Arthroscopic Arthrolysis for Arthrofibrosis of the Knee after Total Knee Replacement

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Abstract *Background* Arthrofibrosis is an uncommon but potentially debilitating complication following total knee replacement which can result in chronic pain and poor recovery of range of motion. The treatment of this condition remains difficult and controversial. *Questions/aims of study* We reviewed our results of arthroscopic arthrolysis of arthrofibrosis of the knee after total knee replacement to assess the potential for this technique to improve range of motion and provide improvement in knee function and pain as measured by the Knee Society Score (KSS). *Methods* Eight patients were treated for arthrofibrosis after total knee replacement with arthroscopic management. The patients included five females and three males. The average age was 67.4 years. Initial rehabilitation efforts, which included manipulation under anesthesia, had failed. Arthroscopic arthrolysis was performed to release fibrous bands in the suprapatellar pouch and to reestablish the medial and lateral gutters. Lateral release of the patellar retinaculum was performed. Intensive physiotherapy and continuous passive motion began immediately post-operatively. The average follow-up was 37.4 months. The KSS was used for assessment of pain and function before arthroscopy and at the latest follow-up. *Results* Six of the eight patients

experienced improvement in the KSS. The average functional score showed improvement from 68 points pre-operatively to 86 at the time of final follow-up. The average pain scores improved from 30 points pre-operatively to 41 at the time of final follow-up. *Conclusions* Arthroscopic management can be beneficial for patients suffering from arthrofibrosis following total knee replacement. Pain and KSS clinical scores can markedly improve.

Keywords arthrofibrosis · total knee replacement · arthroscopic management · knee stiffness

Introduction

Chronic pain and stiffness occurring after total knee Arthroplasty (TKA), are frustrating for both the patient and the surgeon [16]. Overall, stiffness is defined as an inadequate range of movement that results in functional limitations [12]. The criteria for assessing stiffness requiring surgical treatment is defined as having a flexion contracture of 15° or flexion of less than 75° [6]. After total knee arthroplasty (TKA), there is a relatively small group of patients who develop a painful joint with suboptimal range of motion despite accepted surgical technique and good radiographic appearance [4]. Arthrofibrosis, defined as abnormal scarring of the joint in which the formation of dense fibrous tissue and tissue metaplasia prevent normal range of motion, is an uncommon complication of primary TKA [1]. It is thought to be caused by excessive fibroplasia, which results in the formation of adhesions that constrain the extensor mechanism [11]. Arthrofibrosis develops in approximately 3–4% of patients undergoing TKA, and the resulting pain and loss of range of motion leads to patient disability [5, 15].

Arthrofibrosis responds poorly to treatment, which may include physiotherapy, aggressive pain management, manipulation under anesthesia, arthroscopic debridement, and revision surgery with exchange of prosthetic components [9, 14, 16]. Manipulation under anesthesia is

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Level of Evidence: Level IV: Therapeutic Study

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commonly tried but has significant risk, including complications such as distal femoral fracture and patellar tendon rupture. Open arthrolysis is a more invasive option but allows a wide access to the anterior and posterior aspects of the joint. The arthroscopic approach is a less invasive approach that has been advocated for both focal, discrete lesions as well as for more global arthrofibrosis. The procedure involves release of fibrous adhesions within the suprapatellar pouch and re-establishment of the medial and lateral gutters. Lateral patellar retinacular release is also performed [2]. Post-operatively, aggressive pain management using peripheral nerve blocks and intensive physical therapy are necessary [3, 9].

Arthroscopic arthrolysis of TKR diagnosed with post-operative arthrofibrosis has been used in our institution since 2005. The purpose of this study was to evaluate the clinical and functional results of arthroscopic management in patients with arthrofibrosis after total knee replacement. Specifically, we wished to assess the potential for this technique to improve range of motion and provide improvement in knee function and pain as measured by the Knee Society Score (KSS).

Patients and Methods

This retrospective case series reviewed the results achieved following eight arthroscopic releases performed on eight patients who had developed arthrofibrosis following primary total knee replacement. For the purposes of this study, arthrofibrosis was defined as abnormal scarring of the joint in which the formation of dense fibrous tissue and tissue metaplasia prevent normal range of motion. All patients were treated between 2005 and 2009. All patients were diagnosed with arthrofibrosis because they exhibited one or more of the following clinical findings: lack of patellar mobility, flexion contracture, tight retinaculum (lateral and medial), pain, and stiffness. We excluded all cases of stiffness secondary to infection, poor sizing of the implants, mechanical malalignment, or loosening of the implants.

The average age of the patients was 67.6 years (ranged from 62 to 73 years). The patients included in this study were five females and three males. The average follow-up was 37.4 months (ranged from 24 to 52 months; Table 1). The interval between the initial TKR and the arthroscopic release was, on average, 9.6 months (range, 8–18 months).

The main complaints of the patients were limited range of motion. All eight patients showed an extension deficit with an average of 27.5° (10–45°) and pain at activities of daily living or pain at rest. Radiographic examination revealed no abnormalities including radiolucent lines consistent with loosening, malposition of the joint line, heterotopic ossifications, abnormal position of the patellar malalignment of the implants, especially malrotation.

All patients first underwent a trial of conservative treatment before undergoing arthroscopic management without improvement. The indications of arthroscopic arthrolysis were: stiffness and unusual amounts of pain and swelling after total knee replacement in the absence of infection, bleeding, or mechanical complications.

The use of regional epidural anesthesia and the placement of an indwelling epidural catheter were performed for intra-operative and postoperative analgesia. Diagnostic arthroscopy was done for all patients, and other causes of stiffness were excluded. The eight stiff knees were treated with arthroscopic debridement of fibrous tissue around the patella and quadriceps tendon (to improve extension) and by arthroscopic division of the medial and lateral retinacula (to address flexion). A gentle manipulation was carried out following lysis of adhesions, using a slight pressure on the tubercle to avoid fractures and disruptions of the extensor mechanisms. A nonsterile tourniquet is applied on the operative thigh, the extremity is prepped and draped in a standard fashion, and the leg is exsanguinated, and the tourniquet inflated.

An inflow cannula into the knee through a superolateral portal and the knee is maximally distended with saline. This keeps the joint distended and facilitates insertion of the arthroscope through the standard inferolateral portal. In severe cases, it is often difficult simply to insert the arthroscope. A standard inferomedial working portal is then established. Although the camera sheath can be used to manually release adhesions, we prefer to use electrocautery. The excision of adhesive bands and scar tissue is performed in a systemic fashion starting in the suprapatellar pouch. If the pouch is severely scarred, normal landmarks may be difficult to appreciate. Next, adhesions in the medial and lateral gutters are addressed. Often, one can see the adhesions that have formed between the capsule and the femoral condyles. Insertion of a shaver into the inferomedial portal provides access for debridement of the lateral and medial gutters.

Table 1 Patient data

Patient	Age (years)	Sex	Preop. diagnosis	Preop motion (degrees)	Postop motion (degrees)	Follow-up (months)
1	62	M	Arthrofibrosis	45–85	5.0–100	33
2	66	F	Arthrofibrosis	60–90	15–100	40
3	73	F	Arthrofibrosis	15–85	0.0–120	52
4	68	M	Arthrofibrosis	15–90	10.0–97	25
5	70	F	Arthrofibrosis	20–85	0.0–110	24
6	64	M	Arthrofibrosis	15–90	5.0–100	33
7	67	F	Arthrofibrosis	30–85	10–100	42
8	71	F	Arthrofibrosis	20–90	0.0–105	50
Average	67.6	M/F 3/5		27.5–87.5	5.6–104	37.375

The infrapatellar fat pad and pretibial recess are next inspected. We release and mobilize the infrapatellar fat pad from the anterior tibia and re-establish the pretibial recess. A lateral release of patella is performed. The superior lateral geniculate vessel should be preserved if possible. Flexion and extension are again re-evaluated at this point. If a loss of extension or flexion persists intraoperatively, every attempt should be made to regain this motion before leaving the operating room. The tourniquet is released at this time, and meticulous hemostasis is obtained. Suction drains are placed to decrease the occurrence of post-operative hemarthrosis, which can contribute to both pain and flexion contractures. The drain is typically left in place for 24 h.

Postoperative rehabilitation begins in the recovery room, displaying the motion gain to the patient and family while the patient's pain is still controlled. Physical therapy is initiated the day of surgery, reinforcing the motion gain to the patient. This protocol emphasizes the maintenance of knee extension using prone heel hangs and isometric quadriceps-strengthening exercises. Patellar mobilization and knee sags working on knee flexion are also stressed. In order to limit hospital length of stay and cost, we routinely do not use CPM except for revision or refractory cases. Early weight bearing was allowed.

The Knee Society clinical rating system [7] was used to assess the knee joints and functional status of these patients before arthroscopy and at the latest follow-up examination. A normal knee was allotted 100 points, including 50 points for pain, 25 for the arc of motion, and 25 for anteroposterior and mediolateral stability. Functional results were evaluated separately on a 100-point scale including walking (50 points) and stair climbing (50 points). Standing anteroposterior and lateral radiographs were analyzed for evaluation of axial alignment and the position of the components (Table 2).

Results

Arthroscopic debridement and lysis of adhesions following the out-lined protocol typically improved knee range of motion. The mean knee flexion preoperatively was 87.5° and loss of extension 27.5°. The mean knee flexion was 104° (97–120) and extension loss was 5° (0–15) at the end of arthroscopy and was 92° (75–110) at the last follow-up.

Additionally, six of the eight procedures resulted in an improvement of the patients knee score. The average knee society ratings increased from 70 points prior to the arthroscopy to 86 at time of follow-up. The average function score also showed improvement from 68 points pre-operatively to 85 at the time of final follow-up. The average pain scores improved from 30 points pre-operatively to 41 at the time of final follow-up. The average function and pain scores showed no improvement in two patients. They required revision procedures. Their follow-up was not available for this study.

Table 2 Knee Society ratings

Objective scoring	Points
Pain	
None	50
Mild or occasional	45
Stairs only	40
Walking and stairs	30
Moderate	
Occasional	20
Continual	10
Severe	0
Stability (maximum movement in any position)	
Anteroposterior	
<5 mm	10
5–10 mm	5
10 mm	0
Mediolateral	
<5°	15
6–9°	10
10–14°	5
15°	0
Flexion contracture	
5–10°	–2
10–15°	–5
16–20°	–10
>20°	–15
Extension lag	
<10°	–5
10–20°	–10
>20°	–15
Alignment	
5–10°	0
0–4°	3 points each degree
11–15°	3 points each degree
Range of motion (5°=1 point)	25
Functional scoring	
Walking	50
Unlimited	40
>10 blocks	30
5–10 blocks	20
<5 blocks	10
Housebound	0
Stairs	
Normal up and down	50
Normal up and down with rail	40
Up and down with rail	30
Up with rail; unable down	15
Unable	0
Functional deductions	
Cane	–5
Two canes	–10
Crutches or walker	–20
Other	20

Discussion

The aim of this study was to assess our success of treatment of arthrofibrosis following TKR using arthroscopic lysis of adhesions. Using the described technique, six of eight patients experienced clinically significant improvement in range of motion with reduction in pain. Six patients had an improvement in the range of motion ranging between 10° and 35°. At a mean of 16 months

following the arthroscopy, no patient had required an additional surgical procedure. The other two patients had required revision procedures. The average knee society ratings increased from 70 points prior to the arthroscopy to 86 at time of follow-up.

We recognize several limitations to our study. This is a retrospective review of a small number of patients. We must be cautious in rendering generalized recommendations on this limited experience. However, we believe that our report demonstrates that the technique can be successful in some patients with painfully stiff TKRs. We also cannot be sure that arthrofibrosis was the sole cause of stiffness in these patients, but we have made every reasonable effort to exclude other causes of stiffness such as poor component sizing, occult infection, loosening, or poor component alignment. We made the diagnosis only after exclusion of these other entities.

Loss of motion or stiffness after a total knee replacement is frustrating for the patient and surgeon. Stiffness after a total knee replacement results in pain and loss of range of movement. This decreased range of movement can severely affect the patient's ability to perform tasks of daily living such as walking, climbing stairs, or getting up from a seated position. Biomechanical studies and gait analysis have shown that patients required 67° of knee flexion during the swing phase of gait, 83° of flexion to climb stairs, 90–100° of flexion to descend stairs, and 93° of flexion to stand from a seated position [12]. Arthrofibrosis has been treated with physical therapy, manipulation under anesthesia, and arthroscopic debridement with varying degrees of success. With aggressive physical therapy, flexion increases slightly over time and then reaches a plateau where range of movement can no longer be increased. At this point, the therapy is then used just for pain management [13]. Manipulation under anesthesia can be somewhat effective depending on the cause of stiffness and the amount of time that has passed after a total knee replacement [8]. Surgical debridement of adhesions with manipulation has also been shown to drastically improve range of movement in patients with arthrofibrosis after having a total knee replacement [17].

Arthroscopy at the site of a prosthetic knee is a technically challenging procedure, but various reports have shown promising success rates [18]. Williams et al. reported on arthroscopic release of the posterior cruciate ligament in ten stiff painful knees that had undergone posterior cruciate ligament-sparing total knee arthroplasty [19]. At a mean of 20 months after the arthroscopic procedure, the mean increase in knee flexion was 30.5° (range, 10–50°). Eight patients reported satisfaction and decreases in pain and stiffness, whereas two patients went on to have a revision total knee arthroplasty. Diduch et al. studied the efficacy and safety of arthroscopy for diagnosing and treating symptoms in 40 knees that had undergone total knee arthroplasty [5]. Arthroscopy was used successfully to diagnose the cause of the symptoms in 97.5% of the patients, and arthroscopic treatment included removal of impinging tissue or loose bodies [10]. At an average of 19.9 months, the rates of clinical success were 82% for procedures done to treat “clunks,” 60% for those used to

remove impinging synovial or soft tissue, and 63% for those used to treat arthrofibrosis. Similarly, Jerosch and Aldawoudy evaluated the efficacy of arthroscopic management of knee stiffness after total knee arthroplasty [9]. In their series of 32 knees, 25 demonstrated improvements in both the range of motion and the Knee Society Scores [13].

In conclusion, we suggest that arthroscopic lysis of adhesions should be considered in the treatment of patients with pain and poor range of motion after TKR. Conditions such as infection, loosening or improper component sizing, and malalignment should be sought before arthrofibrosis is diagnosed and arthroscopic management prescribed.

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