

Open repair of intraoperative popliteal artery injury during total knee arthroplasty in a patient with severe hemophilia A

A case report and literature review

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Abstract

Rationale: Arterial injuries during total knee arthroplasty (TKA) though rare may occur. Hemophilia may further challenge the management of such injury.

Patient concerns: A 48-year-old male patient with severe hemophilia type A and stiff knee arthropathy underwent bilateral TKAs. Left popliteal artery injury was detected at the end of the left TKA.

Diagnoses: Urgent angiography confirmed the diagnosis of the left popliteal artery transection.

Interventions: With clotting factor VIII replacement treatment, open repair was performed by end-to-end vascular bypass with the autograft of the large saphenous vein. No anticoagulant and antiplatelet treatment was administered postoperatively. Doses of the factor VIII were decreased step by step postoperatively.

Outcomes: Left lower limb was reperfused 4 hours after the onset of the ischemia. The patient recovered uneventfully. Postoperative Doppler examination showed the left popliteal artery remained patent.

Lessons: The hemophilia may endanger the patients to higher risk of arterial injury during TKA because of the severe deformity and fibrosis around knee joint. For the hemophilia patients, with rational coagulation factor replacement therapy, open repair with autograft was an effective revascularization procedure for artery injury.

Abbreviations: OR = open repair, PWH = patient with hemophilia, TKA = total knee arthroplasty.

Keywords: artery injury, hemophilia, open repair, total knee arthroplasty, vascular bypass

1. Introduction

Arterial injury during total knee arthroplasty (TKA) procedure is a rare but serious complication. The reported incidence is between 0.03% and 0.51%.^[1–3] Because of extensive fibrosis, bone deformity, and poor-quality of bone for hemophilia, the TKA procedure for hemophilia is a technically challenging, which can also endanger the intraoperative arterial injury.^[4,5] The arterial injury during TKA for patients with hemophilia (PWH) is also difficult to be treated because of the inadequate coagulation.

In literature, the artery injury during TKA for hemophilia is rare. In this article, we present a case of arterial injury during TKA for hemophilia A. The case highlighted this rare but potential injury, to encourage surgeons to be detailed in perioperative evaluation and to make a justified management strategy for such cases.

2. Case report

The study was approved by institutional review board of Peking Union Medical College Hospital. A 48-year-old male was admitted to the orthopedic department for the hemophilic arthropathy of bilateral knees for 20 years. The patient consent to the publication has been obtained. He complained of pain in both knees. He was diagnosed as severe type A hemophilia 45 years ago. The body weight on admission was 60 kg. Physical examination revealed bilateral stiff knees with restricted range of motion (ROM). The skin and soft tissue around both knee joints were tight and inelastic after palpation. There was also symmetrical and predominant pulse of both dorsalis pedis artery after palpation. Preoperative serum activity of factor VIII was 0.6% and the factor VIII antibody was negative. Ultrasound demonstrated no obvious artery stenosis of bilateral lower limb. Preoperative X-ray of bilateral knees showed the severe hemophilic knee arthropathy.

With sufficient clotting factor VIII replacement therapy (3000 IU factor VIII 30 minutes before operation), the patient underwent simultaneously bilateral TKA under general anesthesia. The tourniquet was set to be 250 mmHg. The surgery was completed through a standard midline incision and a median parapatellar arthrotomy.

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Figure 1. Angiogram showing 8 cm long acute occlusion of left popliteal artery around level of knee joint line.

Right TKA was firstly performed uneventfully. As for the procedure of left knee, the inelastic fibrous tissue around femur side was total released to benefit the exposure and to increase the flexibility. The proximal tibia cut was performed with regular 7° posterior slop. After preparation of the tibia plateau with oscillating saw and removal of tibia bone block with electrocautery, there was slight visible bleeding at the posterior capsule, and gently electrocautery was used. The tourniquet was used for a total of 88 minutes after wound closure and dressing cover. An instant vascular evaluation revealed there was no palpable pulse in the left posterior tibial, and dorsalis pedis arteries, and the left extremity itself was felt to be slightly cold.

With the patient still under general anesthesia, urgent angiography was performed after the patient was transferred to the angiography suite in the same floor. Angiography revealed no obvious extravasation of the left popliteal artery and an 8 cm long occlusion of left popliteal artery around the level of distal femoral condyle (P2 segment). There was 1 vessel runoff to the foot via collateral (Fig. 1, and see supplement for video of angiography; <http://links.lww.com/MD/B970>).

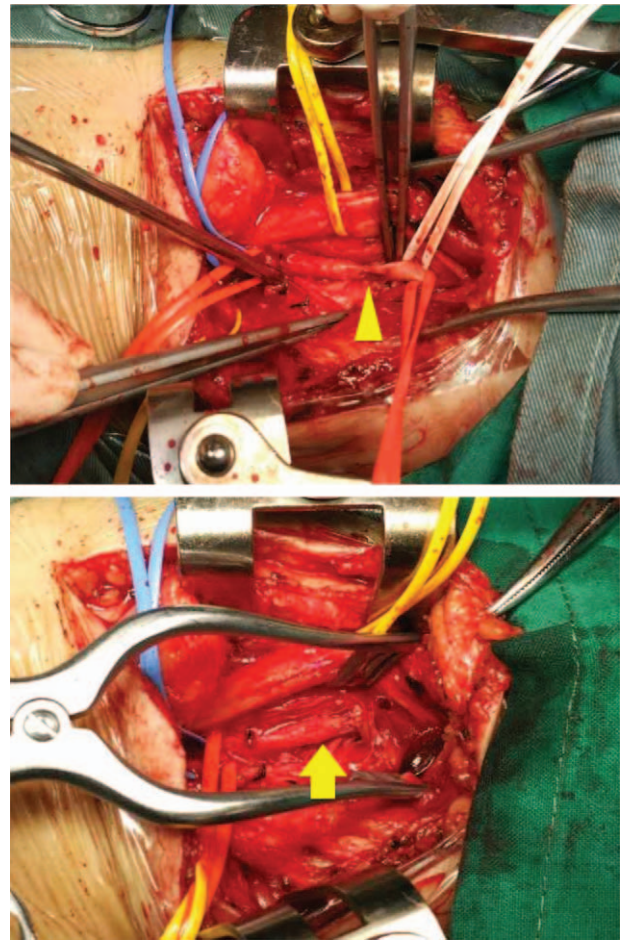


Figure 2. Picture during open repair of the popliteal artery injury. Up, showing the occlusion after laceration and contracture and of the injured artery, arrowhead showing the contracture of the artery. Below, showing the picture after vascular bypass with the autograft of the large saphenous vein, arrow showing the site of the autograft.

Open repair (OR) for popliteal artery injury was performed with the patient on prone position by vascular surgeon, and an “S” incision posterior to the knee was used. The average diameter of popliteal artery was 3mm because of the fibrosis of perivascular tissue. The occlusion was attributed to a full-thickness popliteal artery laceration with contracture and in situ thrombosis (Fig. 2). Three thousand units of heparin were administered before artery clamping was performed. After anastomosis was completed, 30mg protamin sulfate was given to reverse heparinization. The laceration segment of the popliteal artery was resected, the thrombosis was removed and the intimal was carefully inspected. The defect of the popliteal artery was repaired by end-to-end vascular bypass with the autograft of the large saphenous vein harvested from the same side (Fig. 2) and the left lower limb was reperfused 4 hours after the onset of the ischemia. After carefully hemostasis, the wound was closed. The pulse of left dorsalis pedis artery can be palpated after awake from anesthesia.

We referred the guidelines of world federation of hemophilia to assign the strategy of clotting factor replacement therapy.^[6] The level of clotting factor, inhibitor, and activated partial thromboplastin time (APTT) were regularly examined. No anticoagulation or antiplatelet therapy was prescribed during the

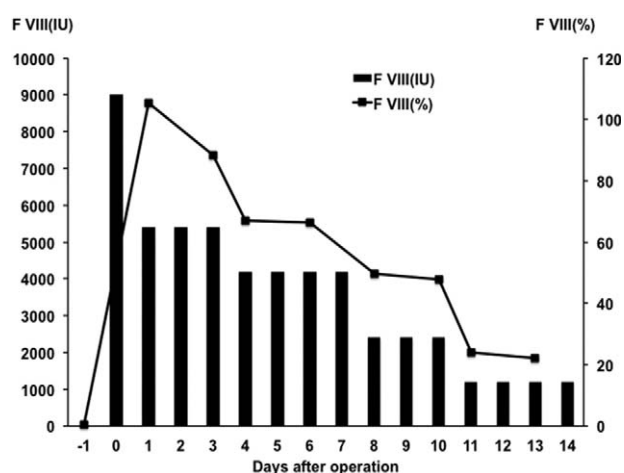


Figure 3. Dose of administered factor VIII and plasma level of factor VIII during perioperative course. Dose represented the total consumption of the factor VIII during each day. Factor VIII was administered by bolus every 12 hours.

postoperative treatment. Another bolus of 3000IU of factor VIII (50IU/kg) was given 30 minutes before artery repair. A bolus of 3000IU of factor VIII was administered every 12 hours within 24 hours after operation and the doses of the factor VIII were decreased step by step (Fig. 3).

The patient began the knee exercise at the 2nd postoperative day and recovered uneventfully. No bleeding episodes were observed during the hospitalization. The ROM of both knees were 0° for extension and 80° for flexion at postoperative 2 weeks. Postoperative Doppler examination of the left lower limb showed the popliteal artery remained patent. At 6 months follow-up, he was mobilizing well without obvious left calf claudication and duplex demonstrated the patency of the left popliteal artery and no thrombosis around the repair site of the left popliteal artery.

3. Discussion

Arterial complications after TKA involve the thrombosis, atherosclerotic occlusion, direct injury by surgical procedure, or indirect injury by tourniquet use or intraoperative manipulation around artery.^[7] In our case of knee hemophilic arthropathy, the soft tissue around popliteal region became fibrosis change and inelastic because of recurrent bleeding, which made the popliteal artery close to the tibia plateau.^[1,5] The reduced mobility of the popliteal artery in the patients also increased the risk of artery injury during the procedure of bone cutting with oscillating saw and soft tissue release around the knee joint. The use of electrocautery may cause the further injury to the vessels by direct injury or indirect heat injury. We hypothesized all the above points may be the possible reason of vascular injury in our case. Regular check the pulse of dorsalis pedis arteries after TKA was important to discover the artery injury.

This particular case presented several challenges such as transection injury without free extravasation and the coagulation disorder of hemophilia. There were limited cases about the surgical intervention for peripheral arterial disease and injury in the setting of hemophilia.^[8,9] Gerhardt et al^[9] reported a 61-year-old man with hemophilia A who underwent femoral-popliteal bypass using an autogenous saphenous vein graft. The patient received intermittent boluses of plasma-derived factor VIII. Other details of the procedure are lacking.

There is no consensus concerning anticoagulant therapy in PWH who underwent surgical treatment.^[10] It was recommended that hemophilia A may block the formation of pathologic arterial thrombus because of the inherited coagulant disorder.^[11] According to case reports in literature, the postoperative anticoagulation was not regularly used for open vascular surgery in PWH.^[8,11,12] Furthermore, if anticoagulants or antiplatelet therapy has to be used in PWH, they should only be used after factor replacement therapy and the levels should not fall below 5% to 15%.^[13]

Although endovascular repair (ER) with percutaneous stent placement has several advantages for popliteal artery laceration and occlusion repair during TKA, such as minimal invasive, the ability to be performed under local anesthesia.^[14] However, the benefits of this approach in PWH are uncertain, especially in view of the need for ongoing antiplatelet or antithrombotic therapy.^[15] Furthermore, the injury in our case was located at the interarticular level and it was difficult to cross the endovascularly after angiography.^[16] Given these points and the less requirement for the postoperative anticoagulation or antiplatelet regimen, OR with autogenous graft would be more effective for the exploration and artery repair.

There is no exact data on the factor VIII replacement treatment for the PWH undergoing peripheral artery procedure. According to the guidelines of World Federation of Haemophilia and the guidelines of the European Society of Cardiology (ESC) for acute coronary syndromes in PWH.^[6,13] Maintaining factor levels in the range of 80% to 100% through the early postoperative period, at least to postoperative day 3, is optimal. And the doses of the factor should be decreased step by step. Furthermore, it is very important to monitor factor activity and its inhibitor to avoid not only bleeding complications but also thrombotic complications.

4. Conclusion

Arterial injuries during TKA procedure though rare may occur. The hemophilia may endanger the patients to higher risk of arterial injury because of the severe deformity and fibrosis around knee joint. For the hemophilia patients, OR with autograft was an effective revascularization procedure. Appropriate coagulation factor replacement therapy is mandatory to achieve better results in vascular surgery for hemophilia.

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