CURRENT CONCEPTS REVIEW

Painful Unicompartmental Knee Arthroplasty: Etiology, Diagnosis and Management

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Abstract

Unicompartmental knee arthroplasty (UKA) is an increasingly common procedure. Patients with persistent or new postoperative pain can present a challenge for surgeons to accurately diagnose and treat. The purpose of this study is to provide a comprehensive review of the presentation, diagnosis, and management of the various pathologies contributing to pain after UKA. The most common causes of a painful UKA include aseptic component loosening and progression of osteoarthritis. Both of these conditions may be treated with either revision UKA or conversion to total knee arthroplasty. While technically challenging, these procedures are often associated with favorable outcomes. Other causes of pain after UKA include infection, atraumatic tibial component subsidence, periprosthetic fracture and malalignment. Careful clinical, radiographic, and laboratory evaluation is therefore critical to accurately identify the source of pain and guide appropriate management.

Level of evidence: V

Keywords: Complications after UKA, Knee arthroplasty, Painful UKA, UKA, Unicompartmental knee arthroplasty, Unicondylar knee arthroplasty

Introduction

Unicompartmental knee arthroplasty (UKA) is an increasingly common procedure used to treat isolated patellofemoral, medial and lateral compartment arthritis of the knee. Compared to total knee arthroplasty (TKA), UKA offers several benefits including superior functional outcomes, improved gait kinematics, cost efficiency and fewer adverse events.[1-9] The annual volume of UKAs performed in the United States is expected to grow 85% to 1.26 million procedures by 2030.[10-12] Unicompartmental knee arthroplasty is utilized widely in Europe as well, with nearly 50% of surgeons in the National Joint Registry for England and Wales offering the procedure.[5] UKA survivorship has improved significantly since it was first introduced, however, it remains inferior to that of TKA with reported 10-year survival rates of 77-97% compared with 88-94% for TKA.[2,13-17] The risk of revision in UKA at mid-term follow-up was shown to be 34% higher than TKA in the younger population (ARR 1.34; CI 1.23-1.47; P<.001) and 165% higher in patients over 65 (ARR 2.65, CI 2.33-2.97; P<.001).[2]

Successful UKA is achieved through a multifaceted approach involving careful patient selection, meticulous surgical technique and effective postoperative management. Appropriate patient selection is particularly crucial but remains controversial,[18-22] and individual surgeon volume has been shown to play a significant role in postoperative outcomes.[23] There are multiple etiologies of pain following UKA.[18,19,22,24,25] Based on data from a French multicenter study, almost half of all UKA failures occur within the first five years postoperatively and 19% occur within the first year, resulting in 1% of patients requiring conversion to TKA annually.[26] Overall, early failures (<5 years) are most frequently attributed to aseptic loosening (36%), whereas mid-term (5-10 years) and late-term (>10 years) failures are most commonly caused by progression of osteoarthritis in the native compartments (38% and 40%, respectively), though it is important to note that failure mechanisms may vary with implant design.[27] Although the precise etiology of failure may be difficult to diagnose and treat, outcomes following revision are reportedly similar to primary TKA and potentially superior to revision TKA.[28,29] Discerning the etiology of painful UKA

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can be challenging given the range and complexity of possible causes. Therefore, the purpose of this review is to provide a concise, evidence-based description of the etiology, evaluation and management of the painful UKA.

Clinical Evaluation

History

The workup of a painful UKA begins with a thorough history and physical examination. The onset of pain in relation to the surgical date and exacerbating and mitigating factors are particularly important. Early postoperative pain, defined as onset within 5 years of surgery, may be due to technical error resulting in retained cement, fracture, intraarticular sources of impingement or periprosthetic joint infection.[30,31] In the late postoperative period with onset greater than 5 years after index surgery, acute-onset pain may be traumatic in nature whereas an insidious onset may suggest infection, tibial subsidence, wear or progression of osteoarthritis.[32] In particular, it is critical to precisely characterize the complaint, differentiating pain, stiffness, instability and swelling. Infection should always be considered and ruled out prior to considering other diagnoses. While timing of onset of pain is important to consider when working up a painful UKA, it remains paramount that providers categorize the pain according to anatomic location: Intra-articular, peri-articular or extra-articular. The various causes of these pathologies will be highlighted in the differential diagnosis section below.

Physical exam

The physical exam should include evaluation of the knee, spine, and hip. The operative knee should be examined for signs of infection including erythema, effusion, drainage, and sinus tracts. Range of motion, ligamentous stability, and patellar tracking should be assessed as well. Areas of tenderness frequently assist in diagnosis and should include the joint lines, proximal tibia, iliotibial band, patella, and pes anserine bursa. Overall limb alignment and gait should be analyzed for varus or valgus malalignment.[33] The hip and spine, including a neurologic exam, should be assessed for sources of referred knee pain, such as hip arthritis and lumbar radiculopathy.

Imaging

First-line imaging includes a complete set of plain knee radiographs including standing anteroposterior, lateral, merchant, and fixed-flexion weight-bearing posteroanterior views. Alternatively, supine positioning may be necessary if patient is unable to bear weight on the affected extremity secondary to pain. Radiographs should be standardized by aligning the beam with the tibial prosthesis (tray and wall). Serial radiographs are particularly important for workup of a painful UKA to allow for interval comparison. Ideally, immediate postoperative radiographs are available with which to compare subsequent radiographs. These are most useful to assess for implant positioning, stability, periprosthetic fracture and progression of osteoarthritis. Benign physiologic radiolucent lines may be seen in more than 62% of cases, so comparison to immediate postoperative films is important to evaluate for component loosening and progression of arthritis.[34,35] Standing mechanical axis films can be useful to evaluate for malalignment, and hip and lumbar spine radiographs are helpful to assess potential sources of referred pain. Advanced imaging may be useful in select cases, but may be limited due to metal artifact. Computed tomography (CT) imaging is generally recommended when there is concern for loosening or significant osteolysis. Magnetic resonance imaging (MRI), particularly using metal artifact reduction, is useful for evaluating progression of osteoarthritis with nondiagnostic x-rays, synovitis, retained meniscus, stress fracture, and neoplasm.[36]

While aseptic loosening and progression of osteoarthritis are the most common modes of failure associated with UKA, there are many etiologies that can lead to a painful UKA. These can be divided into intra-articular, peri-articular and extra-articular pathologies, which help to frame the diagnostic workup. In the following sections, common causes of painful UKA are described in respect to anatomic location, as well as the respective clinical evaluation and management.

Intra-articular Pathology

Painful UKA secondary to intra-articular pathology typically presents with pain localized to the knee joint. Patients describe a deep pain that is often worse with activity. Depending on the pathology, pain may be more confined to a specific compartment, such as the contralateral compartment or patellofemoral joint in the setting of osteoarthritis progression. Patients may report a feeling of stiffness secondary to an effusion, which is often associated with intra-articular pathology.

Aseptic Loosening

Aseptic loosening is the most common mode of early failure, accounting for 26-45% of failures.[26,37] Overall rates of aseptic loosening have been cited as high as 18%, however modern implant designs have seen lower rates of loosening, between 1.5%-3.7% within the first decade and 0.9%-2.25% beyond 10 years.[15,38-42] Loosening of the tibial component is more common than the femoral component.[26] Radiographically, aseptic loosening is suspected with progression of radiolucent lines or component migration on plain films. CT can provide additional information such as degree of bone loss. Infection should always be ruled out with laboratory markers and, if indicated, synovial fluid analysis.

Patient risk factors for aseptic loosening include younger age, obesity and significant varus deformity.[43,44] Mechanical factors that impart increased stress to the tibial component and may contribute to loosening include malalignment, deformity overcorrection, joint line alteration, excessive tibial slope, and ACL deficiency.[27,45] Despite several studies reporting higher revision rates with all-polyethylene designs, a systematic review performed by Costa et al showed that metal-backed tibial components failed to reduce the risk of early aseptic loosening when compared with all-polyethylene components.[27,44,46-48] Mobile-bearing and single peg UKA designs appear to be at increased risk of aseptic loosening, however, revision rates between fixed and mobile-bearing designs are not significantly different.[27,34,49-54] Mohammad et al reported on registry data from England which showed that in mobile-bearing implants, cementless fixation demonstrates lower long-term revision rates compared to cemented fixation (HR 0.92 (CI 0.83-1.01, P = .08). Moreover, the authors found a 3-fold lower incidence of aseptic loosening in patients younger than 60 (0.5% versus 1.6% [P < .001]) and a 4-fold lower incidence in patients between 60-69 years (0.4% versus 1.3% [P = .002]).[55] Results from registry studies suggest that aseptic loosening is best managed with conversion to TKA; however, revision medial UKA has been successfully utilized in patients with acute loosening, intact cruciate ligaments, and no evidence of disease progression in the lateral and patellofemoral compartments.[56-59]

Progression of Osteoarthritis

Progression of osteoarthritis is the most common cause of mid-to-late term failures, accounting for 15-50% of failures.[15,26,27,37] The UKA revision rate for arthritis progression is estimated between 1-9% at long-term follow up.[15,41] Patients often complain of chronic, activity-related pain in the affected compartment with evidence of osteoarthritis on plain films. Most commonly, the contralateral compartment is affected, but progression of patellofemoral arthritis should be considered. In a recent retrospective review of 52 fixed-bearing medial UKAs with 4-year minimum follow-up, 3 (5.8%) knees developed isolated grade 4 patellofemoral arthritis.[60] Patient risk factors that contribute to progression of osteoarthritis include inflammatory arthritis, higher American Society of Anesthesiologists (ASA) score and obesity.[43,48,61] The condition of the lateral compartment immediately postoperatively is also significantly prognostic of lateral osteoarthritis progression when medial compartment arthroplasty is performed.[62] Careful operative technique is essential to minimize the risk of arthritis progression as overcorrection of the mechanical axis in fixed-bearing designs will place increased load on the adjacent compartment. Similarly, mobile-bearing designs may be at increased risk of osteoarthritis progression if the compartment is excessively tightened to avoid mobile bearing dislocation.[63] A hip-knee-ankle angle greater than 180˚ or tibiofemoral angle greater than 5.5˚ have been linked to progressive lateral compartment osteoarthritis after fixed-bearing medial UKA.[62,64,65] Likewise, in fixed-bearing medial UKA designs, raising the medial joint line >2mm relative to the lateral side decreases tibiofemoral joint contact forces and can increase stressors on the contralateral compartment, contributing to arthritis progression.[66,67] Several studies have demonstrated larger bearing size to be an independent risk factor for osteoarthritis progression.[65,68,69] A recent systematic review found that fixed-bearing implants were 1.5-fold more likely to lead to lateral compartment osteoarthritis than mobile-bearing implants.[27]

The preferred treatment of symptomatic adjacent compartment osteoarthritis is revision to TKA.[43] There may also be a role for modular unlinked bicompartmental knee arthroplasty. A conversion from unicompartmental to bicompartmental arthroplasty has been described in the following configurations: an index patellofemoral arthroplasty (PFA) with later unicondylar arthroplasty and vice versa, and an index medial UKA with subsequent lateral UKA.[38,70,71] Despite the relative paucity of data related to this approach, promising short- and mid-term results have been reported with better functional scores and patient-reported outcomes compared to TKA.[63,72,73]

Infection

Infection, albeit uncommon, is a devastating complication following any arthroplasty and UKA is no exception. Infection accounts for 5-7% of UKA failures and tends to occur in a bimodal distribution, with most infections occurring within the first five years or after 10 years.[27] The rate of infection following UKA is 0.2-1%, slightly lower than reported in TKA.[74] UKA periprosthetic joint infection (PJI) carries the unique risk of native chondral damage and thus requires urgent diagnosis and management.

Diagnosis of UKA PJI can be made based on a combination of clinical and laboratory data. Pain, swelling, erythema and painful knee range of motion are clinical signs of possible PJI, which, if present, should trigger arthrocentesis and synovial fluid analysis. Schwartz et al examined 26 infected UKAs to establish proposed cutoffs for inflammatory labs (ESR: 27mm/h, CRP: 14mg/L) and synovial fluid analysis (6200 white blood cells/μL and 60% polymorphonucleocytes).[75] Staphylococcus, S. aureus, group B Streptococcus, E. coli, and P. acnes are among the most commonly isolated organisms.[74,75] Held et al performed a retrospective review of 11,806 patients undergoing UKA and found that operative duration more than two hours was a significant risk factor for developing surgical site infections (odds ratio: 1.76) when compared to duration <90 minutes.[76] Mobile-bearing implants were associated with a higher incidence of infection compared to fixed-bearing (6% vs. 2%, P=0.001), surmised from data from an international systematic review consisting of 37 cohort studies and 2 registry studies.[27] Management of acute UKA infections consists of irrigation, debridement, polyethylene liner exchange and antibiotics. Chronic infections require irrigation and debridement with antibiotic spacer placement followed by antibiotics and conversion to TKA at a later date.[43] Lubuyere et al proposed an alternative to two-stage revision, instead utilizing a synovectomy, one stage conversion to TKA and 3 months of antibiotics with good functional outcomes and no recurrence of infection at 5 years.[74]

Bearing Dislocation

Bearing dislocation, a complication unique to mobile-bearing implants, accounts for 1.5-4.6% of UKA failures, ranking as the third most common cause of early term failure.[27,37,52] Bearing dislocation has been reported at a much higher rate (~32%) in the Asian population secondary to diminished bearing stability in extreme knee flexion.[77-79] Frequent deep knee bending can lead to late term failure due to erosion of the posterior lip.[80] Dislocations are more prevalent in lateral compartment UKA given the increased laxity of the lateral collateral ligament, increased native translation in the lateral compartment due to convexity of the lateral tibial condyle and medial femoral rollback during flexion.[27,37,81-84] The medial compartment is susceptible to instability in the setting of unbalanced flexion/extension gaps, medial collateral ligament (MCL) laxity or injury, and component malposition with impingement of the insert on adjacent bone.[78,85] Regarding technical factors, less than 8.5° of posterior tibial slope postoperatively or a >2.2° decrease from the preoperative slope are associated with an increased risk of dislocation.[86] Soft tissue releases should be avoided in UKA because they can lead to ligament tension imbalance and dislocation.[87] Management of bearing dislocation consists of revision UKA with fixed-bearing or conversion to TKA.[43]

Polyethylene Wear

Improvements in polyethylene wear properties and UKA implant design have reduced the rate of polyethylene-related complications; however, polyethylene wear still accounts for 4-14% of UKA failures.[27,88,89] The majority of cases present as a late mode of failure, with a 10-year incidence around 10-12%, but early cases of catastrophic polyethylene failure report an incidence <1% based on data from an international systematic review.[27,90-94] Patients may complain of chronic, slowly progressive pain in the operative compartment and knee effusion, and radiographs may show loss of mechanical alignment and decreased polyethylene thickness.

Technical factors that lead to polyethylene failure include component malposition and under-correction of deformity.[27,92,95] Implant factors associated with failure include polyethylene thickness <6mm, fixed-bearing design, and polyethylene manufacturing flaws which can lead to intra-articular particulate debris and periprosthetic osteolysis.[27,92] Tibiofemoral implant surface subluxation, often a result of anterior cruciate ligament attenuation or ligamentous laxity, concentrates force over the peripheral aspect of the tibial component, the thinnest aspect of the polyethylene liner, further contributing to wear.[93] Management of polyethylene failure consists of polyethylene exchange or revision to TKA.

Instability

Tibiofemoral instability is a relatively uncommon cause of UKA failure or postoperative pain, accounting for 2.5-5.6% of failures based on data from an international systematic review.[27] It occurs predominantly in the early postoperative period (<5 years).[27,39] Instability tends to cause failure more frequently in fixed-bearing rather than in mobile-bearing implants.[27] Instability can be managed conservatively with physical therapy for dynamic strengthening. Operative management consists of exchanging the polyethylene liner for a larger size to stabilize the tibiofemoral joint or conversion to TKA.

Peri-articular Pathology

Painful UKA due to peri-articular pathology often presents as a localized pain outside of the knee itself. Fracture and subsidence can result in pain in the proximal tibia or distal femur, depending on where the pathology occurs. The pain is typically worse with activity. Pain secondary to soft tissue impingement will often localize to the anatomic structure that is compromised. Patients may note that the pain is more superficial than the classic “deep” knee pain that is described in intra-articular pathology.

Arthrofibrosis

Arthrofibrosis, or abnormal scarring of the joint with the formation of dense fibrous tissue, most commonly presents with pain, stiffness and restricted range of motion in the knee. Thankfully, it is a rare cause of failure after UKA, seen in only 0.5% to 1.0% of UKAs and accounting for only 3.1% of failures, based on recent data out of a single institution in the United States.[39,89,96] Despite its low incidence, arthrofibrosis is an important cause for pain requiring secondary procedures in the early postoperative period. Management of arthrofibrosis includes manipulation under anesthesia in the acute postoperative period (usually less than 12 weeks after surgery).[97] In late cases of arthrofibrosis persisting or appearing longer than 12 weeks from surgery, arthroscopic lysis of adhesions has been effective in restoring motion in total knee arthroplasty, however there is a paucity of data on its effectiveness in UKA and further research is necessary.[98]

Tibial Subsidence without Fracture

The most common cause of periprosthetic failure following UKA is tibial subsidence, accounting for 3.6-10.4% of UKA revisions according to results from a multicenter study conducted in France.[26,99] Tibial component subsidence, or collapse of the tibial metaphyseal bone, is primarily attributed to implant loosening. This is typically seen as a late complication and is more common in elderly patients, suggesting osteoporosis as a potential risk factor.[99,100] Tibial collapse is diagnosed radiographically by migration of the implant and is distinguished from periprosthetic fracture by the absence of fracture lines. Medial UKA is more often implicated given increased load forces.[43] Increased tibial slope generates increased stress across the tibial plateau and can contribute to collapse.[100] Fixed-bearing, all-polyethylene tibial components have increased contact stress forces at the anterior and medial tibia, which contribute to an increased incidence of collapse through edge loading.[101] Depth of tibial resection and the surface area of the tibial component are theorized to increase the risk of tibial collapse, but have not been demonstrated as significant risk factors in the literature.[100] Management of tibial collapse often requires revision to TKA to address implant loosening and may require cement, augments, cones, and stems depending on the amount of bone loss, status of adjacent knee compartments, and degree of deformity.[28,85,102-104]

Periprosthetic fracture

Periprosthetic fracture following UKA is a rare but devastating complication. The overall incidence is reported between 0.1-1.2%, based on institutional data from South Korea.[85,105,106] Kim et al reported on 1576 UKAs and found no periprosthetic fractures in 24 lateral UKAs versus 6 fractures in 1552 medial UKAs.[85] Five of these were tibial fractures with only one femoral-sided fracture. Given the relative rarity of lateral UKA, there is only one reported case of periprosthetic fracture.[107]

Fractures after UKA occur predominantly in the proximal tibia, rather than the distal femur as may be observed following TKA. Risk factors for periprosthetic fracture include over- or under-sized tibial components, poor bone quality, increased BMI, advanced age, female gender, and improper bone cuts.[105,108-110] Fractures have been observed in relation to stress risers associated with pinholes used to affix tibial cutting guides and/or robotic-assisted guiding arms.[110] The sagittal tibial cut and horizontal cut can create a stress riser if too much bone is resected or the sagittal cut extends past the desired resection, leading to fracture. Clarius et al performed a cadaveric study in which a 10° extended sagittal tibial cut significantly reduced the loading capacity of the tibial plateau (3.9 vs. 2.6 kN, $p<0.05$).[111] Tibial component mismatch or malpositioning may play a role in fracture development as well. A large tibial tray generates greater force on the tibial plateau with flexion, whereas a small tibial component concentrates stress over a small and eccentric region of the plateau.[109] Peripheral placement of the tibial component is important to prevent impingement with the anterior cruciate ligament; however, this can also lead to a metaphyseal tibial fracture due to decreased bone support. Periprosthetic femur fractures are rare, but have been reported.[105,109,112] Iatrogenic fracture can result from posteriorly-directed femoral component impaction, generating a shear force across the distal femoral metaphysis.[63] Similarly, a vertical shear force to a flexed knee is considered the most common mechanism of coronal plane fractures of the femoral condyle in cases of high-energy trauma.[63]

Patients with iatrogenic periprosthetic fracture will present with pain in the early postoperative period. Late fractures are more commonly associated with trauma, but fractures can occur spontaneously in patients with osteoporosis or deficient tibial metaphyseal bone support. Radiographs can be confirmatory and, in cases of late periprosthetic fracture or subsidence, comparison to prior films can be valuable.

Management of periprosthetic fractures is guided by the degree of fracture displacement and component stability. Any evidence of component migration on serial radiographs or CT suggests implant loosening. Non-operative management with restricted or protected weightbearing in a hinged knee brace or long leg cast is a reasonable option for nondisplaced fractures with well-fixed components, particularly in elderly, low-demand patients.[112] Displaced fractures with stable components may be treated with isolated open reduction and internal fixation.[113,114] For medial tibial plateau fractures, a buttress plate is preferred.[114] Regardless of displacement, any periprosthetic fracture with component loosening requires conversion to TKA, which often requires stems, bone graft, and augments.[110,112]

Soft tissue Compromise

A goal of unicompartmental knee arthroplasty is to preserve as much native tissue as possible to maintain proprioception and natural kinematic motion about the knee joint. While significant effort is made to minimize bony resection and soft tissue releases, medial UKA has been shown to cause stiffening of the medial compartment, resulting in valgus deformity and increased stress on the MCL.[115,116] This is attributed to differences in stiffness between the cartilage-cartilage interaction in the lateral compartment and the metal-polyethylene interaction in the medial joint space. Additionally, overstuffing the medial compartment can lead to MCL strain, increasing the risk of attenuation or failure.[115] Fixed-bearing UKA may help preserve MCL laxity as implantation often allows for a 2mm tension gauge while mobile-bearing UKA requires increased tension to minimize risk of bearing dislocation.[117] Less common causes of soft-tissue compromise following UKA include anterior and posterior cruciate ligament tears, contralateral compartment meniscal tears and synovial impingement.[39,118] Management of MCL strain can be treated with a period of immobilization in a hinged knee brace. If the cause of the strain is thought to be related to an oversized polyethylene component, the liner can be downsized. Finally, conversion to TKA is indicated when there is an identifiable source of pain that does not resolve with conservative management or revision UKA.

Extra-articular Pathology

Painful UKA attributable to extra-articular pathology can be difficult to characterize. In the case of malalignment, patients may describe pain in the knee if the contralateral compartment experiences increased joint reactive forces. Additionally, patient's may report subjective stiffness or difficulty with activities such as ascending and descending stairs. Pain that extends outside of the area of the knee should clue the examiner to consider extra-articular pathologies. Radiating pain to the hip and groin should prompt an evaluation of hip osteoarthritis. Radiating pain to the back or pain reproduced with straight leg raise should prompt an evaluation of the lumbar spine. Finally, neuropathic pain in which there is no identifiable cause typically presents as allodynia, or pain out of proportion to exam which may or may not be reproducible.

Malalignment

Failure to achieve optimal alignment can lead to pain following UKA. As discussed above, malalignment, particularly in the setting of fixed-bearing implants, can contribute to aseptic loosening, progression of osteoarthritis, bearing dislocation and ligamentous laxity. Patients typically report insidious onset of knee pain which is often diffuse but can be localized to a particular compartment in the case of osteoarthritis progression. Full-length standing films should be obtained and compared to pre-operative films to assess any alterations in mechanical axis. Varus malalignment ≥10° increases anteromedial cortical bone stress.[119] In cases of malalignment resulting from overstuffing of the operative compartment, revision to a smaller polyethylene component can be effective. However, depending on the degree and etiology of malalignment, conversion to TKA may be necessary.

Unexplained pain

Unexplained knee pain accounts for approximately 23% of UKA revisions, according to registry data from England and Wales. This is substantially more than the 9% estimated revision rate of TKA due to unexplained pain.[120] Calkins et al reviewed 77 fixed-bearing medial UKAs in patients with a mean follow-up of 11.2 years, of which 9.1% were revised for unexplained pain.[60] Unexplained pain is commonly associated with all-polyethylene tibial designs, which increase loading on the tibia, resulting in perpetual bone remodeling and increased risk of tibial collapse.[121] While unexplained pain may be due to various intra-articular pathologies, including loose bodies, cement extrusion, and meniscal tears in the native compartment, there are several extra-articular etiologies that can generate knee pain, including joint malalignment, referred pain from the spine or hip, peripheral neurovascular disorders, and chronic regional pain syndrome.[63] Management of unexplained pain following UKA is surgeon-specific and requires a diligent workup to prevent misdiagnosis, including exhausting all potential diagnoses and performing a thorough psychiatric evaluation. Treatment of hip or spine pathology is recommended ahead of revision knee procedures if there is any question that pain could be referred. Currently, there is no consensus regarding the indications or timing of revision UKA for unexplained knee pain, however revision surgery for this indication should be withheld for a minimum of at least two years. Revision UKA or conversion to TKA is unlikely to be successful without an identifiable etiology. Concerningly, surgeons likely have a lower threshold to intervene in patients with a painful UKA compared to TKA, since conversion of a UKA to TKA is often less technically challenging that revising a TKA.[120] In cases of neuropathic pain in which there is no identifiable cause, it is important to refer patients to a pain specialist who can further characterize factors that influence pain and provide directed treatments to relieve pain.

8 Cases

Case 1

A 64-year-old male presented nine months following a left medial UKA complaining of new-onset medial knee pain. Over the previous two months, he developed medial knee pain that was initially exacerbated by running and eventually led to a limp. He also noted increasing knee stiffness and swelling. On exam, he had no signs of infection or ligamentous laxity. Examination of the hip and lumbar spine was similarly unremarkable. Radiographs showed a progressive radiolucent line beneath the tibial component concerning for loosening and no evidence of osteoarthritis progression [Figure 1]. After failure of conservative management and a negative infectious workup, he underwent isolated tibial component revision. His knee pain resolved, and he was able to return to running by 4 months postoperatively.

Case 2

An obese 52-year-old male (BMI 34.3) presented seven years after right medial UKA with three months of gradually increasing right knee swelling and diffuse pain exacerbated with activity. He had returned to high demand activities, including running, hiking, and heavy weightlifting. On exam, he had a large effusion and increased valgus laxity. Radiographs demonstrated thinning of the medial clear space concerning for polyethylene wear but no evidence of osteoarthritis progression [Figure 2]. He underwent revision UKA with polyethylene exchange and experienced significant improvement in his symptoms.

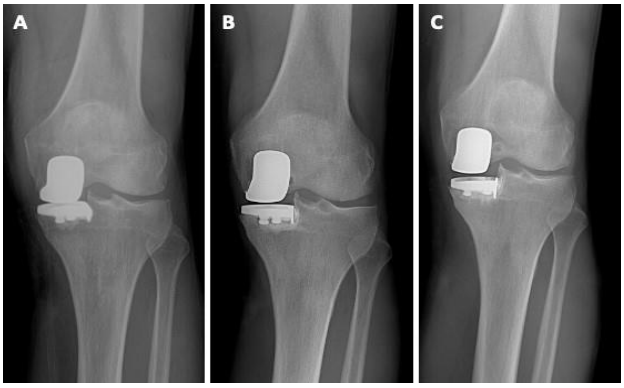

Figure 1. Standing anterior-posterior left knee radiographs of the patient described in Case 1. (A) Three weeks after primary medial UKA with well-fixed components. (B) Nine months postoperatively, the patient developed a radiolucent line beneath the tibial component suggestive of loosening. (C) Three weeks after revision of the tibial component with well-fixed components

Figure 2. Standing radiographs of the right knee. Anterior-posterior (A) and lateral (B) views 3 weeks after primary medial UKA. Anterior-posterior (C) and lateral (D) views 7 years postoperatively with medial clear space narrowing and anterior tibial subluxation concerning for polyethylene wear. Radiographs one month following revision UKA with polyethylene exchange (E and F) showing improved medial compartment alignment

Case 3

A 58-year-old male presented to the emergency department one month after left medial UKA with one day of left knee pain, swelling and erythema. He was febrile to 103˚F with a dry incision and pain with short arcs of motion of the left knee. Arthrocentesis revealed synovial white blood cell count 203,000 with 87% polymorphonuclear cells and gram-positive cocci in pairs, consistent with PJI. The patient was taken to the operating room urgently for irrigation, debridement and polyethylene liner exchange [Figure 3]. Vancomycin and cefepime were initiated empirically and later transitioned to IV Ceftriaxone and Levaquin for six weeks after intra-operative cultures grew Group G Streptococcus. An infectious disease team was involved and the patient was prescribed PO Cefadroxil 1g BID for one year postoperatively, at which point ESR and CRP were within normal limits. The patient continues to do well three years postoperatively.

Conclusions

UKA offers patients with unicompartmental knee osteoarthritis a treatment alternative to TKA that has a faster return to activity and fewer adverse perioperative events. Despite an increased risk of revision with UKA compared to TKA, surgical volume is expected to increase at a rate several times that of TKA.[122, 123] When evaluating a patient with a painful UKA, it is imperative to collect a detailed history, paying particular attention to the onset and chronicity of the pain. Physical exam and serial radiographic analysis can help confirm a diagnosis. While aseptic loosening and progression of osteoarthritis are the most common reasons for knee pain following UKA, there are several diagnoses mentioned in this text which are important to consider [Figure 4]. Appropriate diagnosis is critical to guide treatment and improve patient satisfaction and outcomes following UKA.

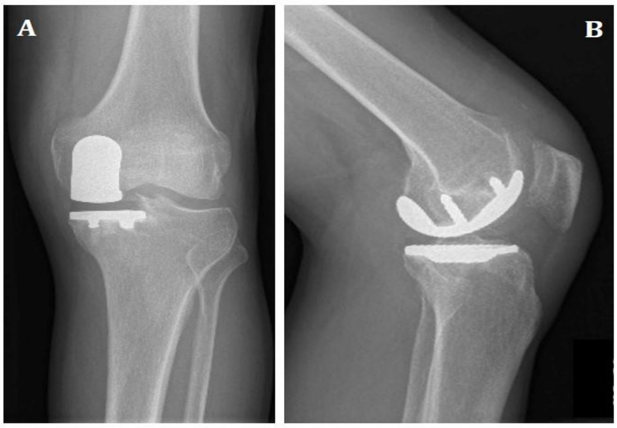

Figure 3. Supine radiographs of the left knee. Anterior-posterior (A) and lateral (B) views 1 month after primary medial UKA. Images demonstrate components in proper position with a moderate knee effusion

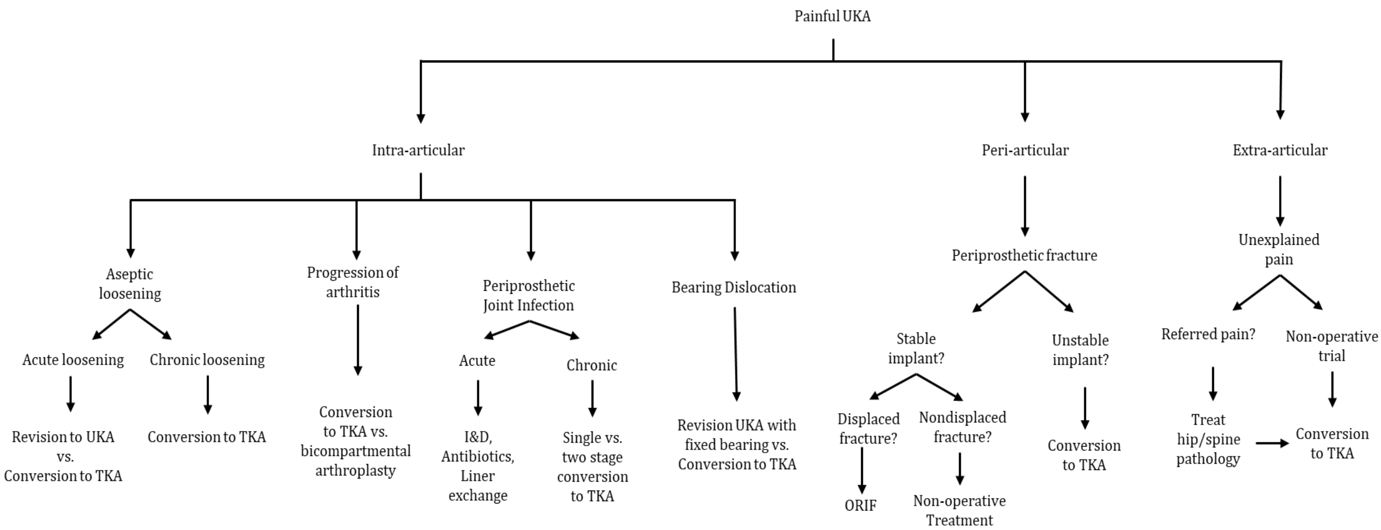

Figure 4. Flowchart showing the management pathway for the most common causes of painful UKA

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