complex disease using a bidirectional approach for recanalization by guidewire and primary stent placement, with a primary patency rate of 92.5% after 1 year. Our results confirm the findings of previous studies that reported the initial outcomes of stenting for diseased and occluded iliac arteries, and indicate the efficacy of the bidirectional approach.

Thavaa *et al*. [9], reported that the brachial approach allows a direct line for recanalization and also helped to increase the torque that could be applied to the guidewire, which was confirmed in the current study as the brachial approach alone was used successfully in 15% of cases.

Previous studies such as those of Lumsden *et al*. [10], and Schneider [11], advocated prestent dilatation as it has several advantages; it makes it easier to perform the second femoral ipsilateral puncture, allows smooth passage of the stent without insult to the plaque, and provides a better view of the dimensions of the balloon and stent needed. It also assesses the dilatability of the lesion before stent placement as there may be some very hard calcific stenoses that may not be amenable to balloon angioplasty at all; so to find this out when the stent is on the balloon will lead to troubles, and this also coincides with our study.

In the current study, routine stenting was used in all cases, which is in agreement with the AbuRahma *et al*. [12] study, which reported that the initial success rate was significantly higher in primary stenting for iliac artery disease compared with balloon angioplasty with selective stenting.

However, two studies by Smith *et al*. [13] and Lawrentschuk *et al*. [14] reported that no major complications occurred in the contralateral CIA with the use of unilateral angioplasty without protection of the other side; in the current study, we used kissing stents in 14 cases with unilateral ostial lesions.

Ichihashi et al. [15] reported the complication rates of iliac stenting; they varied between 4 and 6%. According to Kavaliauskiene *et al*. [16], the complication rates of iliac stenting were reported in all the studies and varied between 2 and 24%, whereas rates of 3 to 7.9% were reported in the iliac percutaneous transluminal

angioplasty series. Early mortality after an iliac stent implantation was described by Ozkan *et al.* [7] and ranged from 0.7 to 3.6%. The complication rate in the current study similar to that of other previous studies for endovascular treatment or bypass surgery (10%). In addition, the periprocedure mortality rate was 0%; thus, our results for complex lesions appear to be acceptable compared with other studies.

Although the Dutch iliac artery stent study did not show any superiority of primary stenting for iliac artery disease as reported by Klein *et al.* [17], other studies such as Koizumi *et al.* [6] reported better primary patency in the stent group than in the balloon angioplasty alone, which is in agreement with our study.

A study carried out by Araki *et al.* [18] to evaluate the 2-year results obtained with a self-expandable stent for CTO of the iliac artery showed primary patency at 2 years to be 96.5%. Another study carried out by Ichihashi *et al.* [15] to assess endovascular treatment with primary stent placement in patients with iliac artery occlusive disease reported a primary patency rate at 1 year of 90% in TASC-II C/D lesions. This is comparable with the result of our study, where the primary patency rate was 92.5% at 1 year.

Conclusion

Endovascular treatment for iliac artery occlusive disease can be considered an alternative to open surgery for TASC-II B, C, D (CTO) disease, especially in surgically unfit patients or those who refuse surgical intervention, and kissing stenting is a safe procedure, but not cost effective.

On comparing our results with many different studies, we can suggest certain selection criteria for the endovascular treatment of CTO of the iliac artery:

General criteria for endovascular treatment

Although endovascular treatment is amenable to all patients, it is particularly beneficial for older patients with limited life expectancy and associated multiple comorbidities such as diabetes, hypertension, and cardiac compromise owing to the less invasive nature of the endovascular procedure and its high patency rate compared with surgery.

Specific criteria for the procedure

Access

The use of different accesses is a key to success in the negotiation of complex iliac lesions; the contralateral retrograde femoral artery is the preferred access for nonflush iliac occlusion and transbrachial access is the preferred access for flush iliac occlusion as it allows a direct line for recanalization with better torqueability and pushability.

Percutaneous transluminal angioplasty and stenting

Routine stenting is the preferred procedure for all iliac occlusive diseases as it is associated with higher success and patency rates compared with percutaneous transluminal angioplasty alone, and predilatation is preferred and has several advantages. A self-expandable stent is used for long, tortuous lesions owing to its flexibility, whereas a balloon-mounted stent is used for short bifurcation lesions owing to its high radial force and to enable precise deployment. The kissing stents technique is preferred in flush CIA occlusion of either unilateral or bilateral lesions; however, it is not mandatory for unilateral lesions.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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