Review

The Role of Arthroscopic Intervention for Symptomatic Total Knee Arthroplasty

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Advances in component design, instrumentation, and operative technique have contributed to the continuing success of total knee arthroplasty (TKA) with 15-year survival rates of >90%.1-3 Despite the high success rate of this procedure, complications and failures exist. Some complications after TKA can be assessed arthroscopically.

Complications that can be managed by an arthroscopic intervention include patella-related complications, arthrofibrosis, loose bodies, aseptic prosthetic loosening, polyethylene wear, infection, postoperative hemarthrosis, and problems due to pseudomeniscal, retained posterior cruciate ligament (PCL), retained meniscus, popliteus tendon, and other soft-tissue structures.

Prior to arthroscopic intervention, assessment of a symptomatic TKA must include a detailed history and physical examination, appropriate imaging, and laboratory testing. The patient’s medical record is reviewed, and appropriate examinations are performed to rule out postoperative complications such as sepsis and septic/aseptic loosening. Anterior knee pain, patellofemoral

crepitus, swelling, loss of motion or stiffness, popping, and catching or clunk of the patellar component are the most common symptoms that may indicate arthroscopic assessment.4-7 Delayed diagnosis is common in these patients, and the duration of symptoms prior to arthroscopy varies from 1 month to 5 years (average: 15.6 months).4-7

Standing anteroposterior and lateral radiographs are necessary for evaluation of axial alignment and the position of the components. Merchant views of the patellofemoral articulation are obtained for assessment of patellar malalignment, tilt, and subluxation. Patellar position and the level of joint line is determined to assess the presence of patella alta or baja using the method described by Figgie et al.8

Plain radiographs, bone scans, and knee joint aspiration with cytologic examination, fluid cultures, and metal or polyethylene debris tracing will help the orthopedic surgeon diagnose the underlying cause of the problem. Nonoperative treatment such as physical therapy and modalities, muscle strengthening, and nonsteroidal anti-inflammatory medications is recommended initially, but is unsuccessful in most conditions.4,5,9,10 When the cause of the problem remains unknown, arthroscopic intervention can be beneficial for diagnosis and treatment.

From 1986-1999, 366 knees in 354 patients who underwent arthroscopic evaluation for symptomatic TKA were found in the literature. Generally, arthroscopy following TKA is not a common procedure and has been performed in 0.01%-1.73%15 of TKAs.
Surgical Considerations

There are special considerations related to arthroscopy in a replaced knee joint. The procedure is performed under general anesthesia through two standard portals, the anterolateral and anteromedial, using a 30° arthroscope. In addition to the basic principles of arthroscopic procedure, special care must be taken to avoid scratching or gouging the knee arthroplasty implants with the arthroscope.6,7,11 The level of the joint line may vary after TKA and must be correctly identified to protect the metal and polyethylene components during insertion of the arthroscope. Additionally, light reflecting off the metal femoral component can be difficult to deal with, and problems with orientation may arise because of the reflection and a mirror-like effect.7

Each knee compartment is inspected both statically and during knee range of motion for soft-tissue impingement. In such cases, a superolateral portal is used to introduce instruments to resect the soft tissue. The superolateral portal also can be used to assess patellar tracking. In most cases, additional portals are unnecessary.6 However, Wasilewski and Frank11 suggested four or five anterior portals in patients with arthrofibrosis because the synovial pouch is severely constricted. The central portal must be excluded because a thick tibial component can raise the level of the joint line and create a functional patella baja.7

Routine instrumentation used includes arthroscopic forceps, scissors, and a motorized shaver. Most surgeons prefer using a tourniquet. A suction drain may be necessary for 24 hours postoperatively.7 All patients must receive prophylactic intravenous antibiotics for 24-48 hours preoperatively. Supervised postoperative physical therapy is recommended based on the underlying diagnosis.

Indications

Patellar-Related Complications

Patellar “Clunk” Syndrome. This syndrome is characterized by the formation of a fibrous nodule at the junction between the proximal patellar pole and quadriceps tendon.12 According to Hozack et al.12 this fibrous nodule may be complicated with impingement of the anterosuperior edge of the intercondylar notch area of the femoral component into the proximal quadriceps tendon or impingement of the patellar button itself into the quadriceps tendon. The fibrous nodule lodges into the femoral component intercondylar notch during flexion and displaces with an audible and painful clunk at 30°-45° from full extension (Figure 1).

Additional complaints of anterior knee pain may be present when walking down stairs. Pain is associated with the “clicking” symptom and increases gradually. Diminished postoperative motion is not common in this condition as in arthrofibrosis and “tethered” patellar syndrome.5

The etiology of this fibrous tissue creation has not been defined and has been reported to result from inflammation at the quadriceps insertion. Patellar clunk syndrome has been noted after TKA with a posterior-stabilized prosthesis such as an Insall-Burstein II knee prosthesis (Zimmer, Warsaw, Ind) due to its design with a shallow femoral sulcus and a sharp transition into the femoral box.13,15 This explanation was not supported by Lucas et al.6 who stated that if the design of the prosthesis was the only etiologic factor in the development of this fibrous formation, recurrence of the nodule formation would be expected after removal. Although the prosthesis was not changed, no recurrences occurred in these patients.13,15 Patellar height, patellar thickness, and alteration of the joint line may be predisposing factors of this problem.8,16,18 The exact role of these factors is not well defined. However, there is agreement in the literature that elevation of the joint line should be minimized, patellar height should be maintained between 10 and 30 mm,8 and the thickness of the patella after resurfacing should be equal to the thickness of the patella preoperatively.16,17

Open excision of this fibrous mass is successful in most cases.12 Open resection can be performed through a limited lateral incision under local anesthesia.18 Currently, most authors recommend arthroscopic removal of the nodule.6,6,13,14,19 Studies involving arthroscopy of the clunk prosthetic knee included relatively few patients; therefore, the efficacy of arthroscopy for treating this problem is not well defined. Beight et al14 reported successful arthroscopic management relief of patellar clunk syndrome in 7
Tethered patella syndrome is associated with painful popping, catching, or grinding with a visible jump or catch of the patellar component with active knee extension (type I and type III) or flexion (type II). Mild range-of-motion limitation is noted in these patients.5

There are no apparent predisposing factors for the development of the fibrous bands. Trauma, faulty prosthetic design, errors in operative technique, or previous operations have not been reported as predisposing factors.5

Grossly, the fibrous bands resemble mature scar tissue that do not completely cover the surfaces of the patellofemoral joint but interfere with patellar motion during extension or flexion. Microscopic analysis of the biopsy specimens of these fibrous bands consistently demonstrates mature dense fibrous tissue.10

Arthroscopic removal of fibrous bands results in immediate and sustained relief of symptoms in most patients.4,5,6,10,20,21 The range of knee motion may not change after arthroscopic treatment5 or may improve slightly.10 There are no complications associated with the arthroscopic removal of these bands, and recurrence is uncommon.10

Tethered patella syndrome can be readily diagnosed and treated arthroscopically. The excellent long-term results have established the efficacy of arthroscopic resection of the intra-articular bands.4,5,7,9,10

Patellar Malalignment. Certain problems associated with patellar malalignment after TKA can be avoided with meticulous operative technique. Patella tracking should be carefully evaluated with all components in place.

Arthroscopic management of patella maltracking problems after TKA is strongly recommended.7,9,22 In patients with patellar subluxation after TKA, arthroscopic lysis of the parapatellar adhesions and lateral retinacular release is followed by symptom resolution (Figure 3).

Patellar Polyethylene Fracture. Polyethylene fracture of the patellar component can cause knee locking and pain after TKA. Bayley et al23 were unable to establish the underlying diagnosis in 32% of their patients who had patellar polyethylene failure diagnosed during revision surgery. Thus, arthroscopy is recommended for the suspected loosening, wear, or fracture of the polyethylene patellar component.11

Arthroscopy establishes the diagnosis and is a much less invasive procedure for early diagnosis, preventing the necessity of complete revision TKA.11

Patellar Component Loosening. Loose patellar components may be sus-
pected on follow-up radiographic evaluation. In low-demand patients not amenable to patellar revision, arthroscopic removal of the loose patella button through an enlarged superior portal is feasible. The remaining patellar bone is shaped (patellectomy) with an arthroscopic shaver and burr.

**Arthrofibrosis**

Arthrofibrosis is defined by the formation of intra-articular adhesions resulting in a stiff joint. The exact cause of arthrofibrosis remains unknown. This complication occurs after reconstructive knee surgery such as TKA, anterior cruciate ligament reconstruction, prolonged immobilization, or trauma. Arthrofibrosis is a progressive condition and consists of a dense band of scar tissue hugging the posterior medial aspect of the mobile meniscal bearing, along with an intercondylar area filled with hypertrophic synovium, resulting in a contracted joint space.

Clinical presentation includes knee stiffness and pain. Treatment options include aggressive physical therapy, manipulation under anesthesia, and open or arthroscopic debridement.

Many authors recommend arthroscopic management of arthrofibrosis in patients without identifiable component malposition and no response to physical therapy 3 months after TKA. Arthroscopic lysis of adhesions followed by manipulation under anesthesia provides significant pain relief in these patients. In a series by Diduch et al., the rate of success in relief of symptoms without recurrence was 63%.

Arthroscopic management appears promising for arthrofibrosis with regard to improvement in range of knee motion and subjective pain reduction. However, some authors estimate that the satisfactory results are temporary, and they note poor final outcome with progressive deterioration of knee motion with time.

Supervised physical therapy is recommended after arthroscopic debridement including a continuous passive motion (CPM) machine for at least 4-6 weeks. Continuous physical therapy is started the day of arthroscopic arthrosis. Van Mourik et al reported good results with a longer period of CPM. Court et al reported major loss of motion occurs within the first days following arthroscopic release. They recommend the use of regional anesthesia for arthroscopy and continuation of pain control with epidural anesthesia allowing intensive postoperative mobilization of the knee. Bae et al reported the arthroscopic benefit in their series was due to the additional special instrumentation. They used specially made metal bars for easier arthroscopic adhesion release and prevention from damaging the arthroscopic instruments. However, only a small number of patients had arthrofibrosis in their study.

There are other extra-articular factors that also can result in restriction of motion that cannot be managed with arthroscopy. Despite the diagnostic capability of the arthroscopic assessment of arthrofibrosis, the therapeutic value remains controversial. Arthroscopic lysis of adhesions may facilitate manipulation under anesthesia and gain knee motion.

**Loose Bodies**

Loose bodies in TKA include retained foreign materials such as pieces of polymethylmethacrylate, polyethylene fragments, or soft-tissue pieces. In the majority of cases, loose bodies are pieces of polymethylmethacrylate. Arthroscopic removal of loose bodies is an efficient procedure and provides prompt relief of the symptoms after removal of all foreign materials.

**Aseptic Prosthetic Loosening and Polyethylene Wear**

A number of patients with problematic TKA may benefit from diagnostic arthroscopy for prosthetic loosening, polyethylene wear, or both. Arthroscopic evaluation includes the presence and location of loosening and wear and the delamination or dissociation of the components. Aseptic loosening and wear usually are most extensive on the medial side of the tibial component. Surface wear and plastic deformation of the tibial polyethylene appear to be a function of component design, thickness, patient weight, activity level, and duration of time the component has been implanted. Tibial component fracture and polyethylene dissociation are rare.

Most patients will require revision surgery after arthroscopy. However, arthroscopy allows accurate diagnosis of loosening and wear, provides temporary symptomatic relief, and facilitates preoperative revision planning. Early arthroscopic diagnosis may lead to revision of one component instead of a complete revision and prevent metal-on-metal rubbing, which necessitates revision of all components.

**Infection With or Without Loosening**

In few patients, the clinical picture
may be suggestive of an infectious process; however, an infection cannot be confirmed despite numerous aspirations for culture, routine laboratory blood tests, and radiographic and radionucleide imaging. Arthroscopy allows synovial biopsy and cultures that could establish the diagnosis of infection. Infection was the underlying diagnosis after arthroscopic assessment of a painful TKA in 3%-15% of cases. Revision TKA is required after the diagnosis of the infected TKA. In these cases, arthroscopy appears to be a procedure with minimum morbidity and it does not compromise any future procedures that may need to be performed for an infected TKA such as arthrodesis or revision TKA.

Hemarthrosis

Hemarthrosis is a rare postoperative complication of TKA. It also can be a result of trauma. In both situations, arthroscopic resolution of hemarthrosis by identification and electrocoagulation of the bleeding sites resolves the preoperative symptoms.

Other Conditions Causing Impingement

Other soft-tissue related problems due to pseudomeniscus, retained PCL, retained meniscus, and popliteus tendon can cause impingement in TKA.

Pseudomeniscus. The exact origin and nature of pseudomeniscus remains uncertain. This can be a normal response to the excised meniscus after TKA. The configuration is similar to that of a normal meniscus, and histologic examination reveals a unique fibrocartilaginous structure. The pseudomeniscus may extend from the capsule at the periphery of the joint, interposing between the femoral and tibial components, as the knee comes into full extension resulting in subluxation and pain. Although pseudomeniscus may be present in many patients, it rarely causes symptoms because its small size is incapable of leading to subluxation. Symptomatic pseudomeniscus in TKA is successfully treated by arthroscopic debridement.

Retained Posterior Cruciate Ligament. Persistent pain following TKA due to a retained PCL is an uncommon complication. In four reported cases, arthroscopy revealed a retained PCL stump impinging between the femoral notch and cam mechanism. Arthroscopic debridement effectively relieved pain in three of four knees.

Retained Meniscus. Retained posterior horn of the lateral meniscus may result in symptoms because of its luxation as a bucket handle tear into the joint. Arthroscopic resection leads to an immediate relief in reported cases. Despite the small number of cases of symptomatic prosthetic knee pain due to retained lateral meniscus, osteophytes, and PCL, these tissues must be removed during the entire bicondylar surface replacement.

Popliteus Tendon. According to Allardye et al, the popliteus tendon may cause a "snap" condition when it rolls over a retained femoral condylar osteophyte or subluxates over the posterior condyle of the femoral component. This painful condition is well recognized and treated arthroscopically. Symptoms usually are relieved after arthroscopic release of the popliteus tendon.

Unknown Pain

The diagnostic value of arthroscopy following TKA is still controversial. van Mourik et al suggested performing arthroscopy in patients with a symptomatic TKA is not indicated if physical examination or radiographic studies have not yielded a preoperative diagnosis. In a series by Boccell et al, 24 (45.2%) arthroscopies were performed for only diagnostic purposes with no significant symptomatic improvement. In another study, at an average follow-up of 19.9 months, 27.5% of knees developed recurrent symptoms after arthroscopic intervention. Generally, the rate of failure to form a diagnosis after arthroscopic evaluation varies from 2.5%-18.5%.

Complications

No arthroscopic-related complications were noted in most of the reported series. However, a 6% infection rate was reported in one series after arthroscopic intervention for symptomatic TKA.

Conclusion

Arthroscopy is a valuable procedure for assessment of painful TKA. Certain conditions appear to constitute the principal indications for arthroscopic intervention including patellar-related complications, removal of loose bodies, hemarthrosis, and problems due to soft tissues such as pseudomeniscus, retained PCL, retained meniscus, and popliteus tendon. Relative indications for arthroscopy include patellar polyethylene fracture, patellar component loosening, arthrofibrosis, aseptic prosthetic loosening and polyethylene wear, infection with or without loosening, and unknown pain.

In patellar polyethylene fracture, patellar component loosening, aseptic prosthetic loosening, and polyethylene wear, arthroscopy remains a much less invasive surgical modality for early diagnosis and may prevent the necessity of complete revision TKA. In arthrofibrosis, arthroscopy may improve motion with various maintenance of the improvement. A painful knee replacement without evidence of significant major intra-articular pathology or with an unclear preoperative diagnosis does not respond well to arthroscopic assessment.

Arthroscopy after TKA is not a common procedure and must be performed on carefully selected patients. Technical difficulties include risk of damaging the polyethylene or metal components of the implants. Accessory portals should be used to obtain full visualization without forcefully manipulating the joint or the arthroscope. Advantages of the arthroscopic procedure such as visualization of all compartments, low morbidity, decreased postoperative disability, and reduced risk of infection predominate over arthroscopy.
REFERENCES