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Acute popliteal arter occlusion after total knee replacement: A rare complication

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Abstract

Total knee replacement is the gold standard for the surgical treatment of end-stage symptomatic knee osteoarthritis that has not responded to conservative treatment. However, as with any surgery, there are potential dangers and complications. Among these, vascular complications are very rare, but when encountered, they can have devastating consequences. In this case report, we describe a patient who developed popliteal artery occlusion and thrombus after total knee arthroplasty. Despite early postoperative diagnosis and thrombectomy treatment, our patient underwent below-knee amputation and died due to pulmonary embolism and cardiac arrest during follow-up.

Keywords: Popliteal artery, thrombosis, total knee arthroplasty

Introduction

The worldwide increase in the elderly population is accompanied by a rising incidence of knee arthrosis and a growing demand for treatment ^[1]. Total knee replacement (TKR) is widely recognized as a highly effective treatment for advanced joint destruction, particularly in cases of primary or secondary osteoarthritis. This procedure offers significant benefits, including substantial pain relief, correction of deformities, improved limb function, and an overall enhancement of the patient's quality of life ^[2]. Despite being an effective and increasingly preferred procedure for end-stage knee arthrosis, total knee replacement also carries several local and systemic complications. These may include prosthesis infection, aseptic loosening, polyethylene abrasion, wound site problems, periprosthetic fractures, joint stiffness, extensor mechanism damage, excessive blood loss, and thromboembolism ^[3, 4]. Despite their low incidence (0.03%), vascular complications associated with total knee arthroplasty are challenging to anticipate and typically have a poor prognosis ^[5, 6]. Here, we report a case of acute arterial occlusion after TKA. In the case presented in this report, thrombotic occlusion occurred after knee arthroplasty despite adequate prophylaxis.

Case report

An 80-year-old male patient presented to the outpatient clinic with a 10-year history of left knee pain. He reported that the pain had recently become very severe, making it difficult for him to walk. During the physical examination, he experienced intense pain when his joint's range of motion was assessed; however, no flexion, extension contracture, varus, or valgus laxity was observed. Anteroposterior and lateral x-ray images were taken and revealed stage 4 gonarthrosis, with no significant varus or valgus deformity present.

The patient was informed about total knee arthroplasty and preoperative preparation was initiated. The patient's medical history included prostate cancer, pneumonia, and hypertension, and he did not describe any additional vascular disease. His preoperative medications were 12.5 mg carvedilol for hypertension and 1000 mg calcium dobesilate for edema. Preoperative blood hemogram and coagulation values were normal (PT: 10.8 APTT: 22.6 INR: 0.98PLT: 133000/ml and HGB: 13.9 g/dl). Preoperatively, cardiology evaluated the patient as low-intermediate risk, pulmonology moderately increased risk, and anesthesiology considered the patient as ASA 3.

He underwent TKA under spinal anesthesia. Antibiotic prophylaxis of 1000 mg of cefazolin and then four ampoules of TXA (tranexamic acid) in 100 ml saline was administered intravenously (IV) 30 min before surgical incision. TKA was initiated with a tourniquet inflated to a pressure of 300 mmHg, and the anterior parapatellar approach was used. The total blood loss for the procedure was 350 mL, measured by weighing the gauze plus the suction drain amount without the irrigating solution. The tourniquet time lasted for 38

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minutes. Intraoperative bleeding control was performed no massive bleeding was observed and no intraoperative complications were noted during the surgical procedure. Compressive dressing was applied on the lower limb after the operation. After surgery, the patient was transferred to the recovery room. Preoperative and postoperative knee X-rays of the patient are shown in Figure 1.



Fig 1: X-ray sequence of a knee joint before and after total knee replacement, showing implant alignment and joint transformation

The patient's motor and sensory functions were not checked in the recovery room due to spinal anesthesia. Still, the patient's lower extremity was cold, and dorsalis pedis and tibialis posterior pulses were absent. The patient was urgently consulted to the cardiovascular surgery department, was evaluated by the cardiovascular surgeon and checked with Doppler, and underwent urgent angio CT (computed tomography) examination upon the absence of pulses. The angio CT obtained at the 1st postoperative hour showed no popliteal artery damage but no flow from the popliteal artery level to distally. (Figure 2) The patient was considered to have an occlusion due to arterial thrombus and was urgently operated by cardiovascular surgery.



Fig 2: CT angiography image displaying lower limb vasculature, highlighting arterial flow and vascular structures in the legs

In the cardiovascular surgery, the femoral artery was explored from the groin area and thrombectomy was performed by entering the femoral artery with a Fogarty embolectomy catheter. The patient was followed up postoperatively in the cardiovascular surgery intensive care unit and ilioprost infusion was started at 1ng/kg/min. In the patient's follow-up, angio CT was planned again due to the persistence of coldness in the distal cruris of the left lower

extremity. The patient was intubated after the patient's medical condition deteriorated and saturations decreased, and the patient was considered to have pulmonary thromboembolism by the pulmonologist. As the coldness of the foot persisted and bruising started, angio CT was performed again on the 2nd postoperative day and no distal flow was observed. (Figure 3) The patient was re-evaluated by cardiovascular surgery and an anesthesiologist, the patient could not be operated on again due to his medical condition and was continued to be followed up with ilioprost infusion.



Fig 3: CT angiography image showing lower limb arteries, providing detailed visualization of the vascular pathways and bone structures in the legs

A demarcation line appeared from the distal left cruris and ischemia occurred in the foot, and below-knee amputation was performed on the 12th postoperative day. (figure 4) Since the patient's medical condition did not allow for ward follow-up, intensive care follow-up was continued after amputation. No wound healing problem occurred at the site of the total knee arthroplasty operation and sutures were removed on the 14th postoperative day. There were local bruises on the suture line of the area where the below-knee amputation was performed, and the wound site was monitored with dressings. The patient died on the 23rd day after the amputation operation due to cardiovascular arrest during follow-up.



Fig 4: Clinical images showing a patient's foot and leg with skin discoloration and possible signs of vascular compromise, alongside an X-ray displaying a knee joint with a prosthetic implant

Discussion

Arterial complications following total knee arthroplasty (TKA) are uncommon, occurring at a much lower rate than other well-known complications such as surgical site infection (1.89% to 5.6%), joint stiffness (1.3%), and venous thromboembolic events (2.1%)^[7-9].

Arterial complications are a potential risk following total knee arthroplasty (TKA), occurring in 0.03% to 0.17% of cases. The most common types of these complications include arterial thrombosis, transection, arteriovenous fistula, and aneurysm formation^[10]. Arterial complications following TKA can have devastating consequences, with approximately 25% of patients experiencing death or limb amputation due to ischemia^[11]. Studies support these findings: Matziolis *et al.* reported amputation in 11 out of 31 cases of popliteal artery occlusion after TKA. At the same time, Chokesy *et al.* found a similar amputation rate (11 out of 29 cases) in TKA patients with thrombosis^[12, 13]. In a retrospective review by Sierra *et al.*, 67 of 18,443 knee arthroplasty patients underwent above-knee amputation. Out of these, 42 amputations were performed for reasons unrelated to the total knee replacement, with peripheral vascular disease being the most common cause (24 knees). The remaining 25 above-knee amputations were directly related to the total knee replacement: 19 were due to uncontrollable infection, 2 for periprosthetic fractures, 2 for pain, 1 for severe bone loss, and only 1 for a vascular complication. The study concluded that the prevalence of above-knee amputations due to vascular complications following total knee replacement was 0.005%^[14]. In our clinic, among a series of 7834 retrospectively reviewed primary total knee arthroplasty records in the last 5 years, only 1 case mentioned in our case report was amputated, a rate of 0.01%. Despite the low occurrence of arterial complications following TKA, their diagnosis and management pose significant challenges for surgeons due to their rarity and unpredictable nature^[15].

Risk factors for acute arterial thrombosis following TKA can be categorized according to Virchow's triad. Intravascular stasis, resulting from immobility during lumbar anesthesia, tourniquet use, and tight postoperative bandages, is a significant contributor. Arterial endothelial damage, caused by hypertension, iatrogenic tibial dislocation, or underlying arteriosclerosis, can also initiate thrombus formation. Additionally, hypercoagulable states associated with cancer or hormonal therapy increase the risk^[16]. Beyond these factors, surgical correction of fixed knee deformities can lead to traction, intimal tears, and compression of the popliteal artery, further predisposing patients to occlusive thrombus formation and subsequent ischemia^[17].

The optimal duration of tourniquet use during TKA remains controversial. While some advocate for its use solely during cementation, others employ it throughout the procedure^[18]. A meta-analysis by Ta-Wei Tai *et al.* linked tourniquet use to an increased risk of thromboembolism, and Charlotta *et al.* reported a correlation between tourniquet time exceeding 100 minutes and higher complication rates^[19, 20]. Conversely, a case report highlighted the potential for arterial occlusion even with a brief tourniquet application during cementation^[12]. Preoperative vascular assessment, including ankle-brachial index (ABI) measurement, may aid in determining the appropriate use of the tourniquet and predicting potential complications^[21, 22].

Since osteoarthritis is a disease seen in the elderly population, the risk of accompanying atherosclerosis is high. Atherosclerosis plaque can easily break and cause embolism even with the short-term use of a tourniquet. Patients with a highly calcified femoropopliteal artery on radiographs should be encouraged to seek preoperative vascular surgery consultation^[23].

Following vascular complications after acute arterial thrombosis, irreversible muscle damage begins after three hours of ischemia and is complete in six hours^[24]. There is a short window in which rapid diagnosis is crucial and the availability of vascular surgery is essential to ensure early and timely resolution of adverse arterial complications. Therefore, it is important to be aware and to perform neurovascular examination in the postoperative period before the patient leaves the operating room and to consult the cardiovascular surgery department in case of any suspicion^[25]. In addition, orthopedic surgeons must be aware that, in some cases, acute arterial occlusion develops even after 9 days postoperatively^[12].

Treatment of acute arterial thrombus involves anticoagulation and surgical intervention including thrombectomy or bypass grafting^[26]. Calligaro2 reported the largest single-center experience managing acute ischemic complications associated with THA and TKA. He claimed this complication was best handled by an aggressive protocol including arterial bypasses and emergency revascularization. Arterial thrombectomy was successful in approximately one-fourth (5 of 18, 28%), only when acute thrombosis was without associated intimal damage^[10].

There are preoperative, intraoperative, and postoperative considerations to avoid vascular complications and to diagnose them early if they occur. Several preoperative evaluations have been suggested to decrease arterial complications in knee arthroplasty. Physical examination is of primary importance in detecting pre-existing arterial disease. History of smoking, hypertension, diabetes mellitus, intermittent claudication, and previous history of transient ischemic attack or stroke should be addressed. Examination of the lower extremity circulation (popliteal artery, dorsalis pedis artery, and posterior tibial artery) should focus on skin ulceration, intolerance to cold, skin discoloration, and history of previous surgery. Careful preoperative selection and vascular surgery consultation are considered necessary in suspicious cases^[27]. The popliteal artery, vein, and posterior tibial nerve usually extend posteromedially to the lateral corner of the tibia, and placing the retractor more than one centimeter in this area may cause direct injury or compression of the popliteal artery; paying attention to this during operation is of great importance to avoid catastrophic complication^[28]. One of the most important signs of vascular stasis is pain and especially regional anesthesia may mask pain until its effect is over. Therefore, it is important to perform frequent vascular examinations in the postoperative period to detect a possible vascular complication early in patients^[29].

Conclusion

Although total knee arthroplasty has successful outcomes in patients with advanced gonarthrosis, the consequences of vascular complications are particularly severe. The rarity of these complications may prevent orthopedic surgeons from being as sensitive as they are for more common

complications such as infection, aseptic loosening, and periprosthetic fracture.

Being sensitive about vascular complications, considering risk factors, consulting cardiovascular surgery if necessary, informing the patient and his/her relatives about the catastrophic consequences that may occur in case of a possible vascular complication, and making patient selection as a result of all these will be protective for both patients and orthopedic surgeons.

In addition, to minimize possible vascular complications regarding tourniquet use, we think that a consensus should be formed by the cardiovascular surgery branch and the orthopedics and traumatology branch, taking into account the patient's age, preoperative vascular examination, ankle-brachial index, and comorbidities, which will be guiding for surgeons who will perform total knee arthroplasty.

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