U·P·O·J

Outcome Of Arthroscopic Arthrolysis Of Arthrofibrosis After Total Knee Replacement

Alaa M. Hegazy, MD
Mohamed A. Elsoufy

Department of Orthopaedic Surgery
Zagazig University

Arthrofibrosis is an uncommon but potentially debilitating complication following total knee arthroplasty (TKA). It has been defined as abnormal scarring of the joint in which the formation of dense fibrous tissue and tissue metaplasia prevent normal range of motion. The treatment of this condition remains controversial. The purpose of this study was to investigate the outcome of arthroscopy in painful and stiff knee arthroplasty without evidence of infection, fracture, wear, and component loosening or malposition that had been refractory to conservative treatment. We reviewed the results to address the questions: (1) How much motion can a stiff TKA regain with arthroscopic treatment, and (2) can the arthroscopic arthrolysis of painful TKA provide an improvement in the patient's knee score and pain level? Patients met criteria for inclusion in the study if, after a diagnostic arthroscopy following TKA, they were felt to suffer from arthrofibrosis and would benefit from arthroscopic management. The average age was 67 years. All patients had failed non-operative management. Arthroscopic arthrolysis was performed in a standardized technique with intraarticular release of all fibrous bands in the suprapatellar pouch, reestablishment of the medial and lateral gutters and release of the lateral patellar retinculum. Intensive physiotherapy and continuous passive motion were started immediately post-operatively. The average follow-up was 37 months (range 24 to 52 months). The Knee Society Score was used to assess the knee joints and functional status of these patients before arthroscopy and at the latest follow-up examination. A total of 6 of the 8 procedures resulted in an improvement of the patient's knee score. The average function score also 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. Our results showed that arthroscopic management could be more beneficial for patients suffering from arthrofibrosis and postoperative knee stiffness following TKA. Pain and functional knee scores can improve markedly.

Introduction

Chronic pain and stiffness occurring after total knee arthroplasty are frustrating for both the patient and the surgeon[1]. After total knee arthroplasty (TKA), there is a relatively small group of patients who develop a painful joint with suboptimal range of motion (ROM) despite optimal surgical technique and good radiographic appearance. Arthrofibrosis, for the most part, is an uncommon complication of primary TKA. It is thought to be caused by excessive fibroplasia, which results in the formation of adhesions that constrain the extensor mechanism[2]. It is known that arthrofibrosis develops in response to surgical intervention in approximately 3-4% of patients undergoing TKA, and the resulting pain and loss of range of motion leads to disability[3].

The options for the patient and the surgeon in this situation are either to accept the reduced range of motion or have it addressed with non-surgical or surgical means. The surgical options are four fold: manipulation under anesthesia (MUA), arthroscopic arthrolysis, open arthrolysis or revision of some or all of the components[4].

Arthrofibrosis responds poorly to treatment, which may include physiotherapy, long-term peridural anesthesia (≤ 2 weeks), closed manipulation, arthroscopic debridement, and open procedures, including revision surgery with exchange of prosthetic components[1]. However, manual manipulation has significant risk, including complications such as distal femoral fracture and patellar tendon rupture. Open arthrolysis is a more invasive option, and it allows a wide access to the anterior and posterior aspects of the joint. The arthroscopic approach is a powerful and controlled method that is effective both for focal, discrete lesions as well as for more global arthrofibrosis, and avoids the risk of fracture inherent to MUA.

Arthroscopic arthrolysis consists of lysis of direct adhesions and is indicated in the case of arthrofibrosis in patients with a difficult rehabilitation and no other apparent cause of stiffness and pain. The ideal indication is a painless, stiff knee that has not improved after 3–6 months of conservative treatment. Although poor results have been reported in painful stiff knees, we think this seems to be a consequence of wrong diagnosis[5]. Arthroscopic management of arthrofibrosis after TKA can be an efficient, relatively cheap and safe mode of treatment, if performed with experienced hands, and followed by regional pain block and immediate intensive physiotherapy[6].

The purpose of this study was to evaluate the clinical and functional results of arthroscopic management in patients with knee stiffness after TKA without evidence of infection, fracture, wear, and component loosening or malposition.

Patients and Methods

For the purposes of this study, arthrofibrosis was defined as abnormal scarring of the joint

Corresponding Author:
Alaa Mahmoud Hegazy, MD
Department of Orthopaedic Surgery
Faculty of Medicine
Zagazig University
12B Kamel El-harouny St
Cairo-Naser City, Egypt
alaa58hegazy@hotmail.com

in which the formation of dense fibrous tissue and tissue metaplasia prevent normal range of motion. This retrospective case series reviewed the results achieved following eight arthroscopic releases performed on eight patients who had developed arthrofibrosis following primary TKA. All patients were treated between 2005 and 2009. The preoperative clinical diagnosis for the patients before the debridement included at least one or more of the following inclusion criteria: lack of patellar mobility, flexion contracture, tight retinaculum (lateral and medial), pain, and stiffness. All cases of stiffness secondary to infection, mechanical malalignment, loosening of the implants and causes of stiffness of the knee other than pure arthrofibrosis were excluded. There were no previous surgical procedures other than TKA in the group; associated co-morbidities were hypertension in two patients and controlled diabetes in three.

The average age of the patients was 67.6 years (range 62 to 73 years). The patients included in this study were 5 females and 3 males. The average follow-up was 37.4 months (range 24 to 52 months) (Table 1). The interval between the initial TKA and the arthroscopic release was on average 9.6 months (range 8–18 months). With regards to the type of primary total knee prosthesis, 4 knees were mobile-bearing TKA and the other 4 were fixed bearing TKA.

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

Pre-operative evaluation:

The main complaint of the patients was limited ROM: the total of eight patients showed an extension deficit with an average of 27.5º (10º–45º). They also complained of pain with activities of daily living or pain at rest. Clinical examination assessed ROM by long goniometer performed by first author, and notation of limb alignment, and presence or absence of swelling. All knees were stable in the coronal and sagittal plane.

X-rays showed no abnormalities (no radiolucent lines, normal joint line, no heterotopic ossifications, normal position of the patella). We documented absence of malalignment of the implants, especially malrotation. Standard format was used for evaluating the radiographs. Alignment of tibial and femoral components was evaluated in anteroposterior and lateral views, the femoral component is oriented in 4°–7° of valgus on the anteroposterior projection and neutral to minimal flexion on the lateral radiograph and tibial components routinely are placed perpendicular to the long axis of the tibia on the anteroposterior projection and perpendicular to slight flexion (3°–6°) on the lateral projection. The tibial sizing is to maximize coverage of the proximal tibial surface and to avoid overhanging the bony surface by more than 1–2 mm. The anterior flange of the femoral component in an ideal setting should be flush with the anterior cortex of the femur. All cases met the accepted radiological features.

In addition, laboratory examination included erythrocyte sedimentation rate and C-reactive protein level. On the basis of aspiration, culture, and laboratory data, all knees were determined to be free of infection.

Operative procedure:

Diagnostic arthroscopy was done for all patients and other causes of stiffness were excluded.

In brief, the treatment consists of 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 improve flexion). A gentle manipulation is carried out following lysis of adhesions, using a slight pressure on the tubercle to avoid fractures and disruptions of the extensor mechanisms.

After appropriate anesthesia, the use of regional epidural anesthesia and the placement of an indwelling epidural catheter was recommended for intraoperative and postoperative analgesia, the operative table is flexed, the operative leg is left hanging without a leg holder, and the nonoperative limb is placed in a leg holder. A nonsterile tourniquet is applied on the operative thigh, the extremity is prepped and draped

TABLE I. Patient Demographics and Clinical Data

Patient	Age (yrs)	Sex	Arthroscopic Preop. Diagnosis	Preop ROM (Degrees)	Postop ROM (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

in a standard fashion, and the leg is exsanguinated and the tourniquet inflated.

After the knee is maximally distended with saline, we typically insert an inflow cannula into the knee through a superolateral portal and then initiate flow.This keeps the joint distended and facilitates insertion of the arthroscope through the standard inferolateral portal and also helps with initial visualization of the joint. 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.

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 next performed to aid in tracking. The superior lateral geniculate vessel should be preserved if possible. Flexion and extension are again re-evaluated at this point. Therefore, if a loss of extension or flexion persists intra-operatively, 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 postoperative hemarthrosis, which can contribute to both pain and flexion contractures. The drain is typically left in place for 24 hours.

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 same 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. Hospitalizations and continuous passive motion machines are expensive additions, and we routinely do not use them except for revision or refractory cases. Early weight bearing was allowed.

Postoperative evaluation:

The Knee Society Score 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 (Table 2). 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.

Statistics

The Student's t-test was utilized on parametric variables to compare the differences within and between the two groups (preoperative and postoperative). The significance level was set to $p=0.05$.

Results

Arthroscopic debridement and lysis of adhesions following the outlined protocol typically improved Knee Society Scores. A total of 6 of the 8 procedures resulted in an improvement of the patients knee score.The mean knee flexion preoperatively was 87.5 degrees and extension was 27.5 degrees. The mean knee flexion was 104 degrees (97-120) and extension was 5.6 degrees (0-15) at the end of arthroscopy and was 92 degrees (75-110) at the last follow up.The average knee society ratings increased from 70 points prior to the arthroscopy to 86 at time of follow up ($P<0.05$).The average functional 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 ($P<0.05$).

Two patients had no improvement in average functional and pain scores; they ultimately required revision surgery. Their follow-up is not available for this study.

Discussion

The purpose of this study was to measure the preoperative and postoperative ROM and pain relief after arthroscopic debridement in patients that have been diagnosed with arthrofibrosis after having a TKA. In the present study, 8 patients underwent arthroscopic removal of scar tissue. Six patients had an improvement in the range of motion ranging between 10° and 35°.At a mean of sixteen months following the arthroscopy, no patient required an additional surgical procedure.The other two patients had required a revision procedure. The average Knee Society Score increased from 70 points prior to the arthroscopy to 86 at time of follow up. At a mean of twenty months after the arthroscopic procedure, the mean increase in knee flexion was 30.5° (range, 10° to 50°). Eight patients reported satisfaction and decreases in pain and stiffness, whereas two patients went on to have a revision TKA.

Loss of motion or stiffness after a TKA is frustrating for the patient and surgeon. Stiffness after a TKA results in pain and loss of ROM Overall, stiffness is defined as an inadequate ROM that results in functional limitations[7]. The criteria for assessing stiffness requiring surgical treatment is defined as having a flexion contracture of 15° or flexion of less than 75°[8]. This decreased ROM 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 require 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[7].

Arthrofibrosis has been treated with physical therapy, manipulation under anesthesia, and arthroscopic

TABLE II. Knee Society Scores

Objective Scoring	Points
Pain	
None	50
Mild or occasional	45
Stairs only	40
Walking & 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 & down	50
Normal up,down with rail	40
Up & 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

débridement with varying degrees of success. With aggressive physical therapy, flexion increases slightly over time and then reaches a plateau where ROM can no longer be increased. At this point the therapy is then used for pain management[9]. MUA can be somewhat effective depending on the cause of stiffness and the amount of time that has passed after a TKA[10]. Surgical debridement of adhesions with manipulation has also been shown to drastically improve ROM in patients with arthrofibrosis after having a TKA[11]. Open arthrolysis seems to have inferior gains in ROM. MUA is more successful in increasing ROM when performed early but still may be effective when performed late. Arthroscopy combined with MUA still is useful 1 year after the index TKA. The numbers of clinically important complications after MUA and arthroscopy (with or without MUA) are similar[12].

Arthroscopy at the site of a prosthetic knee is a technically challenging procedure, but various reports have shown promising success rates[13]. Williams et al. reported on arthroscopic release of the posterior cruciate ligament in ten stiff, painful knees that had undergone posterior cruciate ligament-sparing TKA[14]. Diduch et al. studied the efficacy and safety of arthroscopy for diagnosing and treating symptoms in forty knees that had undergone TKA[15]. 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. 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 TKA[6]. In their series of thirty-two knees, twenty-five demonstrated improvements in both the ROM and the Knee Society Scores[16]. The results showed that arthroscopy after TKA gives reliable expectations for improvement in function, decrease in pain, and improvement for Knee Society Scores for most patients.

Conclusions: Our results showed that arthroscopic management could be more beneficial for patients suffering from arthrofibrosis and postoperative knee stiffness following TKA. Pain and functional knee scores can improve markedly.

References

1. **Ries MD, Badalamente M.** Arthrofibrosis after total knee arthroplasty. *Clin Orthop Relat Res.* Nov 2000(380):177-183.
2. **Kurosaka M, Yoshiya S, Mizuno K, Yamamoto T.** Maximizing flexion after total knee arthroplasty: the need and the pitfalls. *J Arthroplasty.* Jun 2002;17(4 Suppl 1):59-62.
3. **Parvizi J, Tarity TD, Steinbeck MJ, et al.** Management of stiffness following total knee arthroplasty. *J Bone Joint Surg Am.* Dec 2006;88 Suppl 4:175-181.
4. **Arbuthnot JE, Brink RB.** Arthroscopic arthrolysis for the treatment of stiffness after total knee replacement gives moderate improvements in range of motion and functional knee scores. *Knee Surg Sports Traumatol Arthrosc.* Mar 2010;18(3):346-351.
5. **Bocell JR, Thorpe CD, Tullos HS.** Arthroscopic treatment of symptomatic total knee arthroplasty. *Clin Orthop Relat Res.* Oct 1991(271):125-134.
6. **Jerosch J, Aldawoudy AM.** Arthroscopic treatment of patients with moderate arthrofibrosis after total knee replacement. *Knee Surg Sports Traumatol Arthrosc.* Jan 2007;15(1):71-77.
7. **Bong MR, Di Cesare PE.** Stiffness after total knee arthroplasty. *J Am Acad Orthop Surg.* May-Jun 2004;12(3):164-171.
8. **Hutchinson JR, Parish EN, Cross MJ.** Results of open arthrolysis for the treatment of stiffness after total knee replacement. *J Bone Joint Surg Br.* Oct 2005;87(10):1357-1360.
9. **Mont MA, Seyler TM, Marulanda GA, Delanois RE, Bhave A.** Surgical treatment and customized rehabilitation for stiff knee arthroplasties. *Clin Orthop Relat Res.* May 2006;446:193-200.
10. **Kim J, Nelson CL, Lotke PA.** Stiffness after total knee arthroplasty. Prevalence of the complication and outcomes of revision. *J Bone Joint Surg Am.* Jul 2004;86-A(7):1479-1484.
11. **Scranton PE, Jr.** Management of knee pain and stiffness after total knee arthroplasty. *J Arthroplasty.* Jun 2001;16(4):428-435.
12. **Fitzsimmons SE, Vazquez EA, Bronson MJ.** How to treat the stiff total knee arthroplasty?: a systematic review. *Clin Orthop Relat Res.* Apr 2010;468(4):1096-1106.
13. **Seyler TM, Marker DR, Bhave A, et al.** Functional problems and arthrofibrosis following total knee arthroplasty. *J Bone Joint Surg Am.* Oct 2007;89 Suppl 3:59-69.
14. **Williams RJ, 3rd, Westrich GH, Siegel J, Windsor RE.** Arthroscopic release of the posterior cruciate ligament for stiff total knee arthroplasty. *Clin Orthop Relat Res.* Oct 1996(331):185-191.
15. **Diduch DR, Scuderi GR, Scott WN, Insall JN, Kelly MA.** The efficacy of arthroscopy following total knee replacement. *Arthroscopy.* Apr 1997;13(2):166-171.
16. **Insall JN, Dorr LD, Scott RD, Scott WN.** Rationale of the Knee Society clinical rating system. *Clin Orthop Relat Res.* Nov 1989(248):13-14.