20 Infection Remediation in Unicompartmental Knee Arthroplasty

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Introduction

Unicompartmental knee arthroplasty (UKA) has increased in popularity, yet utilization by surgeons varies based on training, experience, or comfort level with the procedure. A recent analysis by Campi et al. estimated that, worldwide, only 10% of orthopedic surgeons perform UKA despite the operation growing in popularity and published 10-year survival rates above 90% for both mobile- and fixed-bearing systems [1–3]. With that said, joint replacement registries still show relatively high rates of revision and failure of partial knee replacements [4]. The most commonly reported modes of UKA failure are aseptic loosening, polyethylene dislocation with mobile-bearing systems, progression of adjacent compartment disease, and less commonly polyethylene wear and prosthetic joint infection (PJI) [5, 6].

The frequency of periprosthetic infection following unicompartmental knee arthroplasty is relatively low. Kim et al. reported on 1576 UKAs performed at their institution from January 2002 to December 2014. They reported a total of 89 complications, of which only five were infections (0.3%) [5]. Foran et al. reported on a single-institution series of 51 patients and 62 cemented, fixed-bearing UKAs. They reported a 10-year survivorship of 98%, 15-year survivorship of 93%, and 20-year survivorship of 90%. None of the failures or revisions were for a diagnosis of periprosthetic infection [7]. Hernandez et al. retrospectively reviewed 22 years of Mayo Clinic data and noted only 15 UKA infections out of a total of 1440 UKAs (1.0%) [8]. Lastly, Bergesen et al. published on 1000 consecutive medial UKAs, in which there was one stated infection (0.1%) [6]. Overall, the reported rate of UKA infection is estimated to be between 0.1% and 1.0% [8–11].

Patient Presentation and Diagnosis

A typical patient presentation is similar to that for a prosthetic total knee infection and should follow the same diagnostic algorithm. Hernandez et al. noted approximately one-third of their 15 infected UKA patients to present acutely post operation, one-third acutely with hematogenous seeding, and one-third as chronic infections [8]. Workup should include a thorough history and physical examination. Laboratory evaluation should include an ESR and a CRP. Of note, these baseline labs should be performed in all patients undergoing revision of their UKA to rule out infection as the potential etiology of failure. If either of these markers is elevated, or clinical suspicion is high,

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a synovial fluid aspiration should be performed and analyzed for white blood cell count, polymorphonuclear percentage with differential, and culture. To aid in the diagnosis of UKA PJI, the Society of Unicondylar Research and Continuing Education published a study with the optimal cutoff values for these tests. After evaluating 259 patients undergoing revision of failed UKA, they found the best test was synovial WBC of 6200 WBC/μL with 60% PMNs, followed by CRP of 14 mg/L and finally an ESR of 27 mm/hr. [12] Finally, a routine series of knee radiographs should also be obtained and carefully reviewed.

Management

Once the diagnosis of UKA infection is confirmed, the best method of management remains unclear. Unfortunately, given the limited data available, the best treatment option remains an area of debate. Options for management include debridement and implant retention (DAIR), one-stage exchange of UKA to TKA and two-stage exchange involving antibiotic spacer placement. Issues are apparent with each method and the risks and benefits are similar to those discussed during management of an infected TKA. However, unique to an infected UKA is the presence of native cartilage. With a UKA infection, the native cartilage surfaces are compromised, which may provide a nidus for continued infection, leading to subsequent chondrocyte necrosis and the potential for accelerated arthrosis of the contralateral compartments. Thus, given the potential for accelerated adjacent compartment disease, the utility of DAIR may be limited. However, this remains a potential treatment option in the setting of an acute infection. One-stage exchange to a TKA has reportedly been successful. In a small cohort of nine infected UKA cases, Labruyere et al. demonstrated success in all cases with a one-stage exchange to TKA, five of which occurred after a previous DAIR [9]. With only one case, Bohm et al. published success with a one-stage exchange to TKA [13]. One-stage exchange, much like DAIR, would involve a complete synovectomy, debridement of all infected tissue, resection of the UKA implant, and placement of a total knee replacement with a course of intravenous antibiotics. If a one-stage exchange is performed, it is the preference of the authors to perform the initial debridement and explantation, then remove all drapes and instruments, and use a second set of sterile drapes and equipment to perform the re-implantation. Surgeons should always have a revision knee system available with stems and augmentation in case of significant tibial or femoral bone loss is encountered.

Although difficult to define a gold standard in the treatment of UKA infection (given the limited data available), two-stage exchange comprising implant resection, bone cuts for a future TKA and removal of remaining cartilage, and placement of an antibiotic spacer (articulating or static) potentially has the highest likelihood of infection eradication. Hernandez et al. published a 100% infection-free survivorship at 5 years for UKA infections treated with two-stage exchange. They did, however, comment that one case had aseptic femoral component loosening at 5-year post re-implantation that required revision to stemmed components. In the same study, they reported a success rate of only 71% for infection-free survivorship at 5 years when the initial treatment was DAIR [8].

Regardless of the intervention chosen, UKA infection requires surgical intervention unless patient medical comorbidities are too significant to undergo anesthesia. All of these situations require a multidisciplinary team approach with medical optimization and consultation with an infectious disease specialist. There does not appear to be a recommended postoperative antibiotic protocol specifically for UKA infections. Currently, most providers are adapting their TKA PJI antibiotic protocols which we feel is the most reasonable approach. All of the above operative interventions should be followed by a tailored course of antibiotics directed by preoperative aspiration cultures, intraoperative tissue cultures, and sensitivity testing.

Conclusion

In conclusion, UKA infection is a relatively uncommon problem, and there is a paucity of cases and recommendations in the literature. Patients can present in any stage of the postoperative period, and it is important to perform a complete workup to assist in the diagnosis of infection. Once diagnosed, patient comorbidities as well as surgeon comfort and experience will undoubtedly and understandably play an influential role in the decision to proceed with DAIR vs. one-stage vs. two-stage intervention. It is important to recognize that although data are limited, DAIR does appear to have a higher rate of failure than one- and two-stage revision procedures. Both one- and two-stage procedures have shown success even in the setting of chronic UKA infection. Regardless, periprosthetic infection requires some method of surgical intervention and a multidisciplinary team approach including medicine and infectious disease specialists for perioperative management. The orthopedic surgeon will need to rely on their team to collaborate and determine the duration and type of postoperative antibiotics, as there is not a strong body of evidence to support any particular protocol.

Patient Case Report

Initial Presentation

A 73-year-old male presents to clinic 5.5 years from right lateral unicompartmental knee arthroplasty due to 3 days of right knee pain and swelling that started on vacation in Europe. The patient reported antecedent subjective fevers and chills prior to the onset of knee pain. He has a history of chronic sinus infections and had started to develop congestion, which he correlated with fevers and chills and started his "usual" treatment of azithromycin. When his knee pain began, he attributed this to increased activity while walking in Europe; however, they flew home the day before presentation and he began having difficulty weight bearing on the knee. He denied other injuries to the knee. He denied wound healing complications after surgery and had no antecedent knee pain prior to 3 days ago.

His medical history is significant for hypertension, gastroesophageal reflux disease, peptic ulcer disease, benign prostatic hyperplasia, hyperlipidemia, deep vein thrombosis in 2001 after being bedridden for spinal infection which was successfully treated with Eliquis, left renal cell cancer with subsequent nephrectomy in 2004 with subsequent chronic renal insufficiency, low-grade intra-abdominal lymphoma diagnosed in 2004 with current surveillance protocol per oncologist, descending aortic aneurysm diagnosed in 2007 that is currently stable, and he was told by a physician in Europe that his heart rate was irregular on examination the previous week, but he had no EKG confirmation or further workup and he has no history of irregular heart rhythm.

Physical Examination

He is alert and oriented with no acute distress. Upon inspection, his right knee appears swollen, with mild warmth and erythema circumferentially around his knee with an erythematous rash over the right lower leg, which he states has developed in the past 3 days correlating with his pain. A significant effusion is present, and ROM was restricted to 0–80 degrees and more painful at terminal flexion. He was otherwise neurovascularly intact with palpable pulses.

- Laboratory Evaluation
- Serum WBC 12.56 cells
- Serum ESR 36 (0–17 mm/hr)
- Serum CRP 110.6 (0.0–8.0 mg/L)

Imaging

Radiographs revealed a well-positioned lateral unicompartmental arthroplasty without radiolucent lines to suggest component loosening or migration (Fig. 20.1).

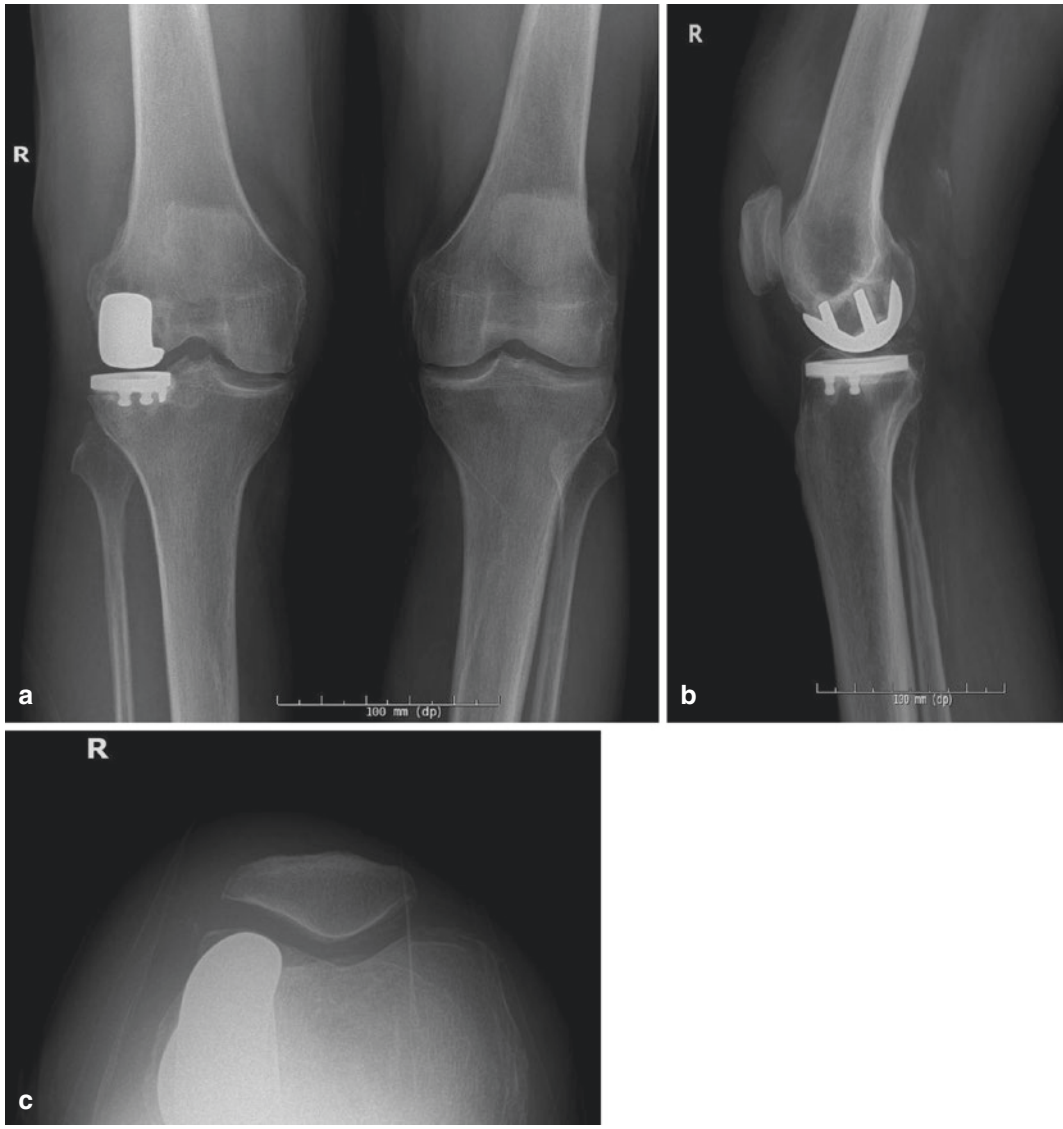

Fig. 20.1 (**a**–**c**) Preoperative radiographs (**a**) AP of bilateral knees, standing (**b**) Lateral view of right knee, and (**c**) Merchant view of right knee

Assessment

With his history, physical examination, and elevated inflammatory markers, we were concerned for possible prosthetic joint infection. An aspiration of his knee was performed, which showed the following:

- Synovial WBC: 63,320 cells with 95.5% PMN
- Synovial RBC: <1000 cells

We felt this was consistent with an acute infection and after discussion of the risks and benefits and surgical options with the patient we chose to perform and DAIR (debridement with implant retention) with polyethylene insert exchange. Patient was admitted to the hospital and surgery was performed the next day to allow for medical evaluation and optimization.

Intraoperatively, the patient was found to have a completely intact retinaculum. A small initial

arthrotomy was made to suction out the joint as much as possible and prevent infected fluid from spreading into the surrounding tissues. This was followed by a complete arthrotomy to allow for complete irrigation and debridement. The polyethylene liner was removed, and the components were irrigated and scrubbed with a brush to attempt to eradicate any bacterial glycocalyx. The contralateral compartments did not show any evidence of softening or cartilage loss. After copious irrigation, we placed the same thickness polyethylene insert back into the knee and closed.

Follow-Up

The infectious disease service directed intravenous antibiotic treatment. The patient ultimately had no growth on cultures from both the aspiration and intraoperative tissue, and it is possible that the azithromycin may have compromised the cultures. Culture-negative infections are not ideal, and in this case, the patient was treated with 6 weeks of IV vancomycin. This antibiotic was chosen due to concomitant lower extremity cellulitis, which led the infectious disease physician to believe this is more than likely a gram-positive infection. His cellulitis improved quickly with treatment as well, which was reassuring. After his IV vancomycin course was completed, the patient was kept on a 6-month history of doxycycline. Apart from antibiotics, the patient was monitored with postoperative visits and laboratory evaluation. He is feeling well, wound healed well, and his ROM is now 5–120. His ESR and CRP normalized by 2 weeks postoperatively and have remained within normal limits on subsequent evaluation.

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