Outcomes of Arthroscopic All-Inside Repair Versus Observation in Older Patients With Meniscus Root Tears

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Background: Meniscus root tears lead to de-tensioning of the meniscus, increased contact forces, and cartilage damage. Management of older patients with root tears is controversial and the efficacy of different treatment options is unclear.

Purpose: To compare the clinical outcomes of patients with moderate knee osteoarthritis who underwent an all-inside meniscus root repair technique versus nonoperative management for either medial or lateral meniscus root tears.

Study Design: Cohort study; Level of evidence, 2.

Methods: Patients with a diagnosed posterior meniscus root tear who underwent arthroscopic repair (AR: 30 knees) or nonoperative treatment with observation (O: 18 knees) were followed for a minimum of 2 years (mean follow-up, 4.4 years). The arthroscopic repair included all-inside sutures to reduce the root back to its remnant (reduction sutures), thereby re-tensioning the meniscus, and 1 mattress suture to strengthen the repair by reapproximating the construct to the posterior capsule. The data collected included the Knee injury and Osteoarthritis Outcome Score (KOOS), Lysholm, Tegner, and Veterans RAND 12-Item Health Survey (VR-12) Physical Component Summary (PCS) and Mental Component Summary (MCS) scores and conversion to total knee arthroplasty (TKA).

Results: Medial meniscus root tears comprised 80.0% of the AR group and 77.8% of the O group. The average Kellgren-Lawrence grade was 2 in both groups. The baseline scores for the KOOS Symptoms subscale were lower for AR (50.2 ± 19.3) than for O (66.5 ± 16.1) (P = .003), as were the KOOS Knee-Related Quality of Life scores (AR, 26.7 ± 16.1; O, 39.6 ± 22.1) (P = .046). No differences were found between groups for the absolute values at follow-up except that follow-up Tegner scores were lower in the O group than in the AR group (P = .004). Significant improvements were seen in the AR group from baseline to ultimate follow-up in average KOOS subscale scores ($P < .001$), Lysholm scores ($P < .001$), Tegner scores (P = .0002), and VR-12 PCS scores ($P < .001$), whereas the O group had a significant improvement only in average KOOS Pain (P = .003), KOOS Function in Daily Living (P = .006), and VR-12 PCS (P = .038) scores. Compared with the O group, the AR group had a significantly larger improvement from baseline to follow-up in average KOOS Pain (P = .009), KOOS Symptoms (P = .029), and Lysholm scores (P = .016). During follow-up, 3.3% of the AR group underwent a TKA compared with 33.3% of the O group (P = .008). The hazard ratio of TKA conversion was 93.2% lower for the AR group compared with the O group (P = .013).

Conclusion: All-inside medial or lateral meniscus root repair showed improved functional outcomes and decreased TKA conversion rates compared with nonoperative treatment and may be considered as a treatment option for the management of meniscus root tears in older patients with moderate osteoarthritis.

Keywords: meniscus root tear; meniscus; meniscal repair; total knee arthroplasty; all-inside repair

The menisci of the knee absorb and transmit compressive loads in the knee joint. Previous investigations have estimated that the fraction of the load carried by the menisci can be approximately 50% during walking and 70% to 99% during other compressive movements.[27,30] Critical to the meniscal role in load-bearing are the root attachments to the tibial plateau, which maintain meniscal positioning and prevent extrusion during compression.[7,11,15] Meniscus root tears (MRTs) can have negative effects on knee health and function due to the loss of these critical functions. Medial MRTs occur in a bimodal distribution; acute root tears typically occur in younger athletes during hyperflexion of the knee[8,11,25,26,34] versus acute-on-chronic tears, which typically occur in older patients with moderate osteoarthritis.[10,11,15,23,26] Similar injuries have been observed to the lateral meniscus posterior root, especially in the setting of multiligamentous injuries.[3,15,26,33]

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Until recently, the effects of MRTs were largely unknown and their long-term clinical consequences were ignored, partly because of the difficulty of diagnosis before the development of modern magnetic resonance imaging (MRI). However, it is now evident that tears of the meniscus posterior root are associated with chondral injury, early degenerative changes, and high rates of total knee arthroplasty (TKA).[17,21,25] Furthermore, biomechanical studies in cadaveric specimens have indicated that these injuries lead to decreased femorotibial contact area, increased peak contact pressure by up to 25% compared with intact knees, and increased stress on the articular cartilage, causing the knee joint to effectively function as if the meniscus had been completely removed.[‖] Additionally, investigators have noted that extrusion of the medial meniscus after MRT occurs very soon after the injury, suggesting the relative urgency of treatment for these lesions.[9] Biomechanical studies looking at the effects of lateral meniscus posterior root tears have noted similar outcomes.[19,29]

Historically, patients with a chronic MRT were treated with nonoperative modalities or with a partial meniscectomy.[4] However, studies have indicated that nonoperative treatment fails in up to 87% of patients, and up to 31% of patients undergo subsequent TKA.[17] Although partial meniscectomy has been observed to provide symptomatic relief, it has failed to arrest the progression of arthritic changes.[23] These observations have spurred the development of several repair techniques, the most common of which are the transtibial pullout and all-inside suture anchor repairs.[4]

The transtibial pullout repair involves passing a suture through a tunnel from the site of meniscal insertion to the anteromedial aspect of the tibia and tying the suture over a button or bone bridge.[1,8,28] The all-inside suture anchor repair involves the insertion of a suture anchor in the tibial plateau and fixation of the meniscus root at its anatomic position.[6,12] Biomechanical studies have indicated that these repairs are capable of restoring femorotibial contact area and contact pressures to a degree that is largely indistinguishable from that of a native knee.[2,9,19,21,24] These results have been corroborated with clinical studies indicating that these repairs can restore native knee functioning and reduce symptoms and progression of cartilage degeneration compared with partial meniscectomy or nonoperative treatment.[8,13,14]

Despite encouraging results, a superior repair technique has yet to be determined, and both techniques have been noted to have several drawbacks.[22] First, inadequate repair with either technique may result in decreased contact area and increased contact pressure compared with an uninjured knee.[18,32] Second, the transtibial pullout repair has the disadvantage of requiring a tibial tunnel to be drilled, which is technically challenging on its own, especially when combined with anterior cruciate ligament (ACL) reconstruction.[13] Transtibial pullout repair also carries the risk of suture abrasion within the bony tunnel and creep of the sutures, which would then decrease the strength of the repair and increase the risk of suture rupture.[4,13,31] Third, the all-inside suture anchor technique entails a technically difficult repair and has the potential complication of loosening of the suture anchor.[4]

The shortcomings of these repair techniques have led to the development of an alternative repair that circumvents these issues. This repair involves the use of all-inside sutures to reduce the root back to its anatomic position and an additional mattress suture that tethers the meniscus to the posterior capsule, thereby strengthening the repair. This technique avoids the need for a transtibial bony tunnel as well as the need for a suture anchor. The goal of this study was to compare the clinical outcomes of this root repair technique with nonoperative management.

METHODS

This study was approved by the Stanford University Institutional Review Board. We identified consecutive patients who were seen in clinic and received a diagnosis of a symptomatic medial or lateral posterior meniscus root tear on MRI between 2006 and 2015. Symptoms of new-onset posteromedial or lateral pain had to be present for a minimum of 6 weeks. After discussing treatment and providing informed consent, patients were given the choice of either an arthroscopic repair (AR group) or nonoperative treatment (observation [O] group). All arthroscopic repairs were performed by a single board-certified orthopaedic surgeon (J.L.D.). All patients in the O group underwent a structured nonoperative management program consisting of 3 components: (1) activity modification and avoidance of heavy load-bearing activities, (2) minimum 6-week physical therapy program, and (3) a 4-week course of nonsteroidal anti-inflammatory medications.

Patient Population and Data Collection

Patients who were >45 years of age, had a clearly demarcated medial or lateral meniscus root tear on MRI, were

[‖]References 2, 7, 20, 24, 25, 27, 30, 31, 35.

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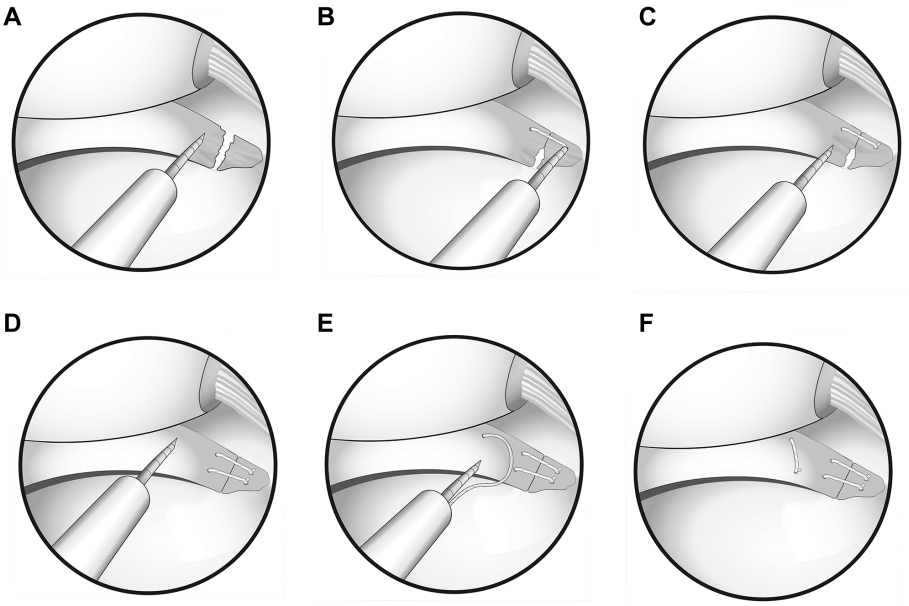

Figure 1. Images of the all-inside meniscus root repair. (A) Suture capture of torn meniscus root. (B) The second arm of the all-inside suture is inserted into the root remnant on the tibial plateau. (C) The suture is tensioned and the root tear is reduced. (D) The technique is repeated with a second all-inside suture placed more anterior or posterior on the meniscus than the initially placed suture. (E) The repair construct is anchored to the posterior knee capsule with a standard vertical mattress suture. (F) Final repair illustrating re-tensioned meniscus and reduced root tear.

consentable for surgery, and exhibited pain in the knee for >6 weeks but for <6 months were included. Patients were excluded if they had a history of an ACL tear, Kellgren-Lawrence (KL) grade 4 osteoarthritis, >6° of malalignment (varus or valgus), previous meniscal repair, or significant debridement. Patients with other knee conditions or a history of knee surgery were not excluded. The final cohort consisted of 30 patients in the AR group and 18 patients in the O group. Zero patients were lost to follow-up. Patient demographics (sex, age, and body mass index [BMI]) and surgical details (history of knee surgery, side of knee injury, root tear location, mechanism of injury, KL grade, knee alignment, and follow-up time) were recorded and compared between groups.

Surgical Technique

The AR group underwent an all-inside meniscus root repair technique (Figure 1). A standard 2-portal diagnostic knee arthroscopy was used. First, an all-inside suture device (FasT-Fix 360; Smith & Nephew, Endoscopic Division) was used to capture the torn posterior horn or root of the meniscus (Figure 1A). The second suture was then inserted into the root remnant on the tibial plateau (Figure 1B) and tensioned (Figure 1C) to reduce the meniscus back to the root remnant. This process was repeated with a second all-inside suture into the posterior horn or root and the root remnant (Figure 1D). An additional vertical mattress suture was then used to anchor the repair construct to the posterior knee capsule (Figure 1E), thereby strengthening the repair. This repair technique reduces the root tear and re-tensions the meniscus (Figure 1F). Postoperative rehabilitation consisted of touchdown weightbearing for 4 days followed by the leg locked in full extension during ambulation for 6 weeks, with range of motion and early strengthening exercises from 0° to 90° of flexion for 6 weeks. Range of motion from 0° to 110° of flexion was allowed from weeks 6 to 12 along with nonrestricted weightbearing. However, no weightbearing with flexion beyond 90° was allowed until after 20 postoperative weeks.

Clinical Outcomes

Clinical outcomes were used as the primary outcome measures. Outcome scores were collected at baseline before surgery and at a minimum of 2 years after surgery. The outcome scores used were the Lysholm score, Veterans RAND 12-Item Health Survey (VR-12) Physical Component Summary (PCS), VR-12 Mental Component Summary scores (MCS), Tegner activity score, and the following subscales of the Knee injury and Osteoarthritis Outcome Score (KOOS): Symptoms, Pain, Function in Daily Living (ADL), Function in Sport and Recreation (Sport/Rec), and Knee-Related Quality of Life (QOL). For patients whose treatment was converted to TKA before 2 years, the follow-up clinical outcome scores were obtained immediately before TKA. Differences were examined between AR and O groups at baseline, within-group changes from baseline to follow-up, and between-group changes from baseline to follow-up.

Statistical Analysis

A sample size of 46 was found to provide more than 80% power to detect a 15% different in mean KOOS Pain score between groups. Differences in baseline patient characteristics between the AR and O groups were examined through use of the Fisher exact test for categorical variables and the Mann-Whitney *U* test for continuous variables. Changes from baseline to follow-up within each group were analyzed with the 1-sample *t* test or the 1-sample Wilcoxon test. For changes from baseline to follow-up between the AR and O groups, the independent-samples *t* test or the Mann-Whitney *U* test was conducted depending on normality. Differences in outcome scores among KL grades and alignments were analyzed with 1-way analysis of variance and Kruskal-Wallis tests depending on normality. The Fisher exact test was used to analyze the rates of conversation to TKA between the AR and O groups. Survival curves were created through use of Kaplan-Meier estimates, and a hazard ratio was created via a Cox proportional hazards model. All analyses were completed in RStudio version 1.1.456, with a level of significance of $\alpha = .05$. Results for continuous variables are presented as the mean ± SD.

RESULTS

The final study size was 48 patients (30 in the AR group, 18 in the O group) with a mean ± SD age of 59.7 ± 10.9 years and BMI of 28.9 ± 5.9. In the sample, 75.0% of the patients were female. The majority of meniscus root tears occurred in the posterior root of the medial meniscus (79.2%), followed by the posterior root of the lateral meniscus (16.7%), with the remaining lesions occurring in the posterior root of both menisci (4.2%). None of the patients in the AR group experienced any perioperative complications.

No differences were observed between the AR and O cohorts with respect to sex, BMI, knee surgery history, side of current knee injury, root tear location, mechanism of injury, KL grade, knee alignment, or average follow-up time (Table 1). The mean ± SD follow-up time was 4.4 ± 1.9 years in the AR group and 4.0 ± 3.0 years in the O group. Follow-up time did not include those patients who underwent TKA because some patients converted to TKA in <2 years. The average KL grade was 2 in both the AR and the O groups. Age was significantly lower for the AR group (56.7 ± 11.1 years) than the O group (64.8 ± 9.00 years) ($P = .009$) (Table 1).

Baseline measurements showed no differences between AR and O groups with regard to KOOS Pain, KOOS ADL, KOOS Sport/Rec, Lysholm, VR-12 PCS, VR-12 MCS, or Tegner (Table 1). However, baseline KOOS Symptoms scores were lower for AR (50.2 ± 19.3) than for O (66.5 ± 16.1) ($P = .003$), and baseline KOOS QOL scores were lower for AR (26.7 ± 16.1) than O (39.6 ± 22.1) ($P = .046$). Absolute values at follow-up showed no difference between groups for these patient-reported outcomes, except that follow-up Tegner scores were lower in the O group (2.2 ± 0.9) compared with the AR group (3.3 ± 1.6) ($P = .004$).

Within-group analyses were conducted for both the AR and the O cohorts. For the AR cohort, significant changes from baseline to follow-up were noted with regard to KOOS Symptoms, KOOS Pain, KOOS ADL, KOOS Sport/Rec, KOOS QOL, Lysholm, VR-12 PCS, and Tegner (Table 2). However, no significant change was observed for AR in regard to VR-12 MCS. Within-group analysis for the O cohort showed significant changes from baseline for KOOS Pain, KOOS ADL, and VR-12 PCS, but no significant changes were observed for KOOS Symptoms, KOOS Sport/Rec, KOOS QOL, Lysholm, VR-12 MCS, or Tegner scores.

Between-group analysis indicated greater changes in outcomes from baseline to follow-up in the AR group than in the O group with respect to KOOS Symptoms ($P = .029$), KOOS Pain ($P = .009$), and Lysholm ($P = .016$) scores. However, no significant differences were seen between the AR and O groups in changes from baseline to follow-up with respect to KOOS ADL, KOOS Sport/Rec, KOOS QOL, VR-12 PCS, VR-12 MCS, or Tegner scores. However, it was noted that for patients in the nonoperative group, there were significant improvements in KOOS Sport/Rec, VR-12 PCS, and Tegner scores when looking at patients with lower (worse) baseline scores ($P = .037$, $P = .030$, and $P = .001$, respectively).

The AR cohort was significantly less likely to convert to TKA than the O cohort ($P = .008$): 1 patient (3.3%) in the AR group and 6 patients (33.3%) in the O group underwent TKA during the follow-up period (Figure 2). The TKA conversion hazard was 93.2% lower for the AR group compared with the O group ($P = .013$).

DISCUSSION

Meniscus root repairs are being performed with increasing frequency because of results from recent clinical studies showing poor long-term outcomes with nonoperative management.[17] Although acute MRTs in young athletes are usually treated operatively, management of acute-on-chronic MRTs in older patients has been unclear. Our study evaluated whether repair of either a medial or lateral MRT that entailed an all-inside, less-invasive technique would lead to improved outcomes from baseline and whether surgical repair would lead to better outcomes compared with nonoperative management in patients with moderate osteoarthritis. The AR group exhibited a greater improvement in clinical outcomes and lower rate of conversion to TKA compared with the O group.

The AR group demonstrated a statistically significant improvement in all clinical outcome measures compared with baseline, except for VR-12 MCS, at a minimum of 2 years of follow-up. Unlike the AR group, the O group had a statistically significant improvement in only the KOOS Pain, KOOS ADL, and VR-12 PCS clinical outcome measures. Although a course of nonoperative management led to improvement of clinical outcomes in some patients, a smaller within-group improvement in functional outcomes was seen in this cohort compared with the AR group.

TABLE 1
Patient Characteristics and Baseline and Follow-up Patient-Reported Outcomes[a]

	Arthroscopic Repair (n = 30)	Observation (n = 18)	*P* Value
Female sex	23 (76.7)	13 (72.2)	.743
Age, y	56.7 ± 11.1	64.8 ± 9.00	.009[b]
Body mass index	29.0 ± 6.7	28.8 ± 4.6	.709
Past knee surgery on same knee	3 (10.0)	4 (22.2)	.400
Left knee	17 (56.7)	8 (44.4)	.552
Posterior root tear location			.511
Lateral meniscus	4 (13.3)	4 (22.2)	
Medial and lateral meniscus	2 (6.7)	0 (0.0)	
Medial meniscus	24 (80.0)	14 (77.8)	
Mechanism of injury			.077
Nontrauma	10 (33.3)	11 (61.1)	
Trauma	20 (66.7)	7 (38.9)	
Kellgren-Lawrence grade			.126
1	3 (10.0)	4 (22.2)	
2	19 (63.3)	6 (33.3)	
3	8 (26.7)	8 (44.4)	
Alignment			.189
Anatomic valgus	6 (20.0)	1 (5.6)	
Anatomic varus	13 (43.3)	7 (38.9)	
Neutral	11 (36.7)	8 (44.4)	
No alignment radiograph	0 (0.0)	2 (11.1)	
Baseline KOOS			
Symptoms	50.2 ± 19.3	66.5 ± 16.1	.003[b]
Pain	47.6 ± 19.0	58.5 ± 20.0	.071
ADL	57.2 ± 21.6	60.0 ± 21.5	.656
Sport/Rec	26.0 ± 25.9	33.3 ± 32.4	.525
QOL	26.7 ± 16.1	39.6 ± 22.1	.046[b]
Baseline Lysholm	42.7 ± 22.3	56.5 ± 23.8	.055
Baseline VR-12 PCS	35.2 ± 8.5	37.3 ± 10.6	.483
Baseline VR-12 MCS	53.8 ± 9.5	52.9 ± 7.9	.753
Baseline Tegner	2.7 ± 1.6	2.2 ± 1.7	.250
Follow-up KOOS			
Symptoms	74.4 ± 20.9	75.8 ± 22.9	.834
Pain	79.6 ± 15.9	74.2 ± 25.2	.422
ADL	84.5 ± 13.2	75.4 ± 26.2	.184
Sport/Rec	54.8 ± 26.6	53.9 ± 38.9	.932
QOL	54.0 ± 23.1	53.5 ± 35.2	.958
Follow-up Lysholm	70.0 ± 19.3	63.6 ± 26.6	.340
Follow-up VR-12 PCS	45.1 ± 9.4	43.4 ± 10.9	.586
Follow-up VR-12 MCS	53.6 ± 10.3	51.4 ± 10.0	.470
Follow-up Tegner	3.3 ± 1.6	2.2 ± 0.9	.004[b]
Duration of follow-up, y	4.4 ± 1.9	4.0 ± 3.0	.177

[a]Values are expressed as n (%) or mean ± SD. ADL, Function in Daily Living; KOOS, Knee injury and Osteoarthritis Outcome Score; MCS, Mental Component Summary; PCS, Physical Component Summary; QOL, Knee-Related Quality of Life; Sport/Rec, Function in Sport and Recreation; VR-12, Veterans RAND 12-Item Health Survey.
[b]Significant at the level of $P < .05$.

Overall, a significant decrease in TKA conversion and a clear improvement in clinical outcome scores were seen in the AR group compared with the O group, demonstrating the benefit of surgical management in the functional outcomes of older patients with MRTs. However, nonoperative management may still be a reasonable option for some patients with MRTs. Our results indicated that for patients in the O group, improvement in the KOOS Sport/Rec, VR-12 PCS, and Tegner scores were significantly higher for patients with lower (worse) baseline scores ($P = .037$, $P = .030$, and $P < .001$, respectively).

The clinical outcome scores of the AR group are comparable with the findings of other studies examining clinical outcomes of the transtibial pullout and suture anchor root tear repair techniques. The transtibial pullout technique has been reported to result in an approximately 32-point increase in Lysholm scores after an approximately 7.0-year follow-up period,[5] and in the present study, the AR group had a comparable 27-point increase after only 4.4 years of follow-up. In addition, suture anchor MRT repair patients showed statistically significant improvement in Lysholm scores of 21 points after an average 2.7-year follow-up period.[12]

TABLE 2
Within-Group Changes in Clinical Outcome Scores From Baseline to Follow-up[a]

	Arthroscopic Repair (n = 30)		Observation (n = 18)		Between Group Comparison
	Mean ± SD	*P* Value	Mean ± SD	*P* Value	*P* Value
Change in KOOS					
Symptoms	24.2 ± 24.6	<.001[b]	9.3 ± 20.5	.070	.029[b]
Pain	32.0 ± 20.7	<.001[b]	15.7 ± 19.2	.003[b]	.009[b]
ADL	27.3 ± 21.1	<.001[b]	15.4 ± 21.9	.006[b]	.064
Sport/Rec	28.8 ± 26.3	<.001[b]	20.6 ± 42.8	.157	.466
QOL	27.3 ± 27.2	<.001[b]	13.9 ± 26.7	.075	.096
Change in Lysholm	27.3 ± 27.2	<.001[b]	7.1 ± 26.6	.248	.016[b]
Change in VR-12 PCS	9.9 ± 11.3	<.001[b]	6.0 ± 11.4	.038[b]	.259
Change in VR-12 MCS	–0.2 ± 8.5	.855	–1.5 ± 5.7	.274	.302
Change in Tegner	0.7 ± 1.0	.002[b]	0.0 ± 1.4	.745	.104

[a]ADL, Function in Daily Living; KOOS, Knee injury and Osteoarthritis Outcome Score; MCS, Mental Component Summary; PCS, Physical Component Summary; QOL, Knee-Related Quality of Life; Sport/Rec, Function in Sport and Recreation; VR-12, Veterans RAND 12-Item Health Survey.
[b]Significant at the level of $P < .05$.

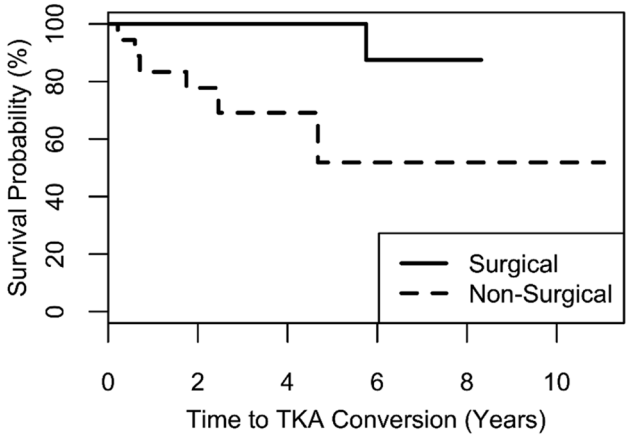

Figure 2. Survivorship curve for conversion to total knee arthroplasty (TKA) ($P = .008$).

The menisci act to decrease contact pressure within the knee, and in particular the meniscus roots prevent extrusion during compression.[7,11,15,20,35] Therefore, one of the main incentives to repair the meniscus root is to decrease the rate of progression to TKA.[10,11,15,23,26] The present study demonstrated a significant decrease in conversion to TKA from 33.3% (O group) to 3.3% (AR group). The transtibial pullout repair has been shown to be associated with a low rate of TKA conversion; 1 study showed that only 1 of 91 patients eventually underwent TKA after a follow-up period of 84 months (7 years). Krych et al[17] found a similar rate of conversion to TKA to the present study in the O group, which was approximately 31% at a 2.5-year average follow-up. Similar to nonoperative management, meniscectomy for root tears has demonstrated a high rate of TKA conversion, with 1 study finding a 54% rate of conversion at an average of 4.5 years of follow-up.[16] The present study had an average follow-up period of 4.4 years, but longer follow-up will be needed to determine whether the conversion to TKA rate continues to be similar to that of the transtibial pullout repair in the longer term.

This study has multiple strengths. It provides the first detailed description of the all-inside repair technique done in a consecutive series of patients by 1 surgeon at 1 institution. Surgical technique and postoperative management protocol were standardized for all patients in the AR group. This technique is a less invasive, less surgically demanding option than the 2 most commonly used MRT repair techniques. Our study is the first study to compare this MRT repair technique versus nonoperative treatment and evaluate multiple clinical outcome variables.

This repair technique requires some additional preoperative preparation. This technique requires 2 sutures to be passed into the posterior capsule, and it is therefore important to evaluate the MRI for an aberrant anterior tibial artery branch and to determine the safe zones for suture placement; for example, the safe distance from the posterior root of the lateral meniscus to the posterior vasculature is 13 mm at 90° of flexion.[6]

Limitations of this study included those inherent to cohort studies. Aside from age, all remaining baseline demographic variables were not statistically different between groups. Baseline KOOS Symptoms and QOL scores were lower in the AR group compared with the O group. Although most demographic variables were not statistically different between groups, we were unable to perfectly match the cohorts due to the small number of patients in the nonoperative cohort. The patients were not randomized, therefore potentially introducing self-selection bias. We did not include imaging evaluation as part of our outcomes and therefore were unable to evaluate osteoarthritis progression on radiographs or meniscal extrusion on MRI. Finally, the study was underpowered to show any other variables that might be associated with better outcomes in either cohort.

Ultimately, compared with nonoperative treatment or meniscectomy of chronic meniscus root tears, arthroscopic repair (whether by the method in this study, transtibial pullout, or suture anchor repair) demonstrated a significant improvement in clinical outcomes and decrease in conversion rates to TKA. The technique used in this study is unique in that it avoids the need for a transtibial bony tunnel or the difficult placement of a suture anchor, so this technique may be achievable by a larger number of orthopaedic surgeons.

Arthroscopic repair may be effectively performed in older patients with MRTs through use of an all-inside repair technique, and clinical outcomes appear to be superior to nonoperative management in this patient population.

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