



## Case report

## Rare Case of Traumatic Anterior Knee Dislocation of Total Knee Arthroplasty With a Serious Neurovascular Injury

Tomas Novotny, MD, PhD<sup>\*</sup>, Eliska Vanaskova, MD, Jan Soukup, MD

Department of Orthopaedics, University J.E. Purkyně, Masaryk Hospital, Usti nad Labem, Czech Republic

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## ABSTRACT

Traumatic anterior dislocation of a total knee arthroplasty (TKA) is an extremely rare occurrence. There are only a few known cases of this type of dislocation which discuss the high risk of a neurovascular complication. This article describes a traumatic anterior dislocation of the TKA with a severe vascular lesion in a 75-year-old severely comorbid patient. Further complications led to the development of a compartment syndrome. Despite the repeated effort in performing a well-functioning anastomosis of the popliteal artery tear by the vascular surgeon, reperfusion of the lower extremity was not effective. Furthermore, multiorgan system failure due to the reperfusion syndrome evolved. This led to an above-knee amputation as a lifesaving procedure. Despite thorough intensive care therapy, the patient did not survive this complication. Presently there are no reported cases with such severe complications after the luxation of a previously well-functioning TKA leading to the death of the patient.

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## Introduction

Total knee arthroplasty (TKA) is one of the most successful and effective orthopedic operations developed during the last century [1]. TKA is projected to grow by 85%, the equivalent of 1.26 million procedures, by 2030 in the United States [2]. Inevitably, the number of procedures will rise so will the number of adverse sequelae reported. An uncommon yet significant complication of TKA, traumatic anterior dislocation, will be discussed in this case report. Traumatic complete anterior knee dislocation of a previously well-functioning TKA is an extremely rare complication [3]. Significantly more often are reported cases with a TKA instability due to a chronically impaired function as a result of a mechanical failure [4] or periprosthetic infection [5]. Traumatic anterior dislocation of a TKA most frequently follows hyperextension trauma [6]. Literature discussing development of severe neurovascular complications is scarce, thus the risk cannot be accurately estimated. We hope this case highlights a potentially life-threatening neurovascular complication of TKA and encourages clinicians to promptly recognize and manage such an event.

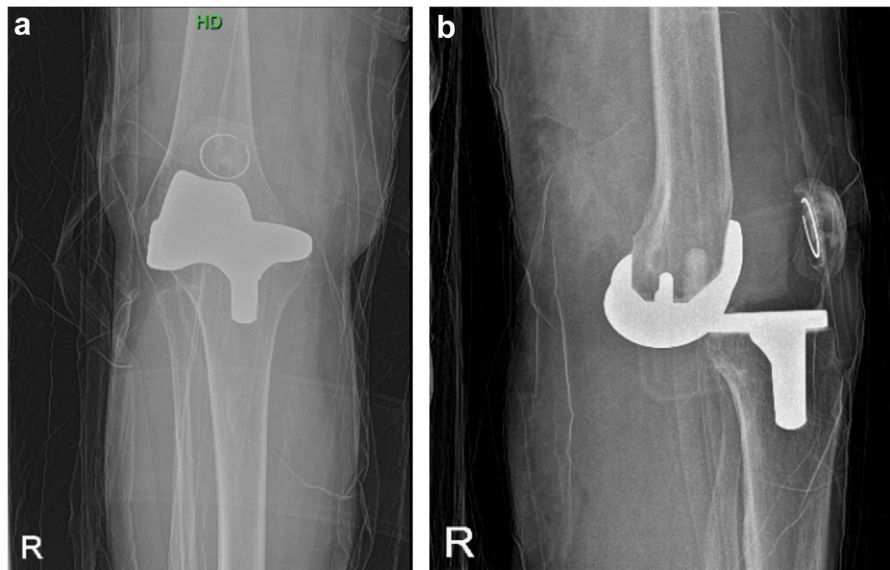
## Case history

A 75-year-old severely comorbid Caucasian female was admitted to Masaryk Hospital, Usti nad Labem, in January 2021 presenting with a traumatic dislocation of her right TKA after a mechanical fall on ice. Her past medical history included hypertension, hyperlipoproteinemia, obesity, diet-controlled type 2 diabetes mellitus, and chronic renal insufficiency. She had undergone an uncomplicated TKA implantation 7 years before this within our institution with an uneventful postoperative recovery. The patient acquired in the long term an excellent knee range of motion from 0° to 120° without any instability in her follow-up examinations. anteroposterior/lateral radiograph showed a complete anterior dislocation of her prosthetic knee (Fig. 1a and b). On clinical examination, she was found to be peripherally desensitized with the absence of anterior tibial and dorsalis pedis pulses.

An urgent closed reduction of the TKA was performed under conscious sedation via axial traction in the emergency department. After this emergency procedure, there was no evidence of collateral instability on performance of the varus and valgus stress test. The lower extremity was immobilized in full extension with a knee brace. The ischemic symptoms and incipient compartment syndrome with the suspicion of severe damage of the popliteal vessels started to present itself approximately 15 minutes after the repositioning. An arterial Doppler ultrasound of the popliteal vessels

<sup>\*</sup> Corresponding author. Department of Orthopaedics, University J.E. Purkyně, Masaryk Hospital, Usti nad Labem, 40113, Czech Republic. Tel.: +420477113060.

E-mail address: [tomas.novotny@kzcr.eu](mailto:tomas.novotny@kzcr.eu)



**Figure 1.** Anterior traumatic dislocation of a total knee arthroplasty captured in (a) anteroposterior radiograph and (b) lateral radiograph.

was carried out revealing a high index of suspicion of a popliteal artery tear with extensive hematoma of the popliteal area.

Further opinion was sought from the vascular team who agreed with the decision to proceed to urgent invasive repair of the damaged artery. This exploration resolved with performing a vascular anastomosis. Lesion of the popliteal vein was solved with a suture. Owing to a suspicion for the development of the compartment syndrome, a fasciotomy of the affected leg was performed simultaneously. After the surgery, a knee brace in full extension was applied. The postoperative computed tomography angiography (CTA) revealed 90% stenosis of the performed popliteal anastomosis (Fig. 2). CTA detected decreased blood flow along the posterior tibial artery and the fibular artery. Despite these discouraging results, the decision was made, with the input of the vascular surgeons, to forgo immediate reoperation considering clinical improvement and reperfusion of her lower extremity. The next morning, an angiography was performed which showed a complete occlusion of the anastomosis (Fig. 3). As a result of the findings, a second revision of the popliteal area was performed with a thrombectomy of the anastomosis. After the revision surgery, the right lower extremity improved in regard to warmth and color, albeit still without any palpable peripheral pulse or active movement. The patient remained in the intensive care unit, where she received vasopressors and blood products to support her blood pressure. There was evidence of progressively evolving reperfusion syndrome with subsequent acute chronic kidney failure and marked hyperkalemia which resulted in hemodialysis.

The day after, signs of hypoperfusion of the right lower extremity such as pulseless, livid color, and plegia of the lower extremity were accelerating (Fig. 4). With regard to the worsening of patient's overall status, femur amputation of the leg was recommended as a lifesaving surgery. The patient was intubated with the support of blood circulation with noradrenaline. It was noted at this time, that the signs of reperfusion syndrome and hyperkalemia were progressing. A CTA was obtained ruling out a pulmonary embolism, but it did reveal an ischemic change in the liver, kidneys, and spleen. Empiric antibiotics and corticosteroid therapy were subsequently initiated.

The next day, a leakage from a scar of the amputation stump led to a surgical revision and stasis of the bleeding. Therapy with

vasopressin was initiated because of further worsening of the patient's clinical status. A bed-side echocardiography demonstrated diffuse hypokinesis, and clinical examination demonstrated a state of hypoperfusion, which led to a dobutamine support of the blood circulation. Despite all these interventions, she suffered from irreversible multiorgan failure leading to her subsequent death by the third day of the therapy.



**Figure 2.** Postoperative computed tomography angiography of a lacerated popliteal artery. This examination detected decreased blood flow of the lower extremity along the posterior tibial artery (black arrow) and fibular artery (white arrow).



**Figure 3.** Angiography one day after the vascular anastomosis surgery of the lacerated popliteal artery. This demonstrated a complete occlusion of the anastomosis. Anastomosis of the popliteal artery is indicated with a black arrowhead.

## Discussion

Traumatic anterior dislocation of the TKA is an extremely rare and unusual occurrence. Far more often, the anterior instability of TKA occurs as a result of a mechanical failure or an infection of the prosthesis, neurological disorder, ligamentous deficiency, component malalignment, polyethylene wear, or suboptimal soft-tissue balancing [7, 8]. In English literature, there are only a few cases of complete anterior knee dislocation with a varied range of clinical course.

Pao and Jiang (2003) documented a 56-year-old patient with end-stage renal failure on hemodialysis [9]. It was one of the first cases with a complete traumatic anterior dislocation of the TKA with an obliteration of the popliteal artery. Bypass surgery was performed by a vascular surgeon in about 30 hours after the injury because of patient's hesitation. The worsening of an overall clinical status of the patient led after 2 days to an above-knee amputation.

Aderinto et al. presented another case (2009) in Canada [10]. On the third day after a closed reduction of the anterior dislocation, the



**Figure 4.** The condition of the right lower extremity on day two, before the knee amputation was performed.

lower extremity became acutely ischemic and pulseless. Complete thrombosis of the popliteal artery from its origin was clearly shown. Femoropopliteal bypass surgery and fasciotomies of all 4 compartments of the leg were performed. An external fixator was applied because of a perioperatively determined instability. After 6 months of this kind of fixation, a complete loss of motor and sensory function was detected as a result of patient's noncompliance in further immobilization.

In Spain, Vilanueva et al. [8] described a case of a 65-year-old patient with a complete traumatic anterior dislocation of the TKA. This case was conjoined with an occlusion of the ascending genicular artery and peroneal palsy. The revision surgery of the TKA was performed using a posterior-stabilized design and was stable and pain-free 6 years after the revision surgery.

In Italy, Conti et al. described in 2014 a case of a complete traumatic anterior dislocation of the TKA without neurovascular damage [4]. The lower extremity was immobilized in full extension in a long leg cast for 30 days after the closed reduction. Six months later, the patient was able to walk independently. At 1-year follow-up, the patient had a range of motion up to 100° without any signs of instability.

In the United States, in 2015, Ahn et al. also described a traumatic complete anterior knee dislocation of the TKA without neurovascular consequences [3]. Despite a 6-week complete immobilization of the knee, instability of the TKA remained. This led to a revision surgery using hinged knee components.

The last documented case was presented by Addevero et al. in 2018 describing a patient with a traumatic anterior dislocation of the TKA without obvious signs of neurovascular injury [6]. A closed reduction in addition to the application of a knee-ankle-foot orthosis was performed. About 80 hours after the trauma, the patient complained of pain, foot numbness, dysesthesia, as well as progressive palsy distally to the knee. CTA revealed a thrombotic occlusion of a popliteal artery. Fibrinolysis reached only a partial

reflow so that a complete revascularization surgery was performed 44 hours after the beginning of fibrinolysis. The development of a compartment syndrome 12 hours after the revascularization surgery resulted in a four-compartment fasciotomy. In spite of this, the recovery of the nerves distal to the knee did not reveal itself up to the 5 months of follow-up. Range of motion of the lower extremity remains a challenge even at the latest follow-up for this patient. Neurovascular complications developed in 5 patients of 8 reported cases (62.5%) including our case. One of 8 patients (12.5%) died as a consequence of the injury. Two of 8 patients (25%) had to undergo an above-knee amputation during the posttrauma therapy. Those 2 patients had suffered from long-term kidney failure. Only one patient of those 8 (12.5%) reported ended up with a satisfying result without the necessity of any further orthopedic intervention.

In regard to this case report, our 75-year-old female was managed initially as any other traumatic luxation of the joint with an urgent closed reduction performed in the emergency department. The popliteal artery laceration, repair, and incipient compartment syndrome were swiftly noted and managed appropriately without delay. Previously we mentioned a potential benefit of hinged external fixator stabilization of a knee joint for the better function of the vascular anastomosis. In our case, we applied a knee brace, which was thought to be sufficient as the knee remained reduced after the reduction was completed. Furthermore, we considered another surgical intervention in the limb with such a severe neurovascular damage as a risk for the development of additional complications. Another point of discussion is the traumatic dislocation of the TKA stemming from performing the closed reduction in the operating room with the possibility of immediate intervention by the vascular surgeon. In case of suspicion of a vascular lesion, the urgent vascular surgeon's involvement and repair of the damaged vessel may be implemented. This prompt intervention would have prevented the several minutes delay as we presented in our case. Therefore, timing appears to be crucial in preventing fatal outcomes, as in the unfortunate case of our patient.

## Summary

A complete traumatic anterior dislocation of a TKA is a very severe occurrence according to heretofore published cases. There is a high probability of acute as well as deferred vascular damage. As there are only 8 reported cases yet, there cannot be any proven recommendations. Nevertheless, CTA appeared to be a useful imaging modality used after the reduction of a TKA dislocation to

visualize and quantify arterial flow. According to our experience, we would highly recommend the provision of a closed reduction only within the realm of a health-care institution equipped with the immediate availability of a vascular surgeon.

## Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

## Informed patient consent

The author(s) confirm that informed consent has been obtained from the involved patient(s) or if appropriate from the parent, guardian, power of attorney of the involved patient(s); and, they have given approval for this information to be published in this case report (series).

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