

CASE REPORT

Popliteal artery thrombosis following total knee arthroplasty managed successfully with percutaneous intervention

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SUMMARY

Acute popliteal artery thrombosis is a rare complication following total knee arthroplasty (TKA), with sequelae including critical limb ischaemia and amputation. We report the case of a 54-year-old woman who developed acute popliteal artery thrombosis following TKA, presenting 2 weeks after the initial symptoms. While such cases have been traditionally managed with surgical thrombectomy or bypass grafting, percutaneous aspiration thrombectomy is an emerging alternative management strategy in the early postoperative period. However, in patients in whom intervention is delayed, the efficacy of percutaneous aspiration thrombectomy is not known. Our patient had complete resolution of thrombus following percutaneous thrombus aspiration, angioplasty and tirofiban administration. Prompt diagnosis and early percutaneous intervention may avert critical limb ischaemia in patients presenting with popliteal artery thrombosis following TKA.

BACKGROUND

Acute arterial complications following total knee arthroplasty (TKA) are exceedingly rare, with incidence ranging from 0.03% to 0.17%.¹ These arterial complications include vessel transection, bleeding, pseudoaneurysms, limb ischaemia and popliteal artery thrombosis (PAT). PAT following TKA can result in sequelae including critical limb ischaemia and amputation. Such cases have been traditionally managed with surgical thrombectomy. Percutaneous thrombus aspiration and angioplasty is an emerging alternative management strategy in patients diagnosed in the early postoperative period. However, late revascularisation may lead to a need for fasciotomy and such patients may develop foot drop.¹ In patients with acute arterial occlusion of the lower extremities diagnosed late or referred late for interventions, the efficacy of percutaneous aspiration thrombectomy is not known.

CASE PRESENTATION

A 54-year-old woman, a known hypertensive, underwent right TKA under epidural anaesthesia in addition to intravenous propofol infusion. Tourniquet time was 52 min. Immediately after surgery the right leg was noted to be cold. Peripheral vascular examination revealed absent right dorsalis pedis and posterior tibial artery pulsations, confirmed with a handheld Doppler ultrasound. Capillary filling was absent in the right toes and only partially improved with warming. There were no sensory or motor

deficits. Findings were consistent with Rutherford grade IIA acute limb ischaemia (ALI).

An immediate colour Doppler study of the right lower limb revealed normal triphasic flow in the common femoral and superficial femoral arteries, in addition to thrombus in the right popliteal artery with monophasic low velocity flow in the right posterior tibial, anterior tibial and peroneal arteries. The patient developed right leg pain once the epidural analgesia was discontinued. Her knee was kept at a 45° flexed position in a brace. She was administered bemparin sodium 5000 IU subcutaneous daily for 5 days along with aspirin 150 mg once daily and cilostazol 100 mg twice daily, after which she became completely asymptomatic. The right leg distal pulses were confirmed to have returned with a handheld Doppler ultrasound; however, the ankle-brachial pressure index was not documented. A repeat right lower limb arterial colour Doppler, performed on the sixth postoperative day, revealed monophasic low-velocity flow in the infrapopliteal vessels. Since the patient was completely asymptomatic, a peripheral angiogram was deferred. The right knee was extended in stages to full range of movement. Subsequently, the patient was discharged from the orthopaedic ward on aspirin 150 mg once daily and cilostazol 100 mg twice daily.

The patient returned on the 15th postoperative day with symptoms of ischaemic right leg rest pain aggravated by walking, of 5 days duration. At this point, she was referred for a peripheral angiogram.

INVESTIGATIONS

A selective right lower limb peripheral angiogram revealed normal flow in the right common femoral and superficial femoral arteries. The right popliteal artery was totally occluded with thrombus at the knee joint level (figure 1A). The right anterior tibial artery and the tibioperoneal arteries were seen filling from anterograde collaterals, with sluggish flow.

TREATMENT

Therapeutic options including open surgical revascularisation and catheter-based thrombectomy were discussed with the patient. After informed patient consent, percutaneous aspiration thrombectomy and/or angioplasty was chosen as the initial revascularisation strategy. From a left femoral artery access, the right popliteal artery lesion was crossed using a 0.035" hydrophilic guide wire taken across a Judkins Right 6F diagnostic catheter. The



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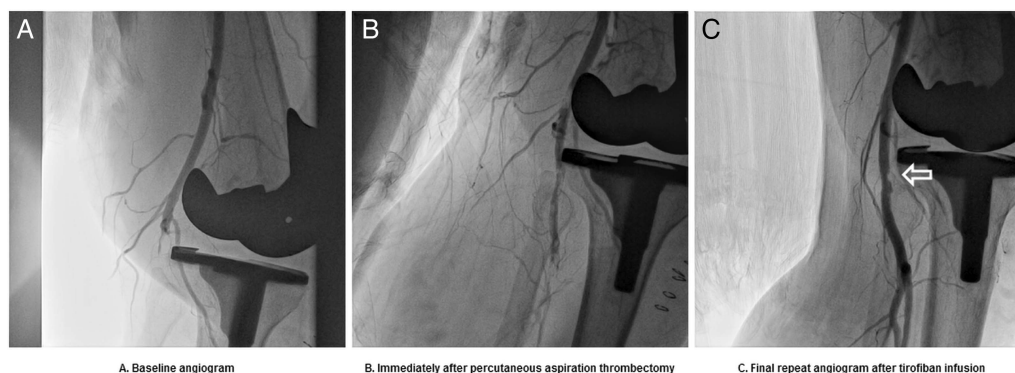


Figure 1 (A) Popliteal artery totally occluded with thrombus. (B) Angiogram immediately after percutaneous aspiration thrombectomy and balloon angioplasty, showing a partially recanalised popliteal artery with residual thrombus. (C) Repeat peripheral angiogram after tirofiban infusion showing no residual thrombus with good distal runoff. Note the site of popliteal artery intimal disruption (arrow) at the level of the replaced knee joint.

hydrophilic wire was exchanged for a 300 cm, 0.035" stiff guide wire. A 7F Judkins Right guide catheter was inserted. Multiple runs of thrombus aspiration were performed by sequentially advancing and retracting the guide catheter, over the wire, across the thrombus containing popliteal artery segment, while maintaining continuous suction using a 20 mL Luer-lock syringe. There was residual thrombus, hence the popliteal artery lesion was dilated with a non-compliant 5 mm×40 mm balloon at four atmospheres. Heparin 80 U/kg intravenous was administered during the procedure. In view of residual thrombus (figure 1B), the patient was maintained on tirofiban infusion 0.15 µg/kg/min for 24 h. Repeat angiogram 48 h postangioplasty showed no residual thrombus in the right popliteal artery and there was good flow in the arteries below the knee (figure 1C).

The patient was discharged in stable condition. Oral anticoagulation with dabigatran 150 mg twice daily was continued for 6 months postprocedure.

OUTCOME AND FOLLOW-UP

At the end of 6 months of follow-up, the right ankle-brachial index was 1.01 and arterial Doppler of the right lower limb showed normal flow dynamics. There were no residual sequelae such as foot drop or vascular claudication at 8 months of follow-up.

DISCUSSION

The popliteal artery may be injured directly or indirectly during knee arthroplasty. Direct surgical injury to the popliteal artery during TKA results in haemorrhage, pseudoaneurysm and/or arteriovenous fistula. Subsequently, PAT may develop due to thrombosis of a popliteal artery aneurysm, or from compression by a popliteal artery pseudoaneurysm. More frequently, PAT results from indirect vascular injury resulting in intimal tear or atheromatous plaque disruption. Indirect vascular injury usually results from excessive joint manipulation or tourniquet application. Hyperextension of the knee joint during preparation of the patella leads to tensing and kinking of the popliteal artery, thereby predisposing to PAT in an atherosclerotic vessel. A recent case series reported two cases of PAT among 3913 elective total knee replacements, with the first patient having acute PAT on the second postoperative day and the latter having subacute PAT at 6 weeks.² Both patients were managed surgically with venous bypass grafts. Reported sequelae of acute PAT include foot drop and clawing of the toes.²

This case report illustrates a patient who developed Rutherford grade IIA ALI following TKA. The limb viability was

marginally threatened, with no associated sensory or motor deficits. In such patients current guidelines recommend immediate initiation of heparin followed by emergent imaging to decide on feasibility of catheter-directed thrombolysis and/or thrombectomy.³ Surgical open revascularisation is recommended as a primary strategy when catheter-directed therapy is unfeasible in patients with limb ischaemia presenting beyond 2 weeks and in ALI with motor and severe sensory deficits.³ Conventional angiography is the investigation of choice in ALI,³ due to the possibility of concurrently diagnosing and treating the arterial occlusion. Partial arterial recanalisation with heparin administration may have led to initial improvement in symptoms. However, once heparin was discontinued, thrombosis and reocclusion may have caused recurrence of symptoms. Delay in vascular surgery/interventional radiology referral and failure to perform angiography promptly in this patient with ALI contributed to the delay in optimal revascularisation. When the patient presented with recurrent symptoms and subacute PAT, absence of motor/sensory deficits justified the choice of catheter-based thrombectomy as the initial revascularisation strategy.

In patients with PAT detected early after TKA, percutaneous angioplasty and thrombus aspiration has been shown to be efficacious in preventing ischaemic complications.⁴ However, the efficacy of percutaneous interventions in patients referred late after PAT following TKA is not established. Major surgery performed within 3 weeks precluded the use of thrombolytic agents in our case. Observational data suggest that surgical embolectomy may reduce amputations in patients presenting late after acute arterial occlusion of the lower extremities.⁵ Our case report illustrates the efficacy of percutaneous aspiration thrombectomy and tirofiban administration in patients presenting late after PAT following TKA. Factors that may contribute to the success of delayed recanalisation in such patients include: presence of relatively preserved arterial intima, minimal adherence of thrombus to the arterial intima, patent distal arterial system free of occlusive disease, minimal thrombus burden in the distal arterial bed, presence of well-developed collaterals across the thrombosed segment, and pre-procedure treatment with antiplatelet drugs and anticoagulants.⁶ Some of these factors may have contributed to the success of revascularisation in our patient.

Many dedicated mechanical thrombectomy devices are available, including those employing rheolytic thrombectomy (eg, AngioJet ultra thrombectomy system, Oasis thrombectomy system), rotational thrombectomy with aspiration (eg, Rotarex and Aspirex thrombectomy systems) and rotational recirculation (eg, Amplatzer, Arrow-Trerotola systems). While these

thrombectomy systems are effective, in selected cases mechanical percutaneous aspiration thrombectomy using large bore over the wire catheters achieve significant thrombus burden reduction. While complete thrombus removal is achieved with percutaneous aspiration thrombectomy in up to 90% of acute lower extremity thrombotic occlusions, the success rate falls to 36% in early chronic cases.⁷ Limb salvage rates with percutaneous aspiration thrombectomy is 88% at 1 year.⁸ Percutaneous aspiration thrombectomy is a safe, simple and inexpensive way of removing thrombus from relatively straight segments of lower limb arteries. Complications of this method include dissection and vessel perforation. However, use of balloon catheters for mechanical thrombus fragmentation carries the risk of peripheral thromboembolism and should be considered with caution.

Glycoprotein IIb/IIIa receptor antagonists such as tirofiban have been shown to reduce the risk of death and/or myocardial infarction when used as an adjunctive therapy for percutaneous coronary interventions in acute coronary syndromes.⁹ These agents have been used in peripheral arterial occlusive disease and arterial thrombosis as well.^{10 11} When used as an adjunct to thrombolysis for peripheral artery thrombosis, some studies have shown that these agents may reduce distal thromboembolism without an increase in haemorrhagic complications.¹² However, the use of glycoprotein IIb/IIIa antagonists as an adjunct to percutaneous aspiration thrombectomy is not well established. In our case, tirofiban infusion resulted in complete resolution of the residual thrombus without distal embolisation.

Preventative measures including meticulous surgical technique remains the cornerstone of avoiding this complication following TKA. While tourniquet use during TKA reduces intraoperative

blood loss, in trials there is a trend for greater complications in the tourniquet group, including venous thromboembolism.¹³ These studies were not adequately powered to detect increase in PAT with the use of a tourniquet during TKA.

In conclusion, PAT is a rare complication following total knee replacement, and needs prompt diagnosis and management in order to avoid sequelae such as foot drop, critical limb ischaemia and amputation. Percutaneous aspiration thrombectomy with adjunct tirofiban use is a simple and effective management option in patients presenting with subacute PAT following total knee replacement.

Contributors AM was involved in the design of case report, acquisition of data, interpretation of data and drafting the manuscript. BJA was involved in acquisition of data and drafting the manuscript. LF was involved in the acquisition of data. EP was involved in drafting the manuscript and gave approval for the final version.

Competing interests None.

Patient consent Obtained.

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Learning points

- Popliteal artery thrombosis is a rare vascular complication following total knee arthroplasty.
- Prompt use of angiography in patients with acute limb ischaemia following total knee arthroplasty will help in appropriate risk stratification and in avoiding delays in achieving optimal revascularisation.
- Percutaneous aspiration thrombectomy is a simple and effective management option in patients presenting with subacute popliteal artery thrombosis following total knee arthroplasty.
- In cases of subacute popliteal artery thrombosis following total knee arthroplasty, glycoprotein IIb/IIIa inhibitors are useful as adjunctive therapy.

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