



## Case study

# Comparison of transfemoral vs transbrachial approach for angioplastic reconstruction of chronic total aortoiliac occlusion



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## ABSTRACT

The angioplasty of chronic total aortoiliac occlusion using transfemoral is controversial. From March 2014 to December 2015, four consecutive patients (4 males; mean age  $58.2 \pm 6.8$  years; age of range 51–65 years) underwent angioplasty and stenting of TASC-D occlusion. In all the cases, we failed to cross from femoral approach. On switching over to left brachial access, angioplasty was done successfully in all. There was no procedural site complication or clinical evidence cerebral thromboembolism. Self-expandable stents were implanted in all with adequate pre and post dilation. Complete revascularisation was achieved in two cases and in other two cases, the angioplasty to the left aortoiliac carina was staged. Therefore, it is better to avoid femoral approach as initial step to cross chronic TASC 2007 type D (chronic total aortoiliac occlusion or called extensive aortoiliac disease) because of failure to cross retrogradely due to subintimal course of guide wire leading to retrograde aortic dissection.

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## 1. Introduction

Chronic infrarenal atherosclerotic aortic occlusion is a rare entity (occurrence of 0.15% in 31,216 autopsies).<sup>1</sup> The incidence of extensive chronic total occlusion of infrarenal aorta (type D)<sup>2</sup> is seen in 3–8.5% of aortoiliac occlusive disease.<sup>2,3</sup> Renal arteries may be involved up to 50% of cases.<sup>3</sup> It is a chronic disease with resting pain, erectile dysfunction, lower limb claudication and digital gangrene due to showers of thromboembolism. Unlike distal occlusion, it rarely needs amputation because of extensive collaterals in chronic cases.<sup>4</sup> TASC II guidelines recommend reconstructive surgery as the best treatment for juxtarenal aortic occlusion.<sup>2</sup> Despite, good long term patency, open surgical repair in the form of bypass grafting or endarterectomy has allowed endovascular therapy (EVT) to lead because of significant morbidity and mortality.<sup>3,5</sup> In the contrary, though EVT is associated with lower primary patency rate and need of repeated intervention, the secondary patency rate after reintervention is as good as surgery.<sup>6</sup> Therefore, at present, if angioplasty reconstruction fails to revascularise, then surgery is chosen as an alternative.<sup>7,8</sup> Antegrade recanalisation from the brachial access and retrograde angioplasty and stenting using bare stents from bilateral femoral accesses is the treatment strategy reported.<sup>9,10</sup>

Several techniques like Y-wire, kissing and gun shooting has been described for easy stent deployment. Protective measures for the renal arteries, such as guidewires, filters, or balloons, become necessary when the distance between the ostium of the lower renal artery and the aortic occlusion is  $<2$  cm.<sup>3,9</sup> The partially occluded IRA is easily crossed retrogradely through either right or left femoral approach but there is controversy regarding the retrograde vs antegrade approach to recanalise the completely occluded IRA with aortoiliac carina involvement. Covered endovascular reconstruction of aortic bifurcation (CERAB) technique has been used for extensive aortoiliac occlusive disease with balloon expandable covered stents to limit complications, such as dissection, arterial rupture, or embolisation.<sup>11,12</sup> However, there is no randomised trial or large study to demonstrate the efficacy of brachial vs femoral approach in percutaneous revascularisation of TASC 2007 type D aortoiliac disease (AOID)<sup>2</sup> except in one small retrospective observation.<sup>13</sup> The study aims at rehearsal of femoral vs brachial approach for angioplastic reconstruction of chronic TASC type D occlusion.

## 2. Case report of 4 cases

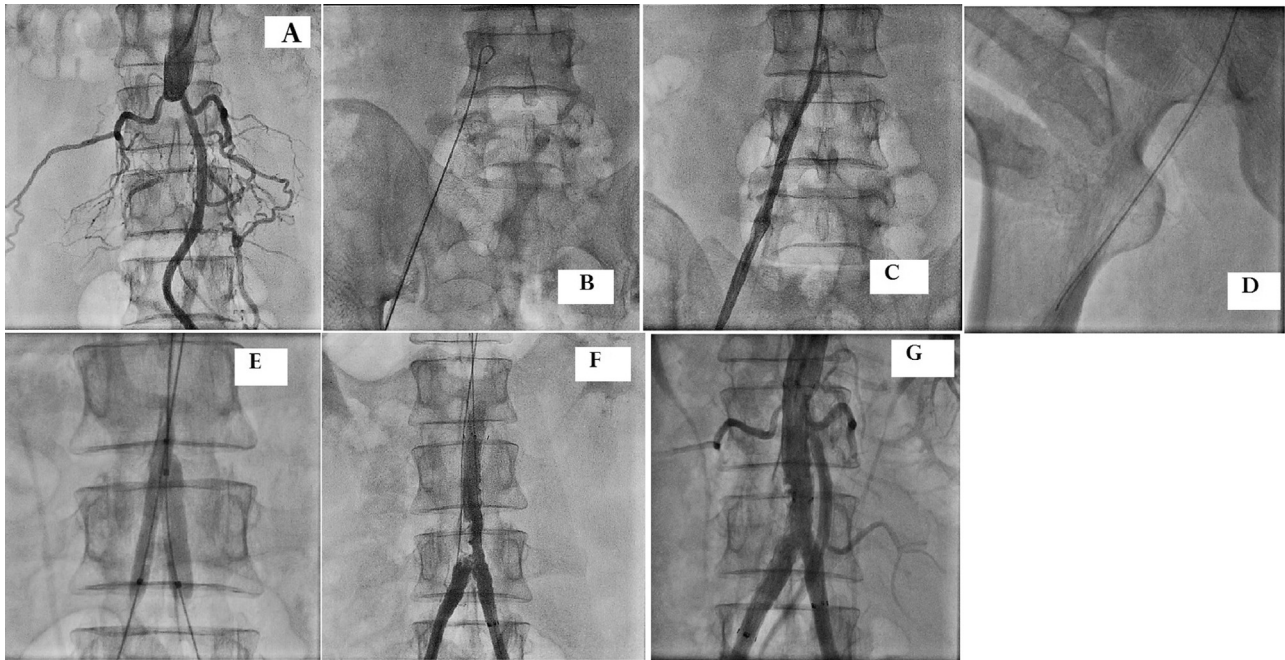
From March 2014 to September 2015, 4 consecutive patients (4 males; mean age  $58.2 \pm 6.8$  years; range 51–65 years) were submitted to angioplastic reconstruction and stenting of completely occluded (TASC 2007, type D)<sup>2</sup> infrarenal aorta after abdominal aortic

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**Table 1**

TASC 2007 classification based on abdominal aortogram from left transbrachial approach of the series of 4 cases.

No	(Sex/Age in years)	Risk factors	Clinical profile	TASC 2007
1.	M/63	Type-2 DM, HTN	Resting pain in the legs and buttock	D
2.	M/65	Type-2 DM, smoking	Toe gangrene	D
3.	M/54	Smoking	Erectile dysfunction	D
4.	M/51	Smoking, HTN	Rest pain in the buttock	D



**Fig. 1.** [Case no. 1]: The interventional approach for this is prototype: (A) – abdominal aortogram at the time intervention showing rounded infra renal end; (B) – failure cross from right transfemoral approach (TFA); (C) – easy crossing of the entire length of occluded segment using 6Fr right Judkin's guide and terumo wire from left brachial approach (LTBA) marked presence JR guide containing wire in right common iliac artery without any additional dissection in healthier area; (D) – rail roading of terumo wire from LTBA through right TFA sheath by clamping the sheath and terumo in it and pulling it out. Then a fresh sheath was inserted into right TFA and an exchange terumo was passed retrogradely above the infra renal aorta using 6Fr RDC guide catheter; (E) – Kiss Y wire technique (simultaneous wiring of both iliac artery from left brachial approach) and kissing balloon technique for angioplasty reconstruction prior to the stenting to avoid occlusion of the other iliac artery because of snow plough effect; (F) – critical stenosis of right aortoiliac (AI) carina after left AI stenting and benefit of Y wire technique to avoid losing access right iliac artery; (G) – final angioplasty and stenting result after stenting right AI and post-stenting balloon dilatation.

angiogram either using right or left transradial approach. Informed consent was obtained. The clinical profile of all the 4 cases have been mentioned in Table 1 and Figs. 1–4.

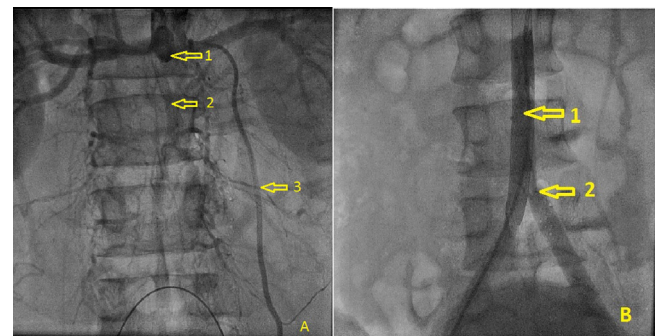
### 2.1. Technique

In the first step, the aortic occlusion was tried to be crossed retrogradely from right or left femoral access in all 4 cases. If this retrograde approach did not succeed, then left transbrachial

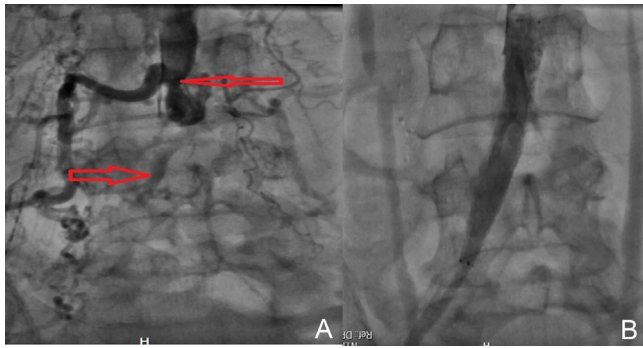
approach (antegrade) was used in the same procedure using radial artery puncture kit and 6Fr sheath. The brachial sheath was secured firmly to the floor of antecubital fossa by suture to reduce its movement related seepage of blood around sheath leading to haematoma or accidental pull out. After successful antegrade crossing of the aortic occlusion using 5 or 6Fr right Judkin's guide catheter or multipurpose catheter and strait tip exchange length



**Fig. 2.** [Case no. 2]: (A) – The rounded cephalic end of infra renal aorta just below the inferior mesenteric artery. (B) – Successful LTBA approach stenting. Left iliac artery stenting was staged.



**Fig. 3.** [Case no. 3]: (A) – The rounded cephalic end (1) of infra renal aorta just below renal arteries. The inferior mesenteric artery (2) and extensive collaterals (3) are shown. (B) – Successful stenting (1) of aortoiliac occlusion using LTBA approach stenting. Left iliac artery flow was brisk and minimal stenosis at carina (2).



**Fig. 4.** [Case no.4]: (A) – Chronic total occlusion with no conical or tapering end in cranial end of the lesion is unfavourable angioplasty; (B) – aorta and right common iliac artery were stented and left iliac artery angioplasty was staged.

terumo wire, the guide was advanced to one of the femoral artery. In some cases, a 5Fr guide catheter was pushed slowly without guide wire towards aortoiliac carina if there was no undue resistance (Dottering). The intraluminal position of guide wire or guide catheter was confirmed both in orthogonal views (anterior-posterior and lateral view) and contrast injection through side port of Y-connector. Then another exchange terumo wire was negotiated through the same Y-connector to the other femoral iliac or femoral artery to ensure the patency during balloon dilatation of the occluded aorta similar to dealing with side branch in the coronary angioplasty. This was followed serial dilatation of both the carina because Y-connector cannot negotiate two peripheral balloons (RAVEL, BARD Inc.) for kissing angioplasty. Then femoral arteries were checked for pulsations. The side with better femoral pulsation was accessed. The terumo wire from LTBA to that side was externalised if still the retrograde crossing of the lesion was difficult. The tapering tip of the exchange length terumo wire (260 cm, 0.35”) from antegrade approach was pushed into the lumen of 6Fr femoral sheath. Then the femoral sheath containing the tip of the terumo was clamped using artery forceps and pulled out with firm pressure in the groin. Immediately, a fresh 7Fr femoral sheath with dilator was railed over the externalised terumo wire into the corresponding femoral access site which secured a retrograde access with arterio-arterial (left brachial to one of the femoral artery) loop. A 6Fr guide catheter was railed over this terumo to suprarenal aorta followed retrograde guidewire to

cross the lesion. Then the ipsilateral antegrade terumo wire was pulled out. By this time, we had 2 terumo wires through infrarenal aorta: one is from one retrograde (from one of the femoral artery) and the other is from antegrade (left brachial). Kissing balloon dilatation of aortic lesion and both the aortoiliac carina were done using one peripheral balloon from LTBA and the other balloon from one of the femoral artery. This technique further simplifies the procedure for retrograde angioplasty and reduces laceration to brachial artery especially using larger size balloon like ATLAS (BARD Inc.) for post stenting dilatation. The significant residual stenosis with or without dissection was stented using trouser technique. Cross-over technique or antegrade (LTBA) approach was used to dilate and stent the iliac artery or common femoral artery with significant lesions. In case of chronic and tough occlusions, Amplatzer extra support (AES) guide wire was used to support guide or small size peripheral balloon. In all the 4 cases, we had used one femoral puncture. We have used self-expanding stents like Wall stent (BOSTON), E. LUMINEX (BARD) and EPIC (BOSTON) stenting. In case of significant residual stenosis after stenting, post dilatation was done when needed. A strict watch on cerebral embolism was maintained.

The inherent issue of haematoma with transbrachial approach and multiple puncture attempts for transfemoral access in the context of chronic total occlusion of aorta and possible dissection of aorta during angioplasty need Strict ACT monitoring. Therefore, anticoagulation with unfractionated heparin was strictly watched. We had given 5000 IU of UFH through intravenous route after securing left brachial approach and the timing and dose of 2nd dose was decided by monitoring ACT to maintain it between 250 and 300.

The left brachial sheath was removed under supervision of trained personnel with inflated blood pressure cuff over the left brachial artery when ACT was <180.

## 2.2. Result

The procedural detail and immediate outcome have been described Table 2 and Figs. 1–4. The total procedural time, fluoro time and contrast volume used in each case have been mentioned in Table 3. There was no access site complication either at the site of left brachial sheath or femoral site. We have not noticed cerebrovascular accidents in any of these cases despite using brachial approach. There was no contrast induced nephropathy in any of the cases.

**Table 2**

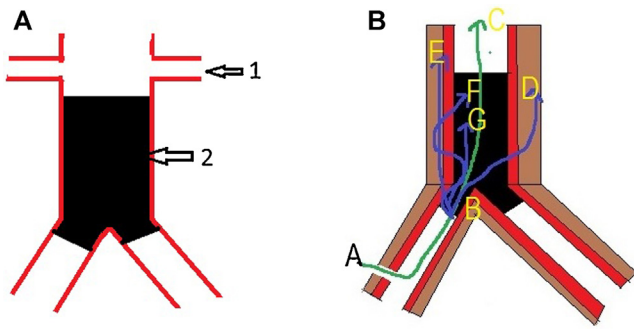
Procedural details of 4 cases of TASC 2007 D (complete aortoiliac or also called extensive aortoiliac occlusion due to atherosclerosis). Number (No); outcome (immediate result); left transbrachial approach (LTBA); right femoral approach (RFA); left aortoiliac (LT AI); right aortoiliac (RT AI); abdominal aorta (AA); one stage complete revascularisation (OSCR).

No	Collaterals	Approach	Angioplasty ± stenting	Outcome
1	Few collaterals	LTBA + RFA	LT AI: E. LUMINEX (BARD) – 14 × 60 mm RT AI: E. LUMINEX (BARD) – 10 × 40 mm	OSCR
2	Few collaterals	LTBA + RFA	RT AI: WALLSTENT (Boston Scientific), 12 × 60 mm	Left iliac angioplasty: staged
3	Few collaterals	LTBA + RFA	AA: WALSTENT (Boston Scientific) 20 × 80 mm, RT AI: EPIC (Boston Scientific), 10 × 40 mm	OSCR
4	Extensive collaterals	LTBA + RFA	RT AI: EPIC (Boston Scientific), 12 × 60 mm	Left iliac angioplasty: staged

**Table 3**

The procedural time, fluoro time and the volume of contrast used in each of the 4 cases.

Items	Case 1	Case 2	Case 3	Case 4	Mean ± S.D.
Procedural time (minutes)	110	90	100	85	96 ± 11
Flouro time (minutes)	27	19	26	21	23 ± 3.8
Volume of the contrast used (in millilitres)	170	145	160	150	156 ± 11



**Fig. 5.** (A) – The TASC 2007 type D aortoiliac occlusion [1: renal arteries and 2: occluded segment is black shaded]. (B) – The transfemoral approach to cross the chronic type D TASC 2007 aortoiliac occlusions. The point A – The entry point of sheath and guide wire; point B – The interface of healthy iliac artery lumen and occluded aortoiliac area; the points C–F show different direction of guide wire tip explaining the reason for frequent dissection or subintimal course of the tip of guide wire because it is extremely difficult or not at all possible to go through the centre of lesion (green curvilinear line) despite AP and lateral views. Black shaded area is occluded aortoiliac area, red shaded area is intima and brown shaded area is media.

### 3. Discussion

Based on conventional aortogram, the total aortoiliac occlusions (TASC 2007 category) can be diagnosed and the plan to treat by endovascular therapy (EVT) or surgical revascularisation can be made. However, the preprocedural computed tomography (CT) or MR angiography of aorta is usually the best imaging modality to assess the location of the stenosis or occlusion, the length of occlusion, the presence of a concomitant occlusive disease affecting visceral arteries, the type and extent of collateralization, the status of side branches like renal arteries and landing zones for the level of the most proximal and distal end of stent.<sup>14</sup> The later approach reduces contrast volume and radiation.<sup>15</sup> We have only used routine angiography in all 4 cases. The overall technical success rate to revascularise partially occluded aorta or aortoiliac disease using retrograde approach is 95%.<sup>16–20</sup> Once revascularised, the midterm and long term patency is encouraging.<sup>16</sup> The angioplasty of completely occluded aortoiliac junction (TASC D) using transfemoral approach is quite challenging or almost impossible as shown in small series.<sup>13</sup> A study by Millon et al.<sup>13</sup> included a total of 74 cases, out of which, 10 patients (20 arteries) had TASC D lesions. They failed to cross retrogradely using either transfemoral approach in all of the 10 cases. However, switching over (left transbrachial approach (LTBA), the technical success of antegrade crossing and angioplasty was 100% without using any special crossing devices. In our study, we failed to cross retrogradely in all of the cases (8 arteries). On switching over to LTBA, revascularisation was successfully completed in all. The various possible reasons which make retrograde crossing a big challenge in TASC D lesion are length of lesion, large diameter vessel (infinite number of directions), significant atheromatous burden with varying consistency, inappropriate hardware, wandering of wire in the large volume of atheromatous plaque and variable degree of calcification of atheromatous plaque without any conical tip in the carina [Fig. 5A and B]. However, especially from LTBA, the lesion crossing is easier because of soft conical tip similar to the distal cap of chronic total occlusion in coronary artery.<sup>21</sup> That is why, some researchers have used ultra sound probe (IVUS) technique similar to superficial femoral artery angioplasty.<sup>22</sup> In such situation, the caps in the either can be visualised with or without prior dilatation attempt to see the feasibility of retrograde approach. It is empirical to check using multiple views to know the details of profile, stent position and

residual stenosis. In comparison to other studies, we had used LTBA and only one femoral artery for the type D occlusion wherein other studies showed two femoral artery puncture have been along with brachial artery. We have not used any crossing device like Millon et al.<sup>13</sup> We had no issue with renal arteries in our study may be because of limited number of cases.

### 4. Limitation

We have not done pre-procedural CT aortogram. We have not used IVUS to visualise the caps of lesion which may have helped.

### 5. Conclusion

Antegrade recanalisation from the left brachial access followed by angioplasty and stenting of the type D infrarenal aortic occlusion can be done with comfort using left brachial approach and one of the femoral access site without any additional dissection in the either end lesions. Self-expanding stents suffices the purpose. However, this observation should be further strengthened by a larger randomised control trial.

### Conflicts of interest

The authors have none to declare.

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