Dilemma of High Rate of Conversion From Knee Arthroscopy to Total Knee Arthroplasty

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Abstract

We tried to reduce our rate of conversion from index knee arthroscopy to total knee arthroplasty (TKA) for degenerative pathology (primarily meniscal) in the setting of coexisting arthritis in patients 50 years or older. We hypothesized that, by using a 2-surgeon independent evaluation method, we could reduce the rate to less than 10% by 3-year follow-up.

Forty-two consecutive patients were initially evaluated by the knee replacement surgeon to determine if they were TKA candidates. They were then independently evaluated by another surgeon regarding the need for TKA and the possibility of arthroscopic debridement.

The data showed a tendency: The under-10% target rate was nearly reached in patients younger than 65 years (12%; 2/17) but not in patients older than 65 years (36%; 9/25). The overall rate of conversion to TKA was 26%. The 2 main groups (arthroscopy only, arthroscopy-plus-TKA) did not differ in all measured characteristics.

Failure of our method to achieve better outcomes demonstrates that conventional criteria are poor in predicting which patients with meniscal pathology, which is believed to be relatively more symptomatic than coexisting arthritis, should avoid arthroscopy and go straight to TKA.

North American and Western European studies typically have found high rates of conversion from index knee arthroscopy to total knee arthroplasty (TKA) when arthroscopic lavage or debridement is performed solely for osteoarthritis (OA) symptoms.[1] For example, in a study of 1000 knee OA patients older than 70 years, Wai and colleagues[2] found an 18% rate of conversion to TKA 3 years after arthroscopy. In patients with medial compartment OA, Spahn and colleagues[3] found a 19% conversion rate by a mean of 7 months after arthroscopy in patients whose mean age was 53 years. Aaron and colleagues[4] reported that 15% of their study patients (mean age, 62 years) underwent TKA at a mean of 14 months after arthroscopic debridement for OA.

The finding of no significant benefit of arthroscopic debridement in knee OA in prospective randomized studies by Moseley and colleagues[5] and Kirkley and colleagues[6] is consistent with the high rates of conversion from knee arthroscopy to TKA already mentioned here. Moseley and colleagues[5] found no significant difference between their sham-surgery group and knee arthroscopy group in terms of pain and function at 2-year follow-up. The strong placebo effect in their study may help explain why the success of arthroscopic debridement for arthritic symptoms is highly variable. After these 2 studies were reported, the American Academy of Orthopaedic Surgeons (AAOS) issued a position statement advising against arthroscopic debridement for knee OA unless there is sufficient evidence that the symptoms are primarily the consequence of underlying meniscal pathology or other mechanical derangement.[7]

In our private practice, we tried to reduce our rate of conversion to TKA to less than 10% after index knee arthroscopy for symptoms primarily from meniscal pathology, though there may be coexisting knee arthritis. We wanted to test the hypothesis that a method of independent evaluations by 2 orthopedic surgeons, still using conventional criteria and decision-making algorithms, would achieve the target conversion rate (< 10%) by 3 years after arthroscopy.

Materials and Methods

This study was conducted at Utah Bone and Joint Center (Murray, Utah), Intermountain Medical Center (Murray, Utah), and LDS Hospital (Salt Lake City, Utah). After obtaining institutional review board approval, we reviewed the clinical records of 42 consecutive patients in our 2-surgeon clinical evaluation method. Patients were enrolled if they had index knee arthroscopy, if their pain was attributable more to painful degenerative meniscal pathology than to knee OA, and if they were older than 50 years (age range, 50 to 87 years) (**Tables I, II**). Of 46 eligible patients, 4 were excluded because their symptoms re-

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Table I. Indications for Index Knee Arthroscopy and Total Knee Arthroplasty[a]

Index Knee Arthroscopy[11]
■ Persistent pain despite 3 months of conservative treatment (non-steroidal anti-inflammatory drug use or intra-articular corticosteroid injections, and muscle-strengthening exercises).
■ Symptoms and signs of meniscal pathology (painful mechanical symptoms; medial joint-line tenderness with positive McMurray or Steinman tests)[12-13] predominate over arthritis symptoms.
■ Absence of varus thrust during walking.
■ Mechanical axis traversing lateral half of medial tibia plateau.
■ Relative preservation of joint space as seen on standing antero-posterior radiographs.
Total Knee Arthroplasty[11,14]
■ Persistent pain attributed to osteoarthritis; failure of conservative treatment.
■ Varus malalignment such that mechanical axis lies across medial half of medial tibia plateau.
■ Varus thrust.
■ Complete or near complete disappearance of medial or lateral joint space (occurring at < 2 mm) as seen on standing anteroposterior radiographs.

[a]Adapted from Bin and colleagues,[11] Dervin and colleagues,[12] Insall,[13] and Mancuso and colleagues.[14]

solved with intra-articular corticosteroid injections and physical therapy. Exclusion criteria were severe bone-on-bone OA in accordance with Kellgren-Lawrence (K-L) grades, rheumatologic conditions, knee symptoms lasting more than 2 years, anatomical knee angulation exceeding 10° of varus or 10° of valgus, worker's compensation claims, and ligamentous laxity (positive Lachman test or > 5 mm medial or lateral joint-space opening with manual varus or valgus stress at 30° flexion). Our sample size was sufficient in a power analysis that used an averaged conversion rate (26%)[2,8,9] with follow-up durations and patient ages that resemble our study and patient population. A sample of at least 37 patients was needed to be able to discern a target rate of 10% or less with statistical probability of $\alpha < 0.05$ and 80% statistical power.

The 2 surgeons were partners in a private practice. All study patients were referred by primary care physicians, who considered them candidates for TKA. All patients received a trial of nonoperative management.[10] They were initially evaluated for TKA by the "knee replacement surgeon." If the surgeon concluded the patient did not require TKA but had significant pain and mechanical symptoms suggestive of meniscal pathology in the setting of comparatively less severe OA, the patient was referred to the "knee arthroscopy surgeon" for independent evaluation for arthroscopic debridement (**Table I**[11-14]). The knee arthroscopy surgeon also independently reconsidered possible

Table II. Patient Characteristics and Data

Characteristic[a]	Group 1: Arthroscopy Only	Group 2: Arthroscopy Plus TKA	1 vs 2, *P*	Rate of Conversion to TKA
No. of knees	31	11	—	26%
No. of patients 50-65 years old	15	2	—	12%
No. of patients older than 65 years	16	9	—	36%
Sex	10M / 21F	2M / 9F	.4	—
Mean (SD)				
Age at time of arthroscopy, y	65.8 (9.1)	69.7 (6.7)	.3	—
Body mass index	31.2 (6.8)	30.1 (4.0)	> .5	—
Medial femoral chondrosis	2.6 (1.1)	2.6 (1.4)	> .5	—
Medial tibial chondrosis	1.3 (1.5)	2.2 (1.6)	.1	—
Lateral femoral chondrosis	1.6 (1.6)	1.5 (1.5)	> .5	—
Lateral tibial chondrosis	1.2 (1.4)	1.0 (1.5)	> .5	—
Patellofemoral chondrosis	2.3 (1.4)	3.0 (0.8)	.1	—
Knee Society Score	58.5 (11.0)	59.5 (7.9)	> .5	—
Kellgren-Lawrence grade	1.0 (1.1)	1.5 (1.4)	.2	—
Tibiofemoral angulation	+2.2° (4.3°)	+3.7° (1.8°)	.3	—
Stable meniscus tear	9/31 (29%)	3/11 (27%)	> .5	—
Moderate to severe OA or TKA in other knee	7/31 (23%)	5/11 (45%)	.2	—

Abbreviations: TKA, total knee arthroplasty; OA, osteoarthritis.
[a]Magnitude of local chondrosis and meniscal tear characteristics were determined during arthroscopy; all other characteristics were determined before surgery.

TKA and ensured or verified that nonoperative management or eventually arthroscopy was offered.

All patients had preoperative Knee Society Scores (KSS),[15] visual analog scale (VAS) ratings of pain, thorough lower extremity physical examinations, and 3-view knee radiographs. The 3 views were patellofemoral (Merchant), lateral standing, and anteroposterior (AP) standing (knees fully extended). Information on sex, medical history, and body mass index (BMI) was collected. All patients were employed or recently retired non-Hispanic Caucasians.

The determination of clinically significant meniscal pathology was based primarily on history and physical examination criteria,[16] which included positive McMurray, Thessaly, and Steinman tests[17,18] and the "common criteria" used by Miller[16] (persistent pain, buckling or locking, effusion, joint-line tenderness, reduced function). For study enrollment, all the criteria had to be fulfilled. The surgeons had independently concluded the patients had more pain from meniscal pathology than from coexisting OA because of prominent mechanical symptoms (buckling or locking) and positive meniscal pathology tests. Other patient details are listed in **Table I**. Surveys were mailed to assess patient satisfaction and opinions.

Magnetic resonance imaging (MRI) scans were not an essential inclusion criterion and were obtained only for patients in whom diagnosing clinically significant meniscal pathology and distinguishing it from articular cartilage pathology (eg, arthritis) were not deemed by the surgeon to be clear using clinical history, physical examination, and radiographic analysis. In the case of clear diagnoses, it was not standard practice for either surgeon to obtain MRI scans, given patient age and economic constraints (cost to patient).[19] Overall, this approach was consistent with conventional criteria and decision-making algorithms of current clinical practice,[10,16,20-22] which include meta-analyses showing that clinical examination is often as accurate as MRI for diagnosing meniscus tears.[19] As MRI scans were obtained in only 23 (55%) of the 42 patients, the results of these studies could not be meaningfully included in the quantitative analyses. Of these 23 patients, 19 were in the arthroscopy-only group, and 4 were in the arthroscopy-plus-TKA group.

The K-L grading scale was used to analyze the preoperative standing AP radiographs.[23] This scale assigns 1 of 5 different grades to a knee: grade 0, no radiographic findings of OA; grade 1, minute osteophytes of doubtful significance; grade 2, definite osteophytes with unimpaired joint space; grade 3, definite osteophytes with moderate joint-space narrowing; and grade 4, definite osteophytes with severe joint-space narrowing and subchondral sclerosis.[23] K-L grades and anatomical tibiofemoral angles (positive values = valgus; negative values = varus) were calculated as the mean of the values from 3 independent evaluations. The evaluators were 2 fellowship-trained total knee and hip arthroplasty surgeons and 1 research assistant who had participated in research projects in which he had been comprehensively trained to read knee radiographs. In 3 cases, the grading was not unanimous, and the final grading was based on consensus opinion after reevaluation of the images. The 3 evaluators also examined the patellofemoral and lateral standing knee radiographs. They were unanimous in independently concurring that these additional views did not show anything more advanced than minor patellofemoral OA, and they did not review the evidence of radiographic changes on lateral views that might suggest worse OA than determined by K-L grades on standing AP radiographs.

All patients received general anesthesia, and the arthroscopic debridements were in accordance with prior descriptions, except that osteophytes were not excised.[24,25] Operative notes and photographs of arthroscopic findings were used to determine Outerbridge OA grades (magnitude of "chondrosis")[9] for the medial femoral condyle, the medial tibial condyle, the lateral femoral condyle, the lateral tibial condyle, and the patellofemoral region. A meniscal tear was deemed unstable if it was full- or partial-thickness, longitudinal and displaceable, radial or oblique, estimated at 3 mm or more, or complex.[12] Patients with failed knee arthroscopy were returned to the knee replacement surgeon, who reevaluated them (using the criteria listed in **Table I**) for possible TKA. All patients who underwent TKA showed radiographic progression of OA from time of arthroscopy.

Three-way analysis of variance (ANOVA) was factored using sex, age (50 to 65 years, > 65 years), and whether TKA was performed (arthroscopy-only, arthroscopy-plus-TKA). One-way ANOVA (continuous variables) or Fisher exact test (categorical variables) was used to determine significant differences between the arthroscopy-only and arthroscopy-plus-TKA groups in terms of patient and knee characteristics (**Table II**). Kruskal-Wallis Z tests were used for the post hoc tests. Questions in a final follow-up satisfaction survey were analyzed for statistical significance using the Wilcoxon Mann-Whitney test.[26] Spearman correlation coefficients were used to assess relationships between some patient characteristics. Statistical significance was set at $P < .05$.

Results

Nearly 1 in 4 patients who were enrolled and had arthroscopy while in our clinical evaluation method underwent TKA by 3-year follow-up. The target rate (< 10%) for conversion to TKA was not reached in this patient cohort, but there was a tendency toward reaching the target rate in patients younger than 65 years (**Table II**). Although all patients had persistent knee pain with medial joint-line tenderness and a positive Steinman test, these findings were considered less significant to each patient when compared with the greater degree of pain associated with mechanical symptoms. Observations made during arthroscopy revealed that all patients had evidence of OA as defined by Outerbridge grades 2 or 3 chondritic changes. No patients had grade 4 chondrosis. There were no complications. Degenerative meniscal tears were found in all but 1 case (a synovial plica and mild degenerative changes were found).

No significant difference was found in prearthroscopy data between arthroscopy-only patients and arthroscopy-plus-TKA patients in terms of VAS pain, sex, age, BMI, KSS, K-L grade, knee angulation, meniscal tear stability, or Outerbridge OA grades of specific anatomical regions of the knee. Positive McMurray and Thessaly tests also did not differentiate the groups

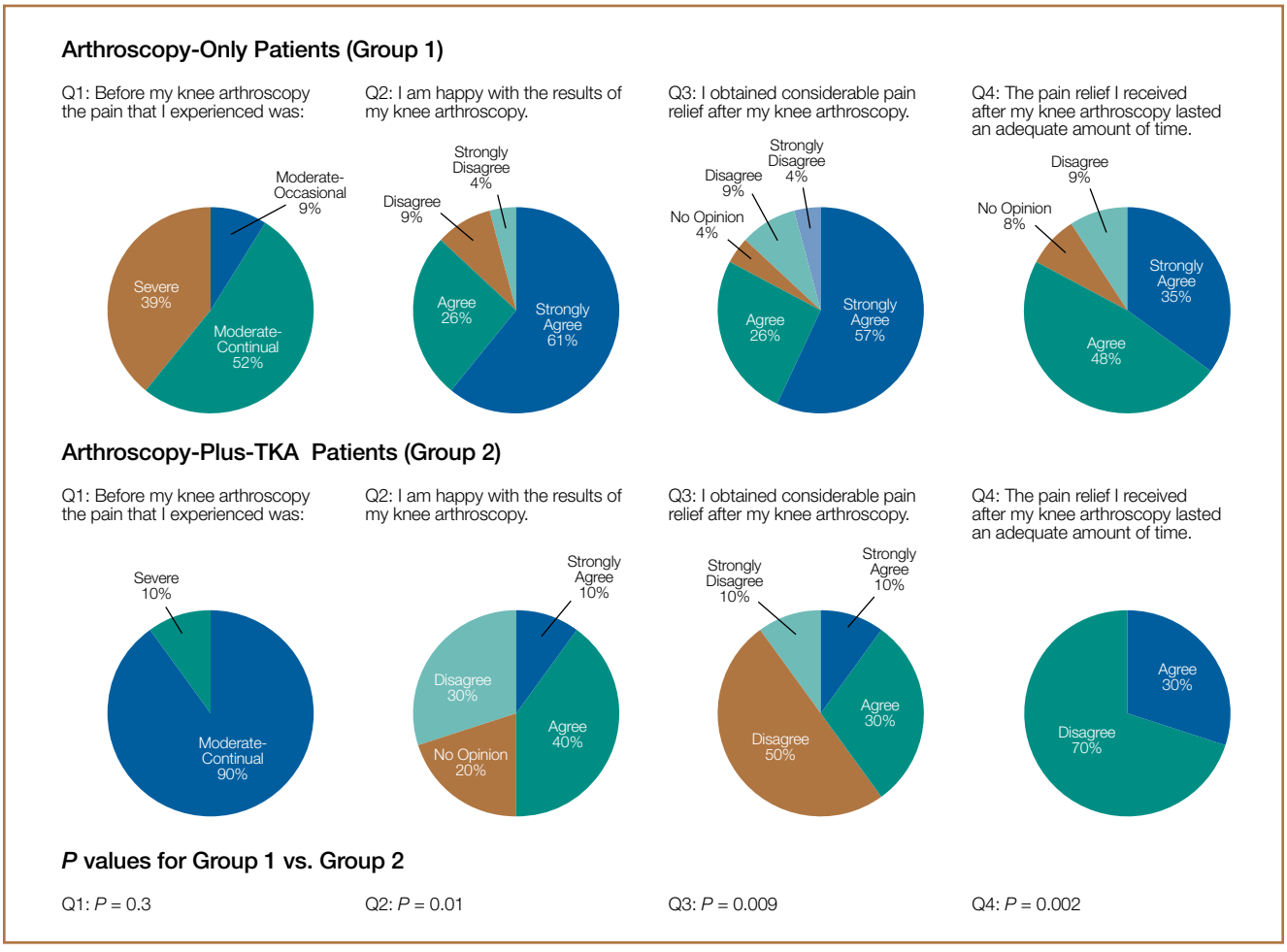

Figure. Results of patient satisfaction survey. Response rates for supplemental questions: (1) arthroscopy-only patients (23/31; 74%), (2) arthroscopy-and-TKA patients (10/11; 91%).

and were not associated with meniscus tear stability. None of the arthroscopy-only patients had repeat arthroscopy or an osteotomy during the 3-year follow-up period. With respect to the 2 groups defined by the 65-year age cutoff, except for age these groups did not differ significantly. However, there was a trend toward worse chondrosis in the medial knee compartment of the older-than-65 group (P = .08). This trend was P = .1 when considering the arthroscopy-only and arthroscopy-plus-TKA groups.

Survey results are summarized in the **Figure**. Four (36%) of the 11 patients who converted to TKA still felt their knee arthroscopy provided "considerable pain relief." Three (27%) of the 11 felt their pain relief lasted an "adequate amount of time." Five (45%) of the 11 were satisfied with having had knee arthroscopy and would have it again, even though they had converted to TKA.

Discussion

Previous studies have found high rates of conversion from index knee arthroscopy to TKA when arthroscopic lavage or debridement is performed solely for OA symptoms.[1-4] We avoided this by selecting patients with meniscal pathology, which coexisted with relatively less symptomatic and lower-grade OA. We tried to reduce our conversion rate to less than 10% by 3 years after arthroscopy. We triaged patients using a method of independent evaluations by 2 orthopedic surgeons who were partners in a private practice. Although we did not reach our goal, much can be learned from this study because it applies to private practice and other surgeons who face the challenge of predicting which patients should go straight to TKA.

At the outset of this study, we were aware of the limitations and potential bias of a 2-surgeon evaluation method in a private practice setting, and of not randomizing patients into alternative study trials and not remunerating them for their participation. However, we think a strength of this study is that it paints a realistic picture of a community-based practice and is based on conventional criteria and widely used decision-making algorithms. Hence, we argue our results are important because they reflect the limitations in the "current state of the art" of performing knee arthroscopy for patients who primarily have pain from meniscal pathology but also have underlying but lower-grade OA. Certainly a control group

of nonoperative patients with meniscal tears and OA would have been helpful in the analysis, but this was not possible or reasonable in our patient population and private practice setting. This became clear, during the pilot evaluations we conducted before initiating our study, when patients typically refused to remain randomized in a nonoperative cohort in which intra-articular corticosteroid injections, an off-loader brace, and physical therapy were being offered.

Another limitation is that AP flexion knee radiographs were not used. Having these radiographs may have helped us reduce our conversion rate because they are more effective than standard AP standing views in detecting joint-space narrowing in patients with knee OA.[27-30] The rate of conversion from index arthroscopy to TKA has been reported to be about 20% in studies that have used AP flexion knee standing radiographs.[9,24,31] The present study found a rate of 26%. Although use of flexion views likely would have helped us reduce our rate, it seems highly unlikely that this would have helped us reach our target conversion rate (< 10%).

With use of the 2-surgeon clinical evaluation method, we nearly reached our target under-10% conversion rate in patients younger than 65 years (12%; 2/17) but not in patients older than 65 years (36%; 9/25). Despite using this approach in a highly selected cohort, we unexpectedly observed high conversion rates at 3-year follow-up in the entire group (26%) and in the group older than 65 years (36%). The high rate found in our patients older than 65 years and in others cited above supports the observation, made by Wai and colleagues,[2] that arthroscopic debridement may be overused in elderly patients for whom primary TKA may be the most appropriate treatment. This observation is supported by data showing that meniscal tears increase with age and are prevalent in both asymptomatic and symptomatic OA knees.[22,32] Degenerative meniscal damage appearing as a tear on MRI may be a symptom of early OA.[33] Bhattacharyya and colleagues[22] found that, in patients with knee OA, meniscal tears do not affect functional status or cause more pain. "Mechanical" symptoms typically thought to be associated with unstable meniscal tears have also been shown to be unreliable predictors of the success of arthroscopic debridement for degenerative meniscal tears in the setting of OA.[12]

Our evaluation method did not identify characteristics (**Table II**) that could help determine which patients would convert to TKA. However, there was a trend toward increased conversion in patients with more advanced medial tibial chondrosis (overall cohort, $P = .1$; 65-year cutoff groups, $P = .08$). A limitation of this study is that preoperative MRI scans were obtained for only 55% of the patients; obtaining these scans, however, was not standard practice for either surgeon. Having only radiographs and history and physical examination findings makes it difficult to differentiate OA, medial femoral condyle osteonecrosis, and meniscal tears. MRI scans could have provided information that would have led to avoiding intervention with knee arthroscopy in some patients. But a strength of this study is that the magnitude of chondrosis was determined from direct arthroscopic observations. Studies have shown that intraoperative assessment of cartilage is an important predictor of outcome.[34,35] By contrast, it is unclear whether preoperative MRI scans are sufficiently sensitive to accurately detect differences in the magnitude of chondrosis that would predict failure of arthroscopic debridement. For example, MRI scans can be used to follow OA progression, but MRI findings have not been shown to correlate well with clinical progression and functional status.[36]

Conclusion

Our 2-surgeon evaluation method resulted in an unexpectedly poor rate (26%) of conversion from index knee arthroscopy to TKA in patients deemed to have pain primarily from meniscal pathology in the setting of lower-grade OA. This was most notably the result in patients older than 65 years (36%). Although our study was conducted at a single private practice clinic and therefore our results might be difficult to generalize, these poor outcomes occurred in a highly selected patient cohort and were based on the conventional criteria and decision-making algorithms used by 2 fellowship-trained joint replacement surgeons.

We conclude that our approach does not alter the outcomes and ultimate transition to TKA, as shown in previous studies. We now advise our patients who are evaluated with this method: In nearly 2 of 3 patients older than 65 years, knee arthroscopy likely provides satisfactory results for at least 3 years; the third patient likely will require TKA within that period. By contrast, about 1 in 10 patients who are 50 to 65 years old are converted to TKA within the first 3 years after arthroscopy.

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