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Case Report

Catastrophic complication after total knee arthroplasty

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Abstract

Infection is a significant complication in total knee arthroplasty (TKA) applications and has serious morbidity. Considering the difficulties in diagnosis and treatment of infections that develop after TKA, and the cost to patient health and national economies, preventing infection development would be a more rational approach. For this purpose, the patient's risk factors should be determined and these risk factors should be optimized adequately and meticulously in the preoperative period. When an infection develops after TKA, the correct diagnosis should be made without delay and the most appropriate treatment method should be determined and applied to the patient. In determining the appropriate treatment approach; the patient's age, the duration of symptom onset, concomitant diseases, bone quality, the status of the soft tissue cover and the type of microorganism should be taken into consideration. In this article, we present two cases, a 75-year-old woman and a 95-year-old woman, who underwent amputation due to infection after TKA. Transfemoral amputation was performed due to infection that developed after two-stage revision.

Keywords: Catastrophic failure, complication, revision total knee arthroplasty; infection; amputation

Introduction

Total knee arthroplasty (TKA) is a successful treatment method used to relieve pain, improve joint functions and improve the quality of life of patients with advanced osteoarthritis [1,2].

TKA infection is one of the most feared and most difficult complications to treat after TKA, and is seen at a rate of 0.8%–1.9% [3]. It has been reported that infection is the most common reason for TKA revision [3].

Above-knee amputation (AKA) is a rare but disastrous complication of TKA. It has been shown to be more common in some patient populations than others [4,5]. It is more common in patients with low socioeconomic status, in female gender, and in black race [4,5].

We present two cases that underwent transfemoral amputation due to recurrent infections.

Case reports

Case 1

A 75-year-old female patient with pain, limited movement, discharge, and increased temperature in her right knee was admitted to us with complaints of discharge from her knee and prosthesis protrusion outside the skin. It was learned that she had a history of primary TKA due to right gonarthrosis 15 years ago, and a two-stage revision TKA surgery due to infection 13 years ago, and that she had no known additional disease. In her physical examination, it was seen that the joint prosthesis in her right knee was exposed and had a foul-smelling discharge (Figure 1a). The patient's knee joint flexion contracture was dominant and there was no extension. Body temperature was measured as 37.4°C. Laboratory tests showed C-reactive protein level (CRP) 51 mg/l, erythrocyte sedimentation rate (ESR) 69 mm/hour, white blood cell count 17,000/mm3, fasting blood sugar 191 mg/dl, complete urine test 10 leukocytes and other blood values were normal.

Revision TKA was observed in the right knee radiographic examination (Figure 1b).

After preoperative preparations, transfemoral amputation was performed on the patient's right lower extremity (Figure 1c). Proteus mirabilis growth was observed in the culture of the tissue samples and urine culture. After consultation with the department of infectious diseases, the patient was started on Tigecycline 1x200 mg loading, 2x100 mg maintenance intravenous (IV) and Polymyxin B Sulfate 1x3.5 vial loading, 2x2 vials maintenance IV.

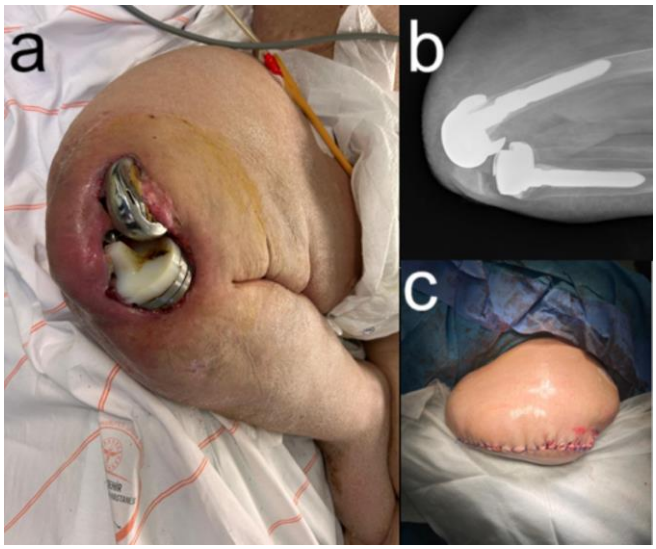

Figure 1. a) Appearance of joint arthroplasty exposed by infection-related skin necrosis on the patient's knee. **b)** Radiographic image of the same patient's knee. **c)** Appearance of the extremity after transfemoral amputation.

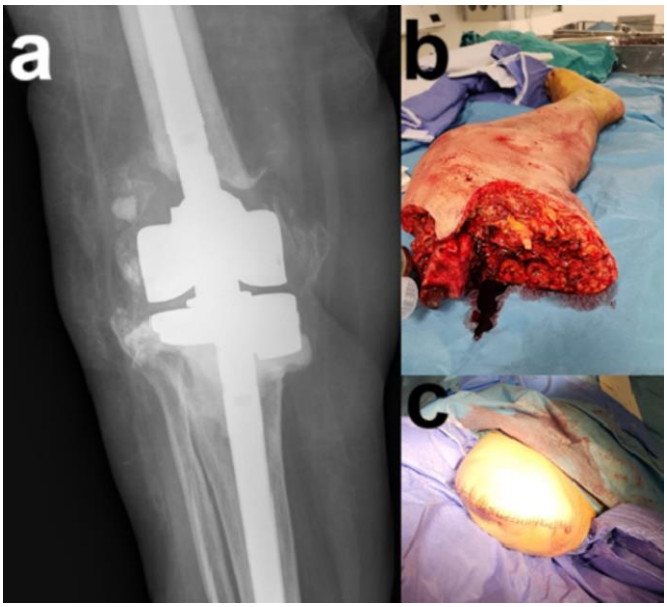

Figure 2. a) Preoperative radiographic image of the patient's knee. **b, c)** Appearance of the extremity after transfemoral amputation.

Case 2

A 95-year-old female patient with pain, limited movement, discharge, and increased temperature in her right knee applied to us with complaints of discharge and resting pain in her knee.

It was learned that she had a primary TKA 40 years ago due to right gonarthrosis, a two-stage revision TKA surgery 6 months ago, that she had not been able to mobilize for the last 5 years, and that she had additional diseases such as diabetes mellitus, hypertension, Alzheimer's, cerebrovascular disease, and pulmonary thromboembolism.

In her physical examination, it was seen that she had a fistulized discharge in her right knee joint. The patient's knee joint movements were limited and painful, and the range of motion was determined as 80 degrees flexion and 0 degrees extension. Her body temperature was measured as 37.5°C. In laboratory tests; CRP 305 mg/L, procalcitonin 0.45 µg/L, ESR 68 mm/h, white blood cell count 11,000/mm3, fasting blood sugar 191 mg/dl, other blood values were normal.

Revision TKA was observed in the right knee radiological examination. (Figure 2a)

After preoperative preparations, a transfemoral amputation was performed on the patient's right lower extremity (Figures 2b and 2c). Proteus mirabilis growth was observed in the culture of the tissue samples taken, and Klebsiella Pneumoniae growth was observed in the urine culture. After consultation with the department of infectious diseases, the patient was started on meropenem 3x1 gr IV, anidulafungin 1x200 mg loading 1x100 mg IV slow infusion maintenance, fosfomycin 3x4 gr IV and tigecycline 1x200 mg loading 2x100 mg IV maintenance.

Discussion

Considering the difficulty of treating TKA infection, protection from infection would be a rational approach. Therefore, reducing patient risk factors, ensuring that the operating room environment complies with standards, and effective treatment of postoperative wound complications play an important role.

Diabetes, obesity, rheumatoid arthritis, history of steroid use, smoking, malnutrition, malignancy, revision surgery, history of previous prosthetic surgery and septic arthritis, anemia, pulmonary, cardiovascular and renal failure have been identified as important risk factors for the patient [6,7]. These risk factors should be carefully evaluated and efforts should be made to correct possible situations, and the patient should be taken to surgery under the most appropriate conditions possible.

Clinical course, serum and synovial fluid markers, microbiological methods and radiological imaging methods are used among diagnostic methods [8]. Pain, swelling, increased temperature and synovitis are common findings [8]. Fistula formation and purulent discharge may be observed in advanced infections [8]. Focal osteolysis areas and periosteal new bone formation on direct radiography should be evaluated in favor of infection [9,10]. CRP, ESH and D-dimer are frequently preferred serum markers. In the presence of clinical suspicion and/or if one or more of the serum markers are high, joint aspiration should be performed without delay [9,10]. Antibiotics should be discontinued at least two weeks before this procedure. Leukocyte esterase test should be performed on joint fluid, white blood cell count and polymorphonuclear leukocyte percentage should be determined and pediatric blood culture tubes should be cultured immediately after aspiration [9,10].

The delegation of the second International Concensus Meeting (ICM) held in Philadelphia in 2018 did not make any changes to the major diagnostic criteria for periprosthetic infection (PPI) but suggested a scoring system for the minor diagnostic criteria [9]. Accordingly, the growth of the same agent in two cultures or the presence of a sinus tract associated with the prosthesis are considered major criteria [9]. Considering the minor criteria, patients with six or more points are considered infected, while it is recommended that infection should not be considered with a score of three or less (Table 1) [9].

PPI classification is based on the onset of symptoms and the time elapsed since surgery [10]. Classifications are also very important in making treatment decisions [11]. Tsukayama et al.

Table 1. Second International Consensus Meeting (ICM) Periprosthetic infection classification diagnostic criteria [9].

Major criteria (at least one of the following)				**Decision**
Two positive growth of the same organism using standard culture methods				**Infected**
Sinus tract with evidence of communication to the joint or visualization of the prosthesis				
Minor Criteria	**Threshold**		**Score**	**Decision**
	Acute	**Chronic**		
Serum CRP (mg/L) *or* D-Dimer (μg/L)	100 Unknown	10 860	2	**Combined preoperative and postoperative score:** ≥6 Infected 3–5 Inconclusive <3 Not Infected
Elevated Serum ESR (mm/hr)	No role	30	1	
Elevated Synovial WBC (cells/μL) *or* Leukocyte Esterase *or* Positive Alpha-defensin (signal/cutoff)	10,000 ++ 1.0	3,000 ++ 1.0	3	
Elevated Synovial PMN (%)	90	70	2	
Single Positive Culture			2	
Positive Histology			3	
Positive Intraoperative Purulence			3	

Table 2. Periprosthetic infection classification developed by Tusukayama et al. [11].

Type	**Classification**	**Diagnosis**	**Treatment**
I	Positive culture at surgery	More than two positive cultures	Antibiotic therapy
II	Early postoperative infection	Infection developing <4 weeks after surgery	Debridement, prosthesis preservation and antibiotic treatment
III	Acute hematogenous infection	>4 weeks postoperatively, hematogenous transmission	Debridement, prosthesis preservation and antibiotic therapy, two-stage revision if treatment fails
IV	Late chronic infection	Postoperative >4 weeks, sinus opening present	Two-stage change

classified total joint arthroplasty infection into four stages (Table 2) [11].

There are multiple treatment methods for the treatment of infections that develop after total knee replacement. These treatment methods include: antibiotic suppression, debridement, antibiotic and implant protection, single-stage replacement, two-stage replacement, arthrodesis and amputation [12].

In determining the treatment plan, the time of infection, the findings of loosening in the prosthesis, the status of the surrounding soft tissue, the virulence of the causative pathogen, the culture antibiogram result, the general health status and expectations of the patient are very important [12]. Single-stage replacement is a method that is increasingly used in the treatment of infections after TKA, especially in Europe and North America, due to its advantages such as completing the surgery in a single stage, shortening the duration of antibiotic treatment, shortening the hospital stay and reducing the cost of treatment [12,13].

Identification of the organism causing the infection, determination of its antibiotic sensitivity before surgery and adequate soft tissue coverage are necessary for single-stage replacement [13]. Two-stage replacement is the most frequently preferred treatment method for chronic TKA infections [12,14]. In the first stage, all prosthesis, cement and foreign bodies are removed [13,14]. All infected and necrotic tissues are meticulously debrided [13,14]. Then, an antibiotic spacer is applied. It is important to use an appropriate dose of antibiotic effective against the causative organism [13,14].

If the wound is clinically good, CRP and sedimentation values tend to decrease and are stable, the second stage is usually planned after 8–12 weeks [13,15]. It is recommended to perform joint aspiration and perform cell counts and leukocyte esterase test before the second stage [14]. During the second stage, after taking tissue and fluid samples for culture, an effective debridement and pressure washing (pulsatile lavage) are performed again. Then,

reimplantation is performed [14]. Antibiotic treatment for 3–6 months after reimplantation has been reported to be beneficial [14].

Young active patients who have failed reconstructive procedures and patients with recurrent TKA infection caused by multiresistant pathogens are suitable patients for arthrodesis [16]. There is evidence that patients who undergo limb-sparing procedures such as arthrodesis have higher rates of postoperative infection, blood transfusions, and higher hospital charges [17].

In a case series of 26 patients who underwent knee arthrodesis with intramedullary nailing after persistent TKA infection by Rohner et al, 13 (50%) of the patients who underwent arthrodesis had persistent infection requiring additional revision surgery. Nineteen patients (73%) reported persistent pain after arthrodesis, and all patients showed significant deterioration in quality of life scoring measures [18]. The authors concluded that arthrodesis cannot be recommended according to AKA after septic failure of revision TKA [18]. Surgeons generally prefer amputation over arthrodesis for TKA infection [18]. Amputation is the last treatment option [13]. It may be the only treatment option in patients with life-threatening systemic sepsis [13]. In addition, amputation should be considered as a treatment option in patients with extensive soft tissue involvement, bone loss that is too extensive for arthrodesis, and persistent infection despite multiple unsuccessful attempts at infection control [13].

AKA is a definitive treatment to resolve infection in patients with persistent infection after TKA who have exhausted all treatment options and/or are not suitable for two-stage exchange arthroplasty or arthrodesis [19]. The incidence of above-knee amputation after primary TKA has been reported to be 0.10% [19]. Most patients who undergo above-knee amputation after TKA infection have low functional status, and only half of the patients are able to achieve independent ambulation [20]. Above- knee amputation should be used for the most severe cases of recurrent or persistent infection and only as a treatment of last resort [20]. As a result, infection developing after TKA is one of the most difficult complications that imposes great financial and moral burdens on the patient, the patient's family, the physician, the health system and society. Therefore, in order to reduce the risk of infection, it is very important that the patient is adequately and meticulously prepared before the operation, the operating room conditions are suitable, the surgery is meticulously performed, soft tissue damage is avoided, and wound problems that develop in the early postoperative period are effectively and rapidly treated. When infection inevitably develops in some patients, the diagnosis should be made without delay, the treatment method with the highest probability of success should be determined according to the patient's age, accompanying diseases, bone quality, soft tissue coverage and organism type, and the necessary effort should be made regularly to implement it in a timely and effective manner.

Author contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by MI˙, AYS, OK, HOA and HT. The first draft of the manuscript was written by MI˙, AYS, OK, HOA and HT and all authors commented on previous versions of the manuscript. All authors read and approved of the final manuscript.

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Conflict of Interest

The authors declare that they have no conflict of interest.

Ethical statement

The authors confirm that this retrospective study was conducted in accordance with the ethical standards set forth in the Declaration of Helsinki and its later amendments.

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