

# Successful treatment of delayed aortobifemoral graft thrombosis with manual aspiration thrombectomy

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## ABSTRACT

We present a 67-year-old man who had undergone aortobifemoral synthetic graft surgery one year earlier. The patient experienced thrombosis of the graft nine months after the operation, and thrombectomy of the graft was planned. However, the patient refused to undergo repeat surgery for thrombus removal and was referred to our center for possible endovascular treatment. We treated the patient with percutaneous aspiration thrombectomy. The thrombi were chronic in nature but could be removed with minimal residue in any part of the graft by using repeated aspiration thrombectomy with 7 F guiding catheters. Underlying stenosis of both distal graft anastomoses was treated with percutaneous balloon angioplasty, and a self-expanding stent was deployed on the right distal anastomosis. A small fragment of thrombus embolized to the right popliteal artery and was removed with aspiration thrombectomy through a second antegrade puncture on the right side. We believe this is the first report of aspiration thrombectomy for an aortobifemoral graft thrombosis. The method was successful despite the chronic nature of the thrombi. Manual aspiration thrombectomy with large-bore guiding catheters can be used as an effective recanalization method for delayed aortobifemoral graft occlusion and could be regarded as a good alternative technique to surgical thrombectomy in selected patients.

**Key words:** • thrombectomy • graft occlusion, vascular • thrombosis

Symptomatic aortoiliac occlusions are regularly treated with aortofemoral bypass. Long-term patency of the bypass graft is very good. Early graft occlusions (within 30 days of surgery) occur in 1%–2% of patients in the postoperative period, usually because of technical difficulties with the bypass procedure. These problems are best treated with graft thrombectomy and correction of the underlying technical problem but can also be overcome by endovascular methods such as percutaneous mechanical thrombectomy with special devices and the infusion of thrombolytics. Late-graft occlusion occurs in 10%–15% of graft limbs, generally three to four years after the primary reconstruction. Late thrombosis is most commonly attributed to anastomotic intimal hyperplasia and/or progression of atherosclerotic disease in the outflow vessels (1). Surgical thrombectomy is the treatment of choice for acute or chronic thrombosis. Endovascular methods are quite effective at the acute stage of thrombosis and can be a good alternative to surgery. Chronic thrombosis of the bypass graft can be treated with surgery alone because endovascular methods are usually ineffective. As a novel alternative to surgical thrombectomy, we present the use of manual aspiration thrombectomy (MAT) for the successful recanalization of delayed occlusion of an aortobifemoral graft.

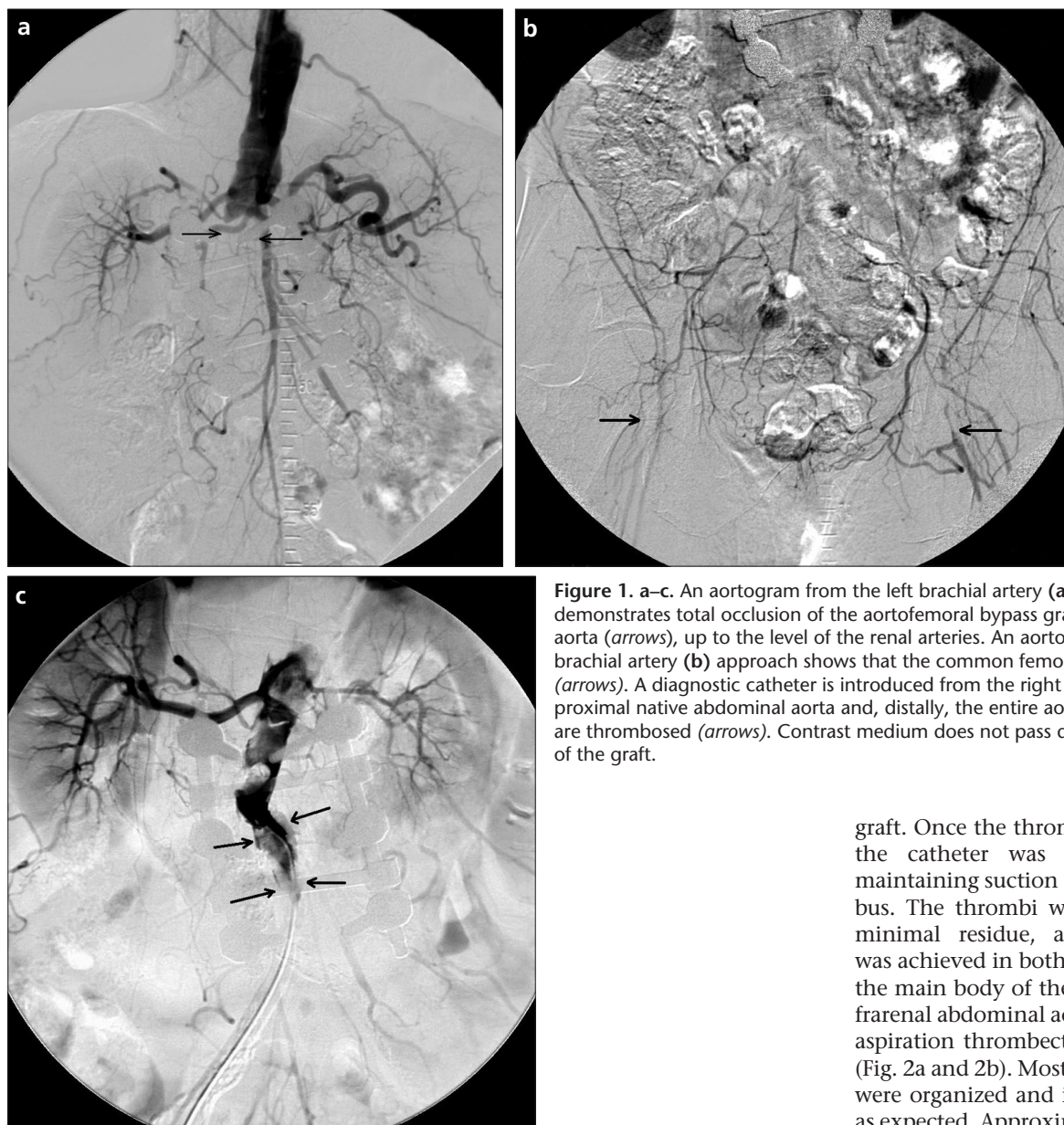
## Case report

A 67-year-old man with a history of aortobifemoral synthetic graft surgery one year prior was admitted to the hospital with a 3-month history of bilateral short-distance claudication. The first symptom appeared suddenly three months ago and deteriorated as time passed. On examination, there were no palpable femoral pulses, and both lower limbs were cold and pale. Color Doppler ultrasonography revealed occlusion of the aortobifemoral graft. Laboratory findings were within normal limits. The patient had been on aspirin since the time of the aortoiliac bypass surgery. The patient had been diagnosed with graft thrombosis three months ago but refused surgical thrombectomy. He expressed the same preference at our center and was referred for possible endovascular intervention. We used catheter-directed thrombolysis (CDT) and MAT for acute or subacute vascular thrombosis. We have had extensive experience with manual aspiration thrombectomy, which has been our primary thrombus removal method for most acute or subacute arterial and venous thromboses in our center over the past 10 years. We have used this method for dialysis fistula declotting, venous thrombosis and arterial thrombosis. We consider this method as more effective, especially in comparison to thrombolysis in subacute or early chronic thrombosis. The most common problem with MAT was intimal dissection, which would cause no problem in patients treated with a graft. Therefore, we offered MAT with or without CDT to the patient as an endovascular

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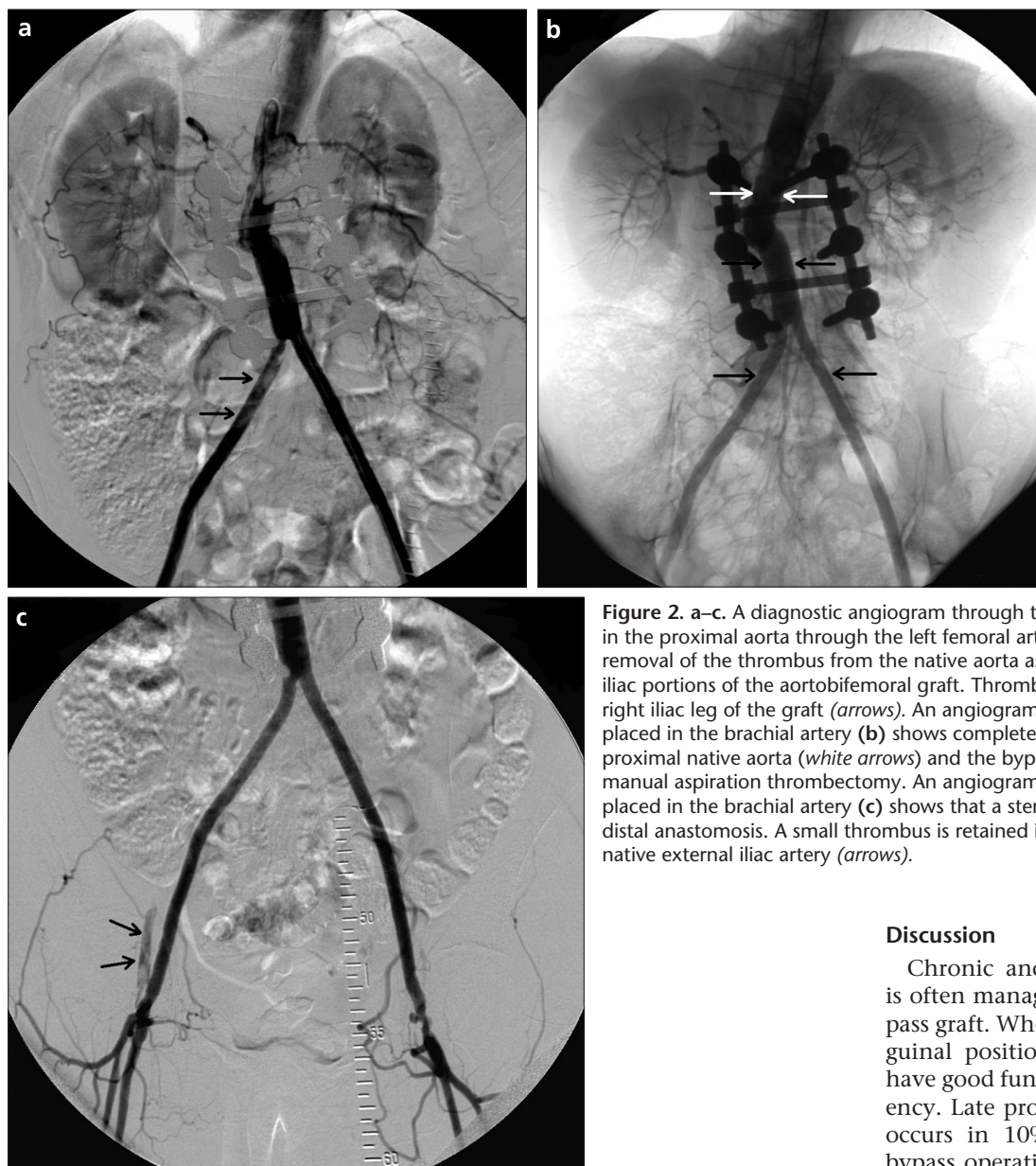
**Figure 1. a–c.** An aortogram from the left brachial artery (a) approach demonstrates total occlusion of the aortofemoral bypass graft and the native aorta (arrows), up to the level of the renal arteries. An aortogram from the left brachial artery (b) approach shows that the common femoral arteries are patent (arrows). A diagnostic catheter is introduced from the right femoral artery. The proximal native abdominal aorta and, distally, the entire aortobifemoral graft (c) are thrombosed (arrows). Contrast medium does not pass down to the iliac leg of the graft.

graft. Once the thrombus was engaged, the catheter was withdrawn while maintaining suction to hold the thrombus. The thrombi were removed with minimal residue, and recanalization was achieved in both limbs of the graft, the main body of the graft, and the infrarenal abdominal aorta using repeated aspiration thrombectomy, as described (Fig. 2a and 2b). Most thrombi aspirated were organized and in a chronic stage, as expected. Approximately 20 passes of the guiding catheter were made on each side to remove the entire thrombus. We used a 7 F multipurpose-type, angled, guiding catheter (Cordis Corporation) to clean the thrombus adherent to the wall of the graft. Initially, we did not remove any of the thrombus at the most proximal and most distal parts of the thrombus. This was left to the end of the procedure to prevent embolization of the thrombus proximally to the renal arteries and distally to the limb arteries. A confirmation angiogram showed that the underlying cause of the thrombosis was bilateral stenosis of distal graft anastomoses. Prior to MAT, there was no flow through the graft. Percutaneous balloon angioplasty was performed bilaterally with 5-mm and 6-mm balloon catheters (Ultrathin, Boston Scientific,

alternative to surgery. The patient agreed to undergo the procedure. The procedure was explained to the patient, and written informed consent was obtained.

The procedure was performed in the angiography suite. Both femoral arteries were prepared in a sterile fashion. The patient was placed under conscious sedoanalgesia with dormicum and fentanyl and was monitored. After placing a vascular sheath into the femoral artery, heparin was administered at a dose of 5000 IU. An aortogram obtained through a left brachial artery puncture revealed total occlusion of the infrarenal abdominal aorta, the main body and both limbs of the graft (Fig.

1a and 1c). Distally, the deep femoral artery with reconstructed collateral circulation showed occlusion in both the common and superficial arteries on the left and right sides; the reconstructed common femoral artery displayed diminished caliber in both the deep and superficial femoral arteries (Fig. 1b). Using ultrasonography guidance, 7 F sheaths were inserted in both limbs of the graft. A 7 F straight-tip guiding catheter (Cordis Corporation, Miami, Florida, USA) was inserted through the vascular sheath to the most distal part of the thrombus, and suction was performed manually with a 20-mL syringe. A guide wire was not used to advance the guiding catheter in the thrombosed



**Figure 2.** a–c. A diagnostic angiogram through the flush catheter placed in the proximal aorta through the left femoral artery (a) shows complete removal of the thrombus from the native aorta as well as the aortic and left iliac portions of the aortobifemoral graft. Thrombus is still present in the right iliac leg of the graft (arrows). An angiogram obtained from the catheter placed in the brachial artery (b) shows complete recanalization of the proximal native aorta (white arrows) and the bypass graft (black arrows) after manual aspiration thrombectomy. An angiogram obtained from the catheter placed in the brachial artery (c) shows that a stent was placed in the right distal anastomosis. A small thrombus is retained in the distal part of the right native external iliac artery (arrows).

## Discussion

Chronic and occlusive iliac disease is often managed by insertion of a bypass graft. When placed in the suprainguinal position, the prosthetic grafts have good function and long-term patency. Late prosthetic graft thrombosis occurs in 10%–15% of aortofemoral bypass operations within five years of surgery (2). Retrograde thrombectomy through the distal anastomosis is a simple and effective way to reestablish graft patency with low morbidity and mortality. However, when acute occlusion of the bypass grafts occurs, it requires emergency reoperation in nearly 50% of patients, and adequate preoperative preparation is rarely possible. When bypass grafts fail, the ensuing repeated surgeries have less favorable short-term and long-term outcomes (3, 4).

Percutaneous CDT is a minimally invasive method to reestablish the patency of acute graft thromboses. This method requires angiography, placement of an infusion catheter into the thrombosed graft and infusion of a thrombolytic agent such as urokinase

Ireland). Flow was established on both sides. The right distal anastomosis was reoccluded with a circulating, residual thrombus. A 6-mm self-expanding stent was inserted into the right distal anastomosis (Fig. 2c). A small fragment of the thrombus embolized to the right popliteal artery. An ultrasound-guided antegrade puncture was made into the right superficial femoral artery, and a 6 F vascular sheath was inserted. The embolized thrombus was aspirated with a 6 F guiding catheter after two passes. Complete aspiration of the aortobifemoral graft took 25 min, including 13 min of fluoroscopy. The total procedure took 135 min, with 19 min of fluoroscopy time.

Immediately after the procedure and the following day, the patient received a therapeutic dosage of heparin as an intravenous infusion with a target partial thromboplastin time of 60–90 s. The patient was discharged the day after surgery and was given acetylsalicylic acid (to be continued lifelong) and warfarin for 6 months. The patient's symptoms resolved after the intervention. Follow-up included clinical examination, ankle brachial index measurement, and Doppler ultrasonography. This follow-up was performed at 1 month, 3 months, 1 year, and 2 years and demonstrated the patency of the graft. The patient has remained asymptomatic for two years.

or tissue plasminogen activator. In situ graft thrombolysis is as effective as surgical thrombectomy and reestablishes flow in 60%–80% of cases (4). Postoperative angiography is also performed using this method of thrombolysis. In up to 80% of late prosthetic graft thrombosis cases, there is an underlying cause, such as stenosis proximal or distal to the graft or kinking or elongation of the graft (4). Treatment of the underlying cause is critical, as thrombolysis alone is not an adequate approach to therapy (1). Local (intra-thrombus) thrombolysis is usually effective in dissolving the thrombus and unmasking the underlying lesion, but has many limitations, such as failure to reestablish flow in 20%–40% of cases, which then mandates surgical thrombectomy, a complication rate of 15%–25%, distal embolization, and required infusions for 12–48 hours (5, 6). The long infusion times required for the use of a local thrombolytic agent may also cause delays in the treatment and may place the extremities of the patient in danger. More effective delivery of the local thrombolytic agent may improve patency, reduce side effects, and decrease the need for prolonged infusion, thereby decreasing the associated risk of bleeding complications. In this regard, mechanical thrombectomy devices seem attractive because they are able to promptly debulk the thrombus, reduce the duration of limb ischemia, decrease the need for prolonged thrombolytic infusion, and thus reduce the risk of bleeding complications. However, they are less effective when treating older adherent thrombi and have high rates of recurrent thrombosis and distal embolization, thus explaining the reason that adjunctive thrombolysis

is often required with these devices. Some thrombectomy devices may lead to hemolysis and hyperkalemia as a result of the mechanical disruption of red blood cells in the path of high-velocity saline jets (1). MAT is a simple, rapid, and cheap way of removing thrombi from the arterial circulation in the straight lower limb arteries. This method could be attempted prior to surgical embolectomy as an alternative to thrombolytic therapy (7–9). However, the technique is limited because of the risk of dissection in native arteries, especially in the hands of inexperienced physicians (8). The risk of dissection could possibly be ignored for grafts.

Surgical treatment of the underlying cause of thrombosis is associated with significant perioperative morbidity and limited patency compared with primary aortoiliacofemoral reconstruction. The increased morbidity is frequently related to a dissection in a previously operated field, which leads to the increased occurrence of bleeding and wound infections (3). The use of angioplasty and stenting as an adjunctive therapy to graft thrombosis has been limited to treating anastomotic disease (10).

We used a combination of thrombus removal with aspiration thrombectomy and angioplasty and stenting to treat a delayed aortobifemoral graft thrombosis. The procedure was successful without major complications. The patient was asymptomatic and had patent grafts after 24 months of follow-up. Aspiration thrombectomy seems to be a safe and effective method to treat delayed aortobifemoral graft thrombosis. This method provides an alternative to surgical thrombectomy, especially for patients who are not good candidates for surgery.

## Conflict of interest disclosure

The authors declared no conflicts of interest.

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