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Comparison of results of revision total knee arthroplasty surgery due to septic and aseptic loosening

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Abstract

The purpose of this study was to share the clinical, functional and radiological results of patients who underwent revision total knee arthroplasty (RTKA) for septic or aseptic loosening after total knee arthroplasty. 34 patients who were diagnosed with septic (n=19) or aseptic (n = 15) loosening after total knee arthroplasty and underwent single stage (aseptic group) or two-stage (septic group) RTKA surgery between May 2015 and June 2020 were analyzed retrospectively. Patients with septic loosening were checked again with clinical and laboratory evaluations for the second stage of revision surgery at the postoperative 3rd and 6th weeks. The changes in the joint line before and after the surgery were measured radiographically. The classification of the defects was performed by using the Anderson Orthopedic Research Institute criteria. Preoperative and postoperative Knee Society Score (KSS) was completed by all patients. KSS scores were a statistically significant increase observed in the postoperative values compared to the preoperative ones in both groups (p = 0.001). Moreover, there was a statistically higher increase observed among the aseptic loosening patients compared to the septic patients and the preoperative period in the KSS scores (p = 0.001). In terms of the preoperative distance between the fibular styloid and distal part of the femoral component used in the evaluation of the joint line, it was observed that postoperatively, there was a higher increase in among the patients with septic loosening TKA compared to the aseptic loosening TKA (p = 0.002). As a result, restoration of the joint line is a very important parameter in RTKA, and the increase in joint distance negatively affects the results clinically and functionally. Two-stage surgical treatment in septic loosening TKA is an effective and successful surgical method for the prevention reinfection.

Keywords: Total knee arthroplasty, septic, aseptic, loosening, revision

Introduction

Besides being a treatment method prevalently used in the advanced stage osteoarthritis treatment with reported 90-95% patient satisfaction rates, Total Knee Arthroplasty (TKA) is reported by the World Health Organization (WHO) as the invention of the 21st century [1].

Although 85-90% of patients have a functional knee for 15-20 years with TKA, approximately 5% of the patients undergo revision surgery during the early period due to septic or aseptic loosening [2,3]. While the revision rates within the four years after knee arthroplasty are reported as 3.5%, it increases to 4-8% in the first eight years [4].

Aseptic loosening is the most prevalent cause of revision, followed by septic loosening, prosthesis (implant) malalignment, periprosthetic fractures, and soft tissue problems [4].

Revision Total Knee Arthroplasty (RTKA) surgeries can be performed in one or two stages. While the revision of aseptic loosening TKAs is performed in a single stage, revisions of septic loosening TKA are generally performed as a two-stage revision surgery. Success rates with two-stage revision are reported to be between 80-100% [5].

In RTKA surgeries; extensive scar tissues, fibrotic soft tissues, extensive bone loss can make joint restoration difficult. In order to obtain good results in RTKA application, it is necessary to obtain the appropriate lower extremity axis, to place the implants in the appropriate position, to provide sufficient soft tissue balance in flexion and extension, to restore the joint line, to provide appropriate patellar axis, and to ensure the joint range of motion at a level that will meet daily life requirements [6].

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Our objective in this study was to share the clinical, functional and radiological results of patients who underwent Revision Total

Knee Arthroplasty (RTKA) for septic or aseptic loosening after TKA in our clinic. Moreover, our hypothesis was to show that patients in the TKA group with aseptic loosening were clinically and radiologically superior to septic patients after RTKA surgery.

Materials and Methods

Thirty four patients who were diagnosed with septic or aseptic loosening after TKA and who underwent single or two-stage RTKA surgery in the Department of Orthopedics and Traumatology at KSU Faculty of Medicine between May 2015 and January 2020 were included. Six patients who simultaneously underwent bilateral total knee arthroplasty, cerebrovascular disease (plegia), and high tendency for bleeding diathesis were excluded in the study. Files of the patients eligible for the study for this purpose were analyzed retrospectively. The patients were contacted again and their final clinical conditions, laboratory results, radiographic images and knee scoring were obtained. The study was conducted in line with Helsinki Principles; and the Ethics Committee of Kahramanmaraş Sutcu Imam University approved the study (Decided no: 10, date: 09/09/2020, session: 2020/17).

Patients

19 of the 34 patients had complaints on the right knee and 15 on the left knee. Antero-posterior (AP) and lateral radiographic images of the affected knees of all patients, who were diagnosed with aseptic or septic loosening after TKA and decided to undergo single or two-stage revision surgery, were obtained.

Erythema, pain and range of motion were evaluated clinically. Presence of leaking fistula openings was recorded. Erythrocyte sedimentation rate (ESR), C reactive protein (CRP), and white blood cell (WBC) values of all patients were examined in laboratory results. Joint aspiration was performed in necessary cases. Gram-giemsa stains, biochemistry analyses, and culture results of the aspiration fluid were requested. Preoperative and postoperative Knee Society Score (KSS) was completed by all patients.

Preoperatively, surgical prophylaxis was administered to all patients with 1g IV cefazolin 20 minutes before tourniquet was applied. Thromboembolism prophylaxis of the patients was performed with the administration of 0.4 cc low molecular weight heparin on the night before the operation. In addition, preoperative and postoperative infectious diseases were evaluated in patients who underwent RTKA for septic loosening.

First stage revision surgical technique

Septic-aseptic differentiation of cases was clinically determined by detection of the existence of pain, redness, temperature increase, swelling and drainage, and laboratory differentiation was determined by the use of have to change as 'WBC count, ESR rate and CRP value, joint puncture, frozen and tissue culture evaluations. Two-stage revision surgery was performed on 19 septic cases (55.9%) and single-stage revision surgery was performed on 15 aseptic cases (44.1%), differentially diagnosed using these evaluation criteria. Standard medial parapatellar approach was used in all cases.

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revision system implants were used to perform RTKA operations in TKA patients with septic and aseptic loosening in a single center by a single surgeon. In cases where single-stage revision surgery was performed, following the extraction of the prosthesis, debridement and taking tissue culture, the femoral and tibial components were fixed using antibiotic cement (Figure 1a, b). In two-stage RTKA surgery, after entering the joint for the first time, cultures were taken from the synovia and joint fluid from the patients with septic TKA. The insert was removed. The tibial and femoral components were extracted and cement and its remnants were cleared off. Soft tissue debridement was continued until no infected tissue remained. The surgical site was washed with 5 liters of saline solution. Afterwards, 40g of ready-to-use antibiotic cement (Gentafix (R) or BioFix 1G) or the spacer prepared with 250g Teicoplanin in 40g of cement was shaped by hand for one to fit the tibiofemoral space and one to fit the suprapatellar pouch. When it reached the freezing stage, they were placed under the applied longitudinal traction. The joint was re-washed. After the tourniquet was opened and bleeding was controlled, a hemovac drain was placed and the layers were closed appropriately (Figure 2a, b).



Figure 1a, b. Radiological AP-lateral images of TKA patient with aseptic loosening before (a) and after (b) revision TKA.

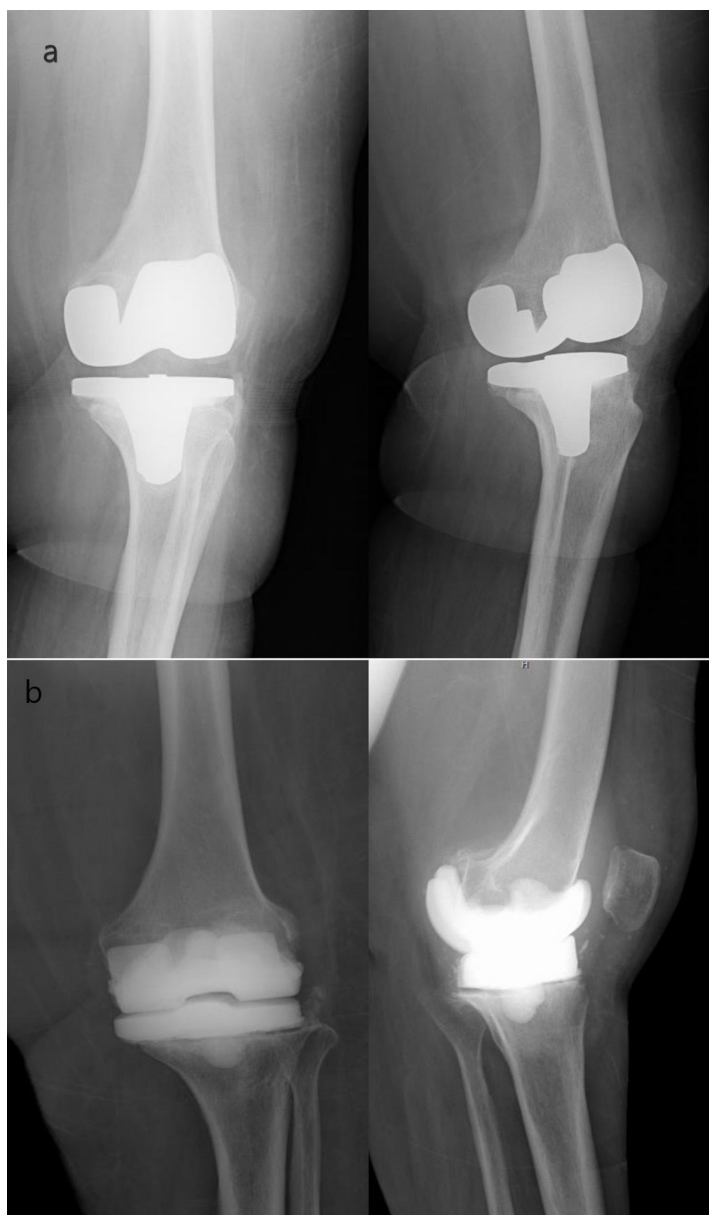


Figure 2a, b. Radiological AP-lateral images of before (a) and after (b) first stage revision surgery of TKA patient with septic loosening.

Postoperative care-1

Postoperative Jones bandage was used on the patients. Postoperatively, the patients were started on 1g IV cefazolin three times a day. On the second postoperative day, hemovac drains were removed and a degree-adjustable knee brace locked in extension was placed. The patients' wounds were dressed every other day. After the intraoperative culture results were obtained, patients were consulted to the department of infectious diseases and the antibiotherapy for the patients was arranged in line with the recommendations of the department of infectious diseases. Sutures of the patients were removed in an average of 15 days and concurrently, they were allowed mobilization with a knee brace, giving weight as much as they could tolerate the pain. Quadriceps strengthening exercises were shown to the patients.

Patients were called for follow-up at postoperative 3rd and 6th weeks. Clinical status of the knee, ESR, CRP, and WBC results were evaluated in follow-ups. At the end of the 6th week, revision

surgery (second stage) was decided for the patients whose infectious parameters regressed and whose infection had passed clinically, with the approval of the department of infectious diseases. All patients who were decided to undergo the second stage were prepared for surgery same as in the first stage.

Second stage revision surgical technique

The joint was opened by entering through the old incision. The previously placed antibiotic cements were removed. Dead tissues inside or outside the joint - if any - were debrided with careful attention being given to the presence of infection. These tissues were cultured. Gram-giemsa staining was performed on tissue samples of patients suspected of infection. Intraoperative evaluation was provided.

In the RTKA surgery, new implants were placed with the help of antibiotic cement. For bone defects in the femur and tibia; out of the cement, allograft, and metal support options, one was used according to the defect size. In the revision surgery of the patients whose patellar component was not changed in primary TKA application, patelloplasty and patellar denervation were performed. After the placement of femoral and tibial components, an insert was placed and stability was checked. A hemovac drain was placed and the joint capsule, the subcutaneous area and the skin were closed (Figure 2c).

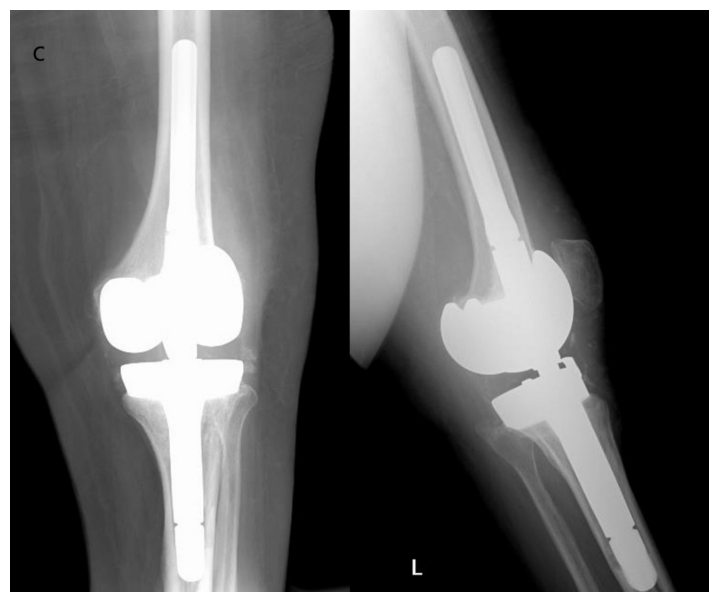


Figure 2c. Radiological AP-lateral images of after second stage revision surgery of TKA patient with septic loosening.

Postoperative care-2

The drain was removed on the second postoperative day, and afterwards, passive movement was started with the Continue Passive Motion (CPM) device. During the hospital stay, gradual knee flexion was starting from 50 degrees was applied up to the tolerable degree daily with the CPM device. Mobilization was allowed with weight on the extremity as much as it could be tolerated. After the culture results of the patients were obtained, the department of infectious diseases was consulted and the patients were discharged with the appropriate antibiotherapy. It was noted that discharged patients were able to be mobilized and able to bring their knees to 90° flexion. Discharged patients were

invited for outpatient follow-up 3 and 6 weeks later. In the follow-up, ESR, CRP, WBC results were evaluated along with bilateral radiographic imaging for loosening.

Radiological evaluation

Changes in the joint line before and after the operation were recorded radiographically, by measuring the distance between the fibular styloid and the distal part of the femoral implant. The distance between the medial epicondyle of the femur and the distal part of the femoral implant was measured and recorded for the radiological evaluation of the anatomical restoration of the femoral component [7]. The classification of the defects was carried out using the AORI (Anderson Orthopedic Research Institute) criteria [8].

Results

Demographic results of the patients

In this study, the mean age of the patients who underwent RTKA was 68.67 ± 7.41 years (55-85) and the mean follow-up period was 25.07 ± 8.04 months. The clinical and demographic data of patients diagnosed with septic or aseptic loosening after TKA

were presented in Table 1. Skin necrosis developed after RTKA surgery in one patient from the patients with septic loosening TKA. Debridement and skin grafting were performed and it was observed that there was no skin problem in the final follow-up of the patient. RTKA was performed for aseptic loosening reasons, most frequently due to osteolysis and prosthesis malalignment. Among TKA patients with septic loosening, Diabetes Mellitus (DM) was observed in 6 cases (31.7%), Hypertension (Ht) was observed in 4 cases (21%), Coronary Artery Disease (CAD) was observed in 4 cases (21%), Rheumatoid Arthritis (RA) was observed in 4 cases (21%), and Asthma was observed in one case (5.3%). In TKA patients with aseptic loosening, DM was observed in 2 cases (13.3%), Ht was observed in 5 cases (33.3%), CAD was observed in 5 cases (33.3%), asthma was observed in one patient (6.7%), and other comorbid diseases accompanied in two patients (13.3%).

Septic loosening period

Among the septic TKA patients in our study, early infection (within the first 3 months) was diagnosed in one case (5.3%), delayed infection (between 3 months and 24 months) was diagnosed in 5 cases (26.3%), and late infection (after 24 months) was diagnosed in 13 cases (68.4%).

Table 1. Demographic data of septic and aseptic loosening TKA patients

Parameters		Septic loosening TKA (n = 19)	Aseptic loosening TKA (n = 15)
Age, mean $\pm$ SD		68.9 ± 6.56	67.54 ± 5.37
Gender n (%)	Male	6 (31.6%)	4 (26.7%)
	Female	13 (68.4%)	11 (73.3%)
Side n (%)	Right	11 (57.9%)	8 (53.3%)
	Left	8 (42.1%)	7 (46.7%)
BMI, mean $\pm$ SD		31.2 ± 2.45	32.21 ± 2.01
Follow-up time (month), mean $\pm$ SD		23.08 ± 7.96	27.07 ± 9.13

Abbreviations: TKA; Total Knee Arthroplasty, SD; Standard Deviation, BMI; Body Mass Index.

Spacer and Revision Total Knee Arthroplasty surgery application period

In septic loosening TKA patients who underwent two-stage revision TKA; mean duration from primary TKA operation to knee spacer application was 56.84 ± 36.33 (3-120) months, and the mean duration from knee spacer application to RTKA operation was 3.94 ± 1.12 (3-7) months. In addition, two TKA patients with septic loosening with MRSA in culture had a second debridement-washing and spacer application due to the persistence of wound discharge and increased laboratory values after spacer application. In aseptic loosening TKA patients who underwent RTKA; mean duration from primary TKA to RTKA was 65.73 ± 32.38 (20-120) months.

Laboratory findings of septic loosening TKA patients

Culture growth was detected in only 12 out of 19 patients (63.1%) with septic loosening TKA. Methicillin-resistant staphylococcus aureus was observed in 2 cases (10.5%), methicillin-sensitive staphylococcus aureus was observed in 4 cases (21.1%), streptococcus was observed in 3 cases (15.8%), enterobacter

was observed in 2 cases (10.5%), and Gr (-) bacillus growth was observed in one case (5.3%). In the other 7 cases (36.9%), the absence of growth in the culture despite the pus coming from the knee joint was attributed to the patients previously receiving antibiotic treatments in their anamnesis.

Blood ESR, CRP and WBC values before knee spacer and revision TKA and at the final check-up of the patients, who had knee spacer and RTKA performed (two-stage revision surgery) due to septic loosening, were presented in Table 2.

Table 2. Laboratory results of septic loosening TKA patients

Parameters	Before knee spacer	Before Revision TKA	Last control
ESR (mm/hour) $\pm$ SD	68.68 ± 23.6	28.26 ± 12.9	29.36 ± 11.96
CRP (mg/L) $\pm$ SD	101.65 ± 38.74	7.93 ± 4.28	10.80 ± 7.33
WBC (109/L) $\pm$ SD	9.36 ± 2.56	7.34 ± 2.37	7.61 ± 2.24

Abbreviations: TKA; Total Knee Arthroplasty, SD; Standard Deviation, ESR; Erythrocyte Sedimentation Rate, CRP; C- Reactive Protein, WBC; White blood cell

Clinical and functional results

Preoperative and postoperative mean KSS Knee scores of all patients who underwent revision TKA were found as 39.5 ± 9.8 and 79.1 ± 9.4 , respectively and the mean KSS functional score was found as 36.1 ± 10.3 and 77.2 ± 9.7 , respectively, and there was a statistically significant increase observed in postoperative values compared to the preoperative values ($p = 0.001$).

Moreover, there was a statistically significant increase observed among patients with both septic and aseptic loosening TKA in knee and functional point scores, respectively, out of the Knee Society Score (KSS) evaluation criteria, and the increase was detected to be higher among the aseptic patients compared to the septic patients, and this was presented in Table 3 ($p = 0.001$).

In the evaluation of the defects of aseptic patients according to the AORI classification; F1 femur defect was observed in 7 cases (46.7%), F2A femur defect was observed in 6 cases (40%) and F2B femur defect was observed in 2 cases (13.3%) while T1 tibia defect was observed in 3 cases (20%), T2A tibia defect was observed in 7 cases (46.7%), T2B tibia defect was observed in 4 cases (26.7%) and T3 tibia defect was observed in 1 case (6.6%). A long stem was used in order to increase the stability of the tibial and femoral

components in all cases except for the cases with F1 defects in the femur. In the elimination of defects, metal supports were used most prevalently followed by cements and autograft bones.

In a patient diagnosed with septic loosening TKA, reinfection developed after two-stage revision surgery and no signs of infection were observed during the early period washing, debridement and final follow-up of appropriate IV antibiotic treatment. Thus, 94.7% success was achieved in two-stage RTKA surgery performed on septic loosening TKA patients.

Radiological results

It was observed that the difference between the postoperative and preoperative distance between the fibular styloid and the distal part of the femoral component used to evaluate the joint line was higher among the patients with septic loosening TKA compared to patients with aseptic loosening TKA ($p = 0.002$). Additionally, although it was observed that the distance between the medial epicondyle of the femur and the distal of the femoral component increased a little more postoperatively among septic patients compared to aseptic patients, this increase was not found to be statistically significant ($p > 0.05$) (Table 4).

Table 3. Knee Society Scores of septic and aseptic loosening TKA patients before and after revision TKA surgery

Knee Society Score		Septic Loosening TKA (n=19)	Aseptic Loosening TKA (n=15)	P value
Knee score, mean $\pm$ SD	Preoperative	34.31 ± 5.97	47.66 ± 10.69	0.001
	Postoperative	74.87 ± 8.31	87.91 ± 3.8	0.001
Functional score, mean $\pm$ SD	Preoperative	29.5 ± 8.35	45.25 ± 6.45	0.001
	Postoperative	73.5 ± 8.31	85.5 ± 3.42	0.001

Abbreviations: TKA; Total Knee Arthroplasty, SD; Standard Deviation

Table 4. Preoperative and postoperative joint line assessment measurements in septic and aseptic TKA patients

Joint Line		Septic loosening TKA	Aseptic loosening TKA	P value
Distance between lateral fibula process and distal femoral component (mm)	Preoperative	30.93 ± 2.40 (26-35)	29.16 ± 3.43 (23-33)	>0.05
	Postoperative	40.18 ± 3.42 (33-45)	36.16 ± 2.48 (33-41)	0.002
Distance between femoral medial epicondyle and distal femoral component (mm)	Preoperative	22 ± 1.24 (20-23)	21 ± 1.04 (20-22)	>0.05
	Postoperative	24 ± 1.36 (22-25)	23 ± 1.18 (22-24)	>0.05

Discussion

In recent years, the results of the TKA operation have been satisfactory and it is one of the most frequently performed operations with high patient satisfaction and price-performance balance. With the increasing TKA operations, complication and revision rates are increase as well [9,10].

After knee arthroplasty, revision rates were reported as 3.5% in the first four years, while this rate increases to 4–8% in the first eight

years. Aseptic loosening is the most common cause of revision, followed by septic loosening. Osteolysis, periprosthetic fractures, ligamentous laxity, prosthesis malalignment, extensor mechanism failure, patellofemoral problems, and instabilities due to soft tissue problems are observed as the causes of aseptic loosening [4]. In this study, we examined patients with septic and aseptic loosening, which are commonly observed complications of TKA. It was determined that RTKA was performed most frequently due to osteolysis and prosthesis malalignment out of the reasons for aseptic loosening.

Periprosthetic joint infections are the leading causes of RTKA. The infection rates in the literature are between 1% and 2% and vary depending on the patient population in the hospital, the surgery and the surgeon. It was shown that presence of additional rheumatologic and other diseases, diabetes, smoking, obesity, previous organ transplantation, previous knee surgery and the use of immunosuppressive therapy increases the incidence of periprosthetic infections [11]. In this study, septic loosening TKA patients had accompanying comorbidities compatible with the literature (5-32%).

Infection diagnosis is not always easy. Parvizi et al. identified 6 parameters in diagnosing infection. These are preoperative aspiration, sedimentation, CRP, serum white blood cell elevation, culture and histological examination [12]. In our study, we used these parameters to diagnose septic loosening TKA.

Studies have reported that the RTKA is most prevalently caused by infection within the first two years and instability after the second year especially in postoperative TKA loosening [13-15]. Periprosthetic joint infections (PJI) are divided into 3 sections according to the onset time; early infection (within the first 3 months), delayed infection (within 3-24 months), late infection (after 24 months). While early and delayed infections usually occur during the implantation of the prosthesis, late infections are predominantly formed by hematogenous spread. The most common sources of bacteremia are skin, respiratory, dental, and urinary tract infections [16, 17]. In a recent study involving 63 cases of PJI over a 16-year period, 29 percent of cases were early infections, 41 percent were delayed infections and 30 percent were late infections [18]. Another study observed infection types are as follows: 4 (18.18%) acute infection cases; 5 (27.72%) delayed infection cases; and 13 (59.09%) late infection patients [19]. In our study, early infection (within the first 3 months) was diagnosed in one case (5.3%), delayed infection was diagnosed in 5 cases (26.3%) (between 3 months and 24 months), and late infection was diagnosed in 13 cases (68.4%) (after 24 months).

The most common microorganisms causing PJI are observed as; Coagulase-negative staphylococci (30-43%), *S. Aureus* (12-23%), Mixed flora (10-11%), Streptococci (9-10%), Enterococci (3-7%), Gr (-) Basil (3-6%), Anaerobes (2-4%), No organism (11%) [16]. In our study, microorganisms close to the literature were grown in culture, and as the only difference from the literature, no microorganism growth was observed at a high rate (36.9%). In these 7 cases (36.9%), despite the presence of pus from the knee joint, the absence of growth in the culture was attributed to previous antibiotic treatments in the anamnesis of the patients.

There are methods in the treatment of septic loosening TKA including debridement and polyethylene replacement, single-stage revision, two-stage revision, arthrodesis, all the way to amputation. Among these treatments, the gold standard method is two-stage revision [5]. Success rates with two-stage revision are reported between 80–100% [5]. In our study, reinfection developed after revision TKA in 1 case, and a success rate of 94.7% was observed in two-stage RTKA.

Recently, there are publications stating that reinfection rates in RTKAs performed after septic loosening are up to 40%. Causes of re-infection include multi-drug resistance in bacteria,

previous unsuccessful revision surgeries, host unresponsiveness to treatment, and accompanying comorbidities [12, 20]. The risk of reinfection is increased in methicillin-resistant staphylococcus aureus infections and in the presence of culture-negative infections [21, 22]. There are studies showing that use of prophylactic antibiotics for 28 days after two-stage revision surgery reduces the risk of reinfection [23, 24]. In our study, Methicillin-resistant Staphylococcus aureus infection grew in joint fluid culture in a reinfection-related RTKA patient. In our study, antimicrobial prophylaxis was administered to all patients after RTKA to reduce the rate of re-infection (1 gr IV Cefazolin for patients weighing less than 80 kg, 2 g IV Cefazolin or 1.5 g IV Cefuroxime for patients weighing more than 80 kg) [25, 26].

It is important to fully understand the mortality risk of PJI patients undergoing a two-stage revision protocol. Mortality in this patient population varies widely in the literature, from 0% to 34% with various follow-up periods (0.25-9 years). In the study they conducted, Lum et al. found that the annual mortality rate of patients with PJI after TKA was 3.18%. In our study, no mortality was observed in the follow-up of septic or aseptic loosening TKA patients who underwent two-stage and single-stage revision TKAs [27, 28].

Knee Society Score is prevalently used for pain, functionality and clinical evaluation after RTKA. In a study conducted related to revision TKA, preoperative and postoperative KSS Knee scores were 34.0 and 41.6, while KSS functional scores were 64.2 and 60.2 [29]. In another study, it was determined that the average KSS knee score of 46.3 before revision increased to 84.3 after revision while the average functional score increased from 34.3 to 75.0 [30]. In our study, the preoperative knee score was 39.5±9.8 (20-60) and the functional score was 36.1±10.3 (10-55), postoperative knee score was 79.1±9.4 (61-88) and the functional score 77.2±9.7 (60- 88) and, therefore, slightly superior results were obtained compared to the literature. Moreover, a statistically higher increase was observed in the KSS scores among aseptic loosening TKA patients compared to the septic patients and the preoperative scores.

In the study on RTKA by Wirries et al., according to AORI classification in measuring intraoperative bone loss, femur Type 1 was observed in 10 (21.3%) patients while Type 2A in 13 (27.7%), Type 2B in 22 (46.8%), Type 3 in 2 (4.2%) patients and tibia Type 1 was observed in 2 (4.2%) patients while Type 2A in 20 (42.6%), Type 2B in 21 (44.7%), Type 3 in 4 (8.5%) patients [31]. In our study, the results in the evaluation of bone defects with the AORI classification were found to be partially similar to the literature.

Anatomical joint line restoration is necessary for obtaining successful results in RTKA application. The epicondyle of the femur, which is one of the reference points that can be used during the restoration of the joint line, is normally approximately 2-2.5 cm proximal from the joint line. During the revision of the femur, it should be aimed to keep the distance between the joint line and epicondyle within these limits by using grafts or metal supports to repair bone defects [30]. Secondly, the joint line is located approximately 10 mm proximal to the fibular styloid. There are studies reporting that the results are better among cases with less than 8 mm of joint line displacement. [32]. In our study, since the joint line was moved less than 8 mm in aseptic loosening TKA

patients, their clinical and functional outcomes were found to be superior to patients with septic loosening.

In the study conducted by Bilgen et al., the average distance between the medial epicondyle of the femur and the distal of the femoral implant, used for the evaluation of the joint line, was 23 mm before revision, while the average was measured to be 24 mm after the revision. In the same study, the average distance between the fibular styloid and the distal of the femur prosthesis was 31.5 mm while the average was measured as 40.5 mm after the surgery [30]. In the study conducted by Laskin et al., postoperative distance between the medial epicondyle of the femur and the distal of the femur prosthesis was found as 25 ± 3 mm [32]. In our study, the distance between the fibular styloid and the distal of the femur implant and the distances between the medial epicondyle of the femur and the distal of the femur implant, in the determination of the joint line, were found to be similar to the literature. We think that the distances in the determination of joint line being shorter among the aseptic patients compared to the septic group is related to the revision surgery being performed in a single session.

Complications such as infection, extensor mechanism complications, aseptic loosening, periprosthetic fractures, wound complications, and instability are prevalently observed after RTKA as well [33-35]. In the revision series of Rand et al. with 427 cases, the most prevalent cause of revision was inadequate fixation while abnormal alignment, component malposition, fractures and patella problems were reported as other causes of revision [35]. In our study, one patient reinfection was observed in a septic group and wound site problem was observed in one patient from the aseptic group and necessary treatments were performed.

A limitation of the current study could be considered to be the low sample size in the groups, but the number was appropriate according to the power analysis calculation. In addition, we think that some examinations in the joint fluid (CRP and D-dimer) in septic loosening patients may be useful in the follow-up of the disease and in the treatment phase and in future studies.

Conclusion

Restoration of the joint line is a very important parameter in RTKA and the increase in joint distance negatively affects the results, clinically and functionally. Two-stage surgical treatment is an effective and successful surgical method to prevent re-infection in septic loosening TKA. Since the patients are subjected to surgical operation twice in two-stage RTKA performed on septic loosening cases, more bone defects and a higher increase in the joint distance being observed compared to the aseptic loosening patients causes lower clinical and functional results.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

All authors declare no financial support.

Ethical approval

The study was conducted in line with Helsinki Principles; and the Ethics Committee of Kahramanmaraş Sutcu Imam University approved the study (Approval number: 10, date: 09/09/2020, session: 2020/17).

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