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Case Report

Pulmonary Thromboembolism After Revision Total Knee Arthroplasty: A Report of Two Cases

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Abstract: Two female patients (74 and 80 years old) underwent revision total knee arthroplasty surgery due to aseptic loosening. Patient 1 was obese, while patient 2 had history of abdominal surgery, cerebrovascular and autoimmune disease. They were both under anti-depressive medication. Intravenous tranexamic acid was administrated according to institutional protocol. Knee mobilization and enoxaparin in prophylactic dose was initiated at day 1 postoperatively. Both patients had pulmonary thromboembolism within the first 30 days after surgery. Individual risk factors predispose to pulmonary thromboembolism, while tranexamic acid way of administration does not seem to be responsible for the risk increase.

Keywords: Revision Total Knee Arthroplasty; Pulmonary Embolism; Tranexamic Acid; Intravenous.

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1. Introduction

The number of patients undergoing primary total knee arthroplasty (TKA) has increased exponentially in recent years, as has the need for revision total knee arthroplasty (rTKA) surgery [1]. Indications for knee revision surgery are aseptic loosening, corresponding to 39% of total rTKA and the main indication for late revisions; prothesis infection, which is the main cause for early revision surgery (27% of total rTKA); ligamentous instability (8% of total rTKA); arthrofibrosis (5% of total rTKA) and periprosthetic fracture (5%) [2]. The literature reports a median incidence of 1.2% for thromboembolic venous events following rTKA surgery, including pulmonary embolism (PE) (0.9%) and deep vein thrombosis (DVT) [3]. Other complications that occur more frequently include pain, stiffness, infection and neurovascular injury. However, there is a lack of studies examining the relationship between thromboembolic venous events and rTKA surgery [4].

Here, we present two cases of pulmonary thromboembolic events after rTKA surgery, in two female patients. The patients were informed that data relating to their cases would be submitted for publication, and they gave their consent.

2. Case Report

In both cases, patients were submitted to rTKA by the same experienced knee surgeon, after being clinically, radiographically and scintigraphically diagnosed with aseptic loosening after primary total knee arthroplasty (Figures 1 and 2). Pre-operative evaluation

included posterioranterior chest x-ray, standard EKG and blood tests (hemogram, prothrombine time, activated partial thromboplastin time, ionogram, serum creatinine, blood urea nitrogen and c-reactive protein). Since no patient had major risk factors for pulmonary embolism or DVT no thrombophilia screening test were performed.

Figure 1. Preoperative knee radiography of patient 1. 1.1. An anteroposterior view of the right knee. 1.2 A lateral view of the right knee.

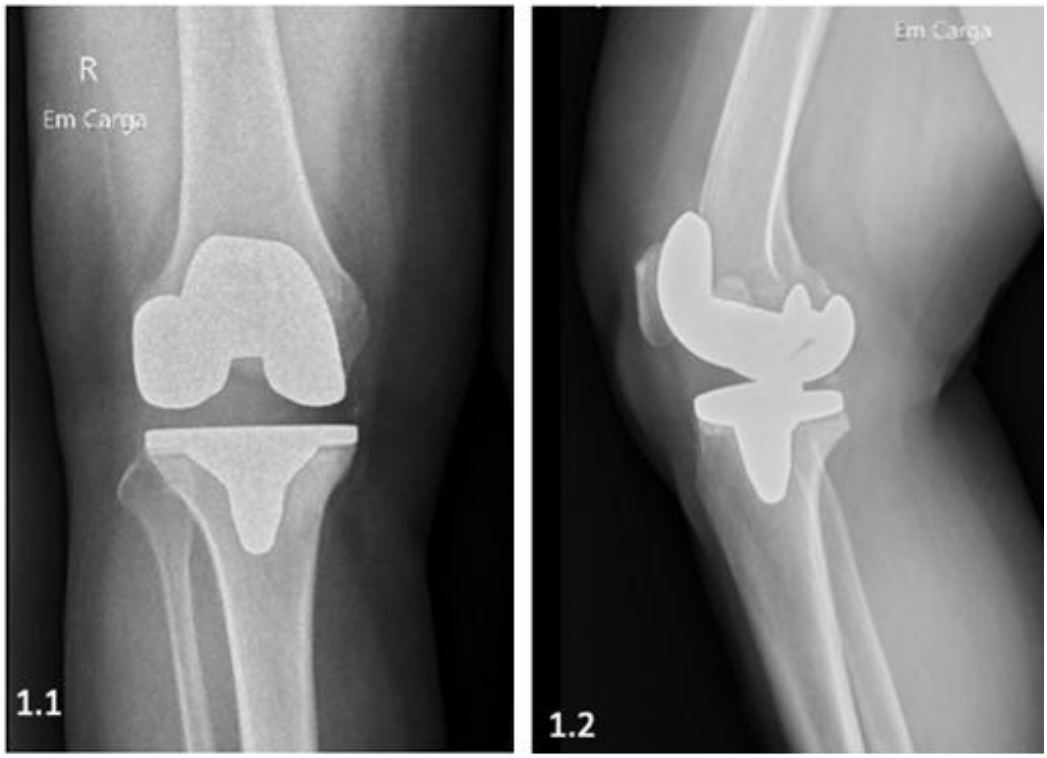


Figure 2. Preoperative knee radiography of patient 2. 2.1. An anteroposterior view of the right knee. 2.2. A lateral view of the right knee.

Both procedures were performed according to institutional protocol: using combined loco-regional and general anesthesia and positioned in dorsal decubitus, with a thigh

tourniquet that remained inflated during the entire intervention. Operative time was 118 and 132 minutes, and tranexamic acid (TXA) administration was according to institutional protocol, in 3 doses: 1g diluted in 100 mL of saline solution, intravenously, during induction of anesthesia, 15 minutes before tourniquet deflation and 3 hours after the second dose.

2.1 Case 1

Female, 80 years and previously autonomous. Known comorbidities were obesity (Body Mass Index: 33.6 Kg/m2), chronic venous insufficiency and major depressive disorder medicated with citalopram; and previous history of spinal fusion instrumentation of L4-L5-S1; right knee partial meniscectomy in 2013 and right TKA in 2017 (Table 1).

Table 1. Demographic characteristics, comorbidities, pharmacological and perioperative variables observed in both patients.

Case 1	Case 2	Both
–	–	Female
80 years	74 years	> 65 years
Autonomous	Partially dependent	
Obesity	–	–
Venous insufficiency	–	–
–	–	TCA
–	RA; Psoriasis; EN	–
–	Stroke	–
–	Total hysterectomy	–
Spinal instrumentation; TKA	Bilateral TKA	–
–	–	Surgery duration
–	–	Intravenous tranexamic acid
–	–	Enoxaparin SC 40 mg od

Abbreviations: RA. Rheumatoid arthritis. EN. Erythema nodosum. TKA. Total knee arthroplasty; TCA. Tricyclic antidepressants. SC. Subcutaneous. IV. Intravenous. Od. once daily.

The patient was submitted to a rTKA 25 days after diagnosis. Previous TKA components were removed through an antero-medial approach. Intra-operatively a femoral and tibial defect were identified, F2A and T2A respectively, according to the AORI classification [5]. The femur and tibia were realigned and a cemented constrained nonhinged prosthesis was implanted (Figure 3); the patella was resurfaced and a drain was placed. TXA was administered as previously discriminated.

At day 1 post-operative the drain was removed, the patient started continuous passive mobilization (CPM), and started prophylactic anticoagulation therapy with 40mg of enoxaparin, once a day, subcutaneously. At day 2 started walking training with a walker. Routine post-operative blood tests were performed, without relevant changes. Patient was discharged at day 4 post-operative. Six hours after discharge, the patient had symptoms of sudden dyspnoea at rest and chest pain. At the emergency room (ER) she was diagnosed with a bilateral segmental and subsegmental pulmonary thromboembolism through thoracic computerized tomography angiography scan (CTA) (Figure 4).

The patient started therapeutic anticoagulation with 60mg enoxaparin, twice a day, subcutaneously, during in-hospital stay; and was discharged 3 days later, with indication for oral anticoagulation with Rivaroxaban 15 mg twice a day for 15 days, followed by 20 mg, daily, for 6 months. Last follow-up, at one-year post-operative, the patient had started physical therapy and presented a range of motion of 120º in flexion and a deficit of 5º in

extension; maintained knee stability in valgus and varus, with no signs of infection or other complication.

Figure 3. Post operative knee radiography of patient 1. 3.1. An anteroposterior view of both knees. 3.2. A lateral view of a cemented constrained nonhinged prosthesis of the right knee.

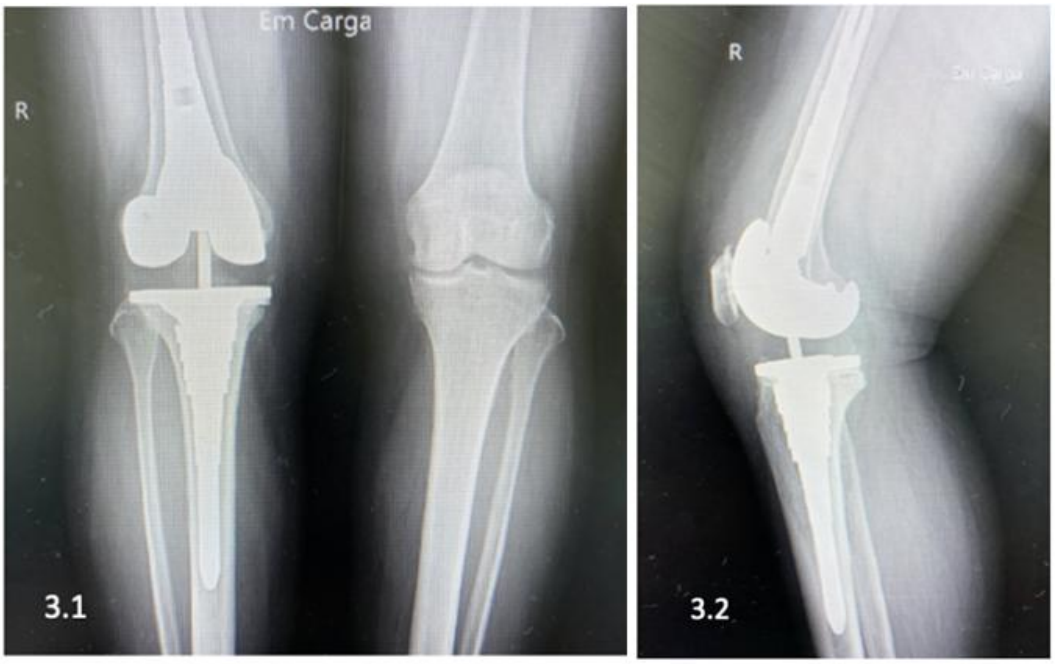
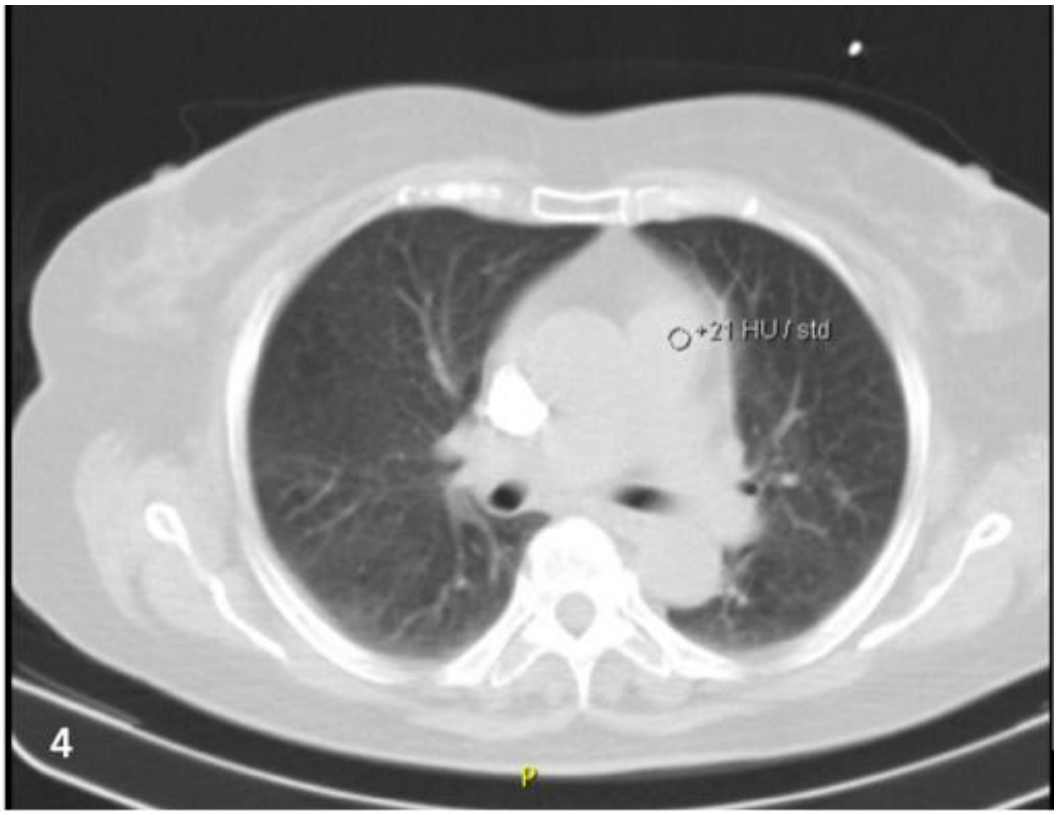


Figure 4. CTA image of a bilateral segmental and subsegmental pulmonary thromboembolism diagnosed in patient 1.

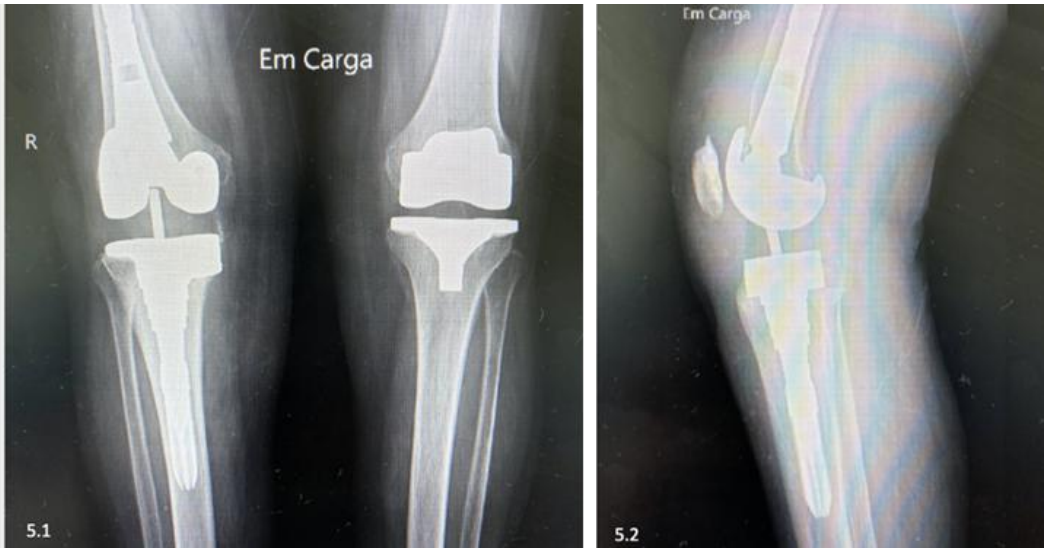


2.2 Case 2

Female, 74 years, partially dependent for daily life activities, but with no need for a walking aid. Known comorbidities were rheumatoid arthritis, psoriasis and erythema nodosum, cerebrovascular disease (status post-ischaemic cerebrovascular accident in 2017), major depressive disorder; and previous history of total hysterectomy for myoma in 2008 and a bilateral TKA (right in 2015 and left in 2017). The patient is medicated with both citalopram and acetylsalicylate (Table 1).

The patient was submitted to a rTKA 18 months after diagnosis, Previous TKA components were removed through an antero-medial approach. Intra-operatively femoral and tibial defects were identified, F2A and T2A respectively, according to the AORI classification [5]. Femur and tibia were realigned and a cemented constrained nonhinged prosthesis with augmentations in lateral femur condyle and medial tibial plate was implanted (Figure 5); the patella was resurfaced and a drain was placed. TXA was administered as previously discriminated against.

Figure 5. Post operative knee radiography of patient 2. 5.1. An anteroposterior view of both knees. 5.2. A lateral view of a cemented constrained nonhinged prosthesis with augmentations in lateral femur condyle and medial tibial plate of the right knee.



At day 1 post-operative the drain was removed, the patient started continuous passive mobilization (CPM), and started prophylactic anticoagulation therapy with 40mg of enoxaparin, once a day, subcutaneously. This patient also started walking training with a walker on day 2. Post-operative blood tests showed no relevant changes, the patient maintained clinically stable and hydrated during hospitalization. Patient was discharged on day 5 post-operative, with indication to maintain prophylactic anticoagulation therapy for 30 days. On day 21 of post-operative period, the patient had an episode of lipothymia and was admitted to the ER, where she was diagnosed with a right subsegmental pulmonary thromboembolism by CTA (Figure 6).

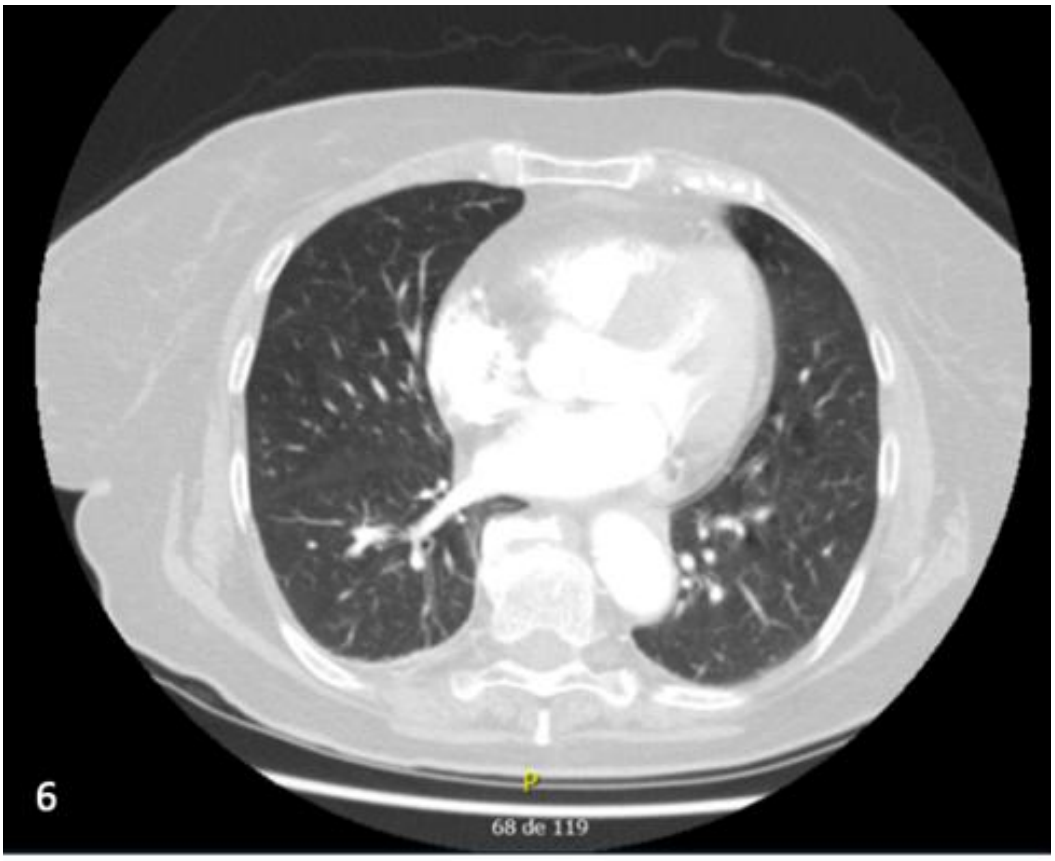
The patient was discharged on the same day, anticoagulated with Rivaroxaban 15 mg twice a day for 15 days, followed by 20 mg, daily, for 6 months. The patient always maintained physical therapy until last follow-up at one-year post-operative. At this time, the patient presented with a range of motion 120º in flexion and 0º in extension; maintained knee stability in valgus and varus and no signs of infection or other complication.

3. Discussion

There are modifiable and non-modifiable risk factors that may lead to a pulmonary thromboembolic event following rTKA. Among the non-modifiable demographic factors

present in both patients are female gender and age over 65, which significantly increase the likelihood of experiencing an adverse pulmonary embolic event [3], [6]. Tate et al [4] found that for every additional year of age, the risk of an adverse thromboembolic event increase by 2.5%. Obesity [3, 7] and prior spinal fusion instrumentation [7], as seen in patient 1, have also been described as risk factors for pulmonary thromboembolic event following rTKA. In patient 2, a history of abdominal surgery (hysterectomy) [7], previous stroke [3], [7] and autoimmune disease (such as rheumatoid arthritis, nodosum erythema and psoriasis) [7] emerge as potential non-modifiable risk factors that could increase the risk of a thromboembolic pulmonary event. Shahi et al [3] highlights the significantly elevated risk of venous thromboembolism associated with the use of antidepressants, citing case reports of severe pulmonary embolism linked to this class of medication.

Figure 6. CTA image of a right subsegmental pulmonary thromboembolism diagnosed in patient 2.



Both patients were on antidepressant therapy, which can be classified as a modifiable risk factor. Additionally, in both cases, modifiable risk factors such as prolonged surgical duration [7] and TXA administration [8, 9] might have contributed to a risk increase. Knee revision surgery is more technically demanding than a primary total knee arthroplasty and often requires extensive soft-tissue manipulation to achieve sufficient exposure for removing the old implant and placing the new one [4]. This can result in longer operating times and may, in theory, increase the risk of thromboembolic events [10].

In a retrospective study from 2000 to 2011, Parvizi et al. [11] reported a PE rate of 1.4% after revision TKA and 1.8% after primary TKA, an unexpected finding. Similarly, Boylan et al. [10] compared PE incidence 30 and 90 days after surgery and observed higher rates in primary TKA at both intervals (0.82% vs 0.52% at 30 days, $p < 0.001$; and 0.90% vs 0.63% at 90 days, $p < 0.001$). The authors suggested that more aggressive thromboprophylaxis in revision cases may partly explain the lower PE rates in the rTKA group [4, 10]. They also noted that stricter patient selection - with fewer comorbidities [10] and lifestyle

modification [3] before revision surgery may contribute to these findings. Further research is needed to clarify the reasons behind these counterintuitive results.

Concerning TXA way of administration, Shin et al [8], in a meta-analysis that compared the topical and intravenous use of TXA in primary TKA, showed no difference regarding pulmonary embolism or other thromboembolic adverse events. Porto, J et al [12] in a retrospective cohort study in high-risk patients undergoing primary TKA showed that TXA is not associated with increased postoperative DVT or PE, though a slightly higher incidence of ischemic stroke/transient ischemic attack has been reported compared to those who did not receive TXA (5.6% vs. 3.9%). Nonetheless, its use remains justified given the consistent reductions in transfusion rates, readmissions, and overall mortality [12]. Nevertheless, it is important to reconsider a topical way of administration over an intravenous, especially in patients with a history of thromboembolic complications or cerebrovascular disease [9].

4. Conclusion

Although rTKA appears to be associated with fewer pulmonary embolisms than primary arthroplasty, the method of administration of TXA does not appear to influence this. The authors conclude that individual risk factors and co-morbidities had an important role in risk increase in both patients reported. It is crucial to conduct thorough research on patients and develop a more organized thromboprophylaxis algorithm prior to surgery.

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Research Ethics Committee Approval: The patients provided written informed consent for participation, and the study was conducted in accordance with the ethical guidelines outlined in the Declaration of Helsinki.

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Conflicts of Interest: All other authors declare no conflicts of interest.

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