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ORIGINAL PAPER

Arthroscopy with partial meniscectomy for degenerative tear does not increase the risk of total knee arthroplasty at five year follow up; however, this population undergoes total knee arthroplasty with a lower threshold of osteoarthritis

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Abstract

Purpose Degenerative meniscus tears can cause discomfort in some patients, and when medical treatments fail to provide relief, arthroscopy may be considered before resorting to knee prosthesis. However, the benefits of arthroscopy over non-surgical treatments in patients over 60 years old are limited, and the evidence regarding its overall efficiency and drawbacks remains scarce. Furthermore, there has been no investigation into whether those patients treated with partial meniscectomy, undergo the knee operation at an earlier stage of osteoarthritis.

Methods This study focused on data from a single Belgian hospital, involving patients over 60 years old with internal meniscal tears. The participants were categorized into two groups based on the treatment they received: arthroscopic partial meniscectomy (APM) or conservative management. The primary outcome assessed was the occurrence of knee arthroplasty within a five year period. Secondary outcomes included evaluating the ICRS cartilage grade and the time taken until total knee arthroplasty (TKA).

Results A total of 194 patients with internal meniscal tears were included in the study. At the 5-year mark, the overall rate of knee arthroplasty was found to be 16.5%, with 11.9% of cases occurring within two years. After the 5-year follow-up, it was observed that 19.2% (24 patients) of the APM group and 11.6% (8 patients) of the conservative management group underwent knee arthroplasty. Notably, patients over 70 years old who underwent APM had a higher risk of eventually requiring TKA compared to those who received conservative management. Additionally, patients who underwent meniscectomy and later underwent TKA showed less wear in the internal compartment of the knee compared to patients in the conservative treatment group who underwent TKA.

Conclusion The study suggests that patients who underwent arthroscopy faced a similar risk of knee arthroplasty compared to those who underwent conservative management, excepted for patients over 70 years old. Despite this similar risk of arthroplasty for the whole population, they exhibited lower osteoarthritis severity when compared to the conservative group.

Keywords Meniscal tears · Partial meniscectomy · Osteoarthritis · Total knee arthroplasty · Elderly

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Introduction

The total knee prosthesis is an effective treatment for patients with knee osteoarthritis, but before these patients reach the stage of indication for knee prosthesis, there is a certain mechanical discomfort that sometimes is not relieved by medical treatments associated with physical therapy and which leads to perform arthroscopy for a degenerative meniscus tear [1, 2].

In light of the numerous randomized controlled trials and studies of other designs [3, 4] showing that arthroscopy does not really postpone the arthroplasty, there is little evidence about the efficiency or the inconvenient of such a treatment. But we must admit that we do not know whether physical therapy and conservative treatment [5, 6] really helps patients with these diagnoses by postponing the arthroplasty. Indeed, it does not make a lot of biologic or anatomic sense since we know that we cannot predict that cartilage [7] and the meniscus [8] are going to continue to degenerate with or without arthroscopy, whatever the stress conditions [9, 10] or the shape of the meniscus [11].

On the other hand, a patient's decision to have discretionary surgery is largely driven by how surgeons present that option to them. Offering a patient an operation (or even a patient "asking" for one) is not evidence of that procedure's efficacy, but the fact that some surgeons do not recommend such an intervention because there is a risk of inefficiency does not make sense for some patients, particularly when they have contraindications for medical treatments and do not want to receive a total knee arthroplasty. These patients may perceive inaction as negligence to their symptoms.

Another limit is that in most studies, the number of reoperations [3, 4, 6, 12] is used to judge the effectiveness of the treatment. It is difficult to compare the number of knee prostheses after partial meniscectomy and, in the same way, the number of knee prostheses performed after conservative treatment: it must be remembered that in both cases a good number of patients are probably not reoperated, and even those who are not well. It is therefore difficult to get an idea of the relevance of one treatment or another, that is to say partial meniscectomy or conservative treatments by medical treatments and rehabilitation. Among the several million patients [13] who have symptomatic and advanced knee OA, this discussion is frequent and probably cannot be resolved by the numerous randomized trials [6, 14] conducted around the world comparing arthroscopy and nonsurgical alternatives, since the benefits observed from surgery or physical therapy could be subjective and simply attributable to the passage of time in many situations.

If we now examine the osteoarthritis threshold leading to prosthesis, it is independent of the patient's knee score; nor is it related to the perception of pain. It is simply related to the radiological status of the knee. So even if we are unable to identify the reasons which lead to knee arthroplasty, it would be helpful to guide the clinician discussing with the patient, whether TKA will be performed at the same threshold of osteoarthritis for patients with arthroscopy than for those who have undergone conservative treatment. There are many studies comparing the benefits and risks of arthroscopy before total knee replacement, but there is no study evaluating whether patients treated by partial meniscectomy have conversion to a TKA at an earlier stage of osteoarthritis or not, as compared to the general population.

The aim of this study was therefore to study the thresholds of osteoarthritis leading to the indication of a total knee prosthesis during the spontaneous evolution of the osteoarthritis disease, compared to the threshold of osteoarthritis leading to the knee prosthesis after a partial meniscectomy for degenerative meniscus.

Methods

The ethics committee of the institution approved the study (P2023/032).

Data source

In this monocentric study, the collection of data was obtained from a Belgian hospital of patients who underwent arthro-computed tomography (arthro-CT) for knee pain and suspicion of meniscal tears.

Participants and exposure

All patients over 60 years old undergoing arthro-computed tomography for knee pain between January 2017 and December 2018 were reviewed. Patients with internal meniscal tear were selected for the study, and all demographic records were extracted after identification. Only isolated internal meniscal tears cases were eligible for inclusion, excluding patients with isolated external meniscal tears [8], with prior surgery to the same knee, with ligament reconstruction and meniscal procedures [15]; patients with previous unicompartimental arthroplasty or femoropatellar arthroplasty also were excluded. For all patients, age at the time of arthro-CT, sex and ICRS cartilage grade for each compartment were obtained. For each compartment, cartilage involvement was studied on various reconstructions (axial, frontal, and sagittal), and the most severe grade was recorded. From this population, two groups were established: one group with arthroscopic partial meniscectomy, and the other group with conservative management for the meniscal tear.

Arthro-CT protocol and images acquisition

During the arthro-CT, all patients were positioned supine, lying on their back, with the examined leg fully extended. A total of 10ml of iodinated intra-articular contrast was injected using a medial patellofemoral approach under fluoroscopy, after evacuation of effusion if present. All images were acquired using the same Siemens machine and protocol, with consistent tube parameters (250mAs, 120kV), exposure time of 0.5s, reconstruction thickness of 0.6mm, reconstruction spacing of 0.4mm, and a display field of view of 170mm. Both examinations included axial views of the entire knee (including the whole patella, femoro-tibial joint), as well as reconstructed coronal and sagittal views. The images were analyzed using the DICOM viewer Telemis.

Studies interventions

In the group arthroscopic partial meniscectomy, surgeries were performed during a one day surgery procedure, under spinal anaesthesia and general anaesthesia. The patients were placed in a supine position with a pneumatic tourniquet applied at the root of the operated limb (inflated to 250mmHg). An "optical" approach was made externally to the patellar tendon at the level of the joint space. After inspecting the femoropatellar compartment, the medial femorotibial compartment was examined to confirm the diagnosis of meniscal injury. An "operating" channel was then created internally to the patellar tendon at the joint space level and under intra-articular visual control to avoid injuring the anterior horn of the medial meniscus. After exploring the notch and the external compartment, partial meniscectomy was performed using forceps and with the assistance of a "torpedo" probe (Arthrex) mounted on an arthro motor. After removing the meniscectomy fragments and evacuating the intra-articular fluid, the patients received a hyaluronic acid injection.

The treatment in the conservative group consisted of initiating analgesic therapy, initially involving anti-inflammatory medications and physiotherapy. In case of failure of this treatment, patients received intra-articular corticosteroid injections, followed by hyaluronic acid and/or PRP injections. If there was a positive response to the analgesic treatment, patients were monitored in outpatient consultations to watch for potential recurrence of symptoms and to provide early intervention if needed.

Patients were referred to the surgical group if they presented mechanical symptoms of their meniscal lesion, i.e., knee blocking and instability. In the absence of these signs, conservative treatment was proposed.

In each group, the decision for conversion to prosthetic surgery was made by the surgeon in consultation with the patient, following the failure of the initially proposed treatment (conservative treatment). For patients who underwent APM, the consideration of prosthetic surgery naturally followed a lack of symptom improvement after infiltrations.

Outcomes

The primary outcome analyzed between the two groups was the occurrence of knee arthroplasty within 60 months (5 years) following either the arthroscopic partial meniscectomy (APM) or the knee arthro-CT for non-APM patients. As secondary outcomes, the severity of the ICRS grade, the average time until total knee arthroplasty (TKA), and the survival rate (Kaplan–Meier curve) for each group were also analyzed.

Statistical analysis

The study determined the absolute rate of knee arthroplasty for each group. The risk (odds ratio) of knee arthroplasty in patients with a history of APM was compared to the general population (those without a history of APM) at two and five years of follow-up. To assess the impact of each variable on the arthroplasty risk, discrete variables were analyzed using non-parametric tests (Chi-square or Fisher's exact test). The results were presented as percentages with odds ratios and 95% confidence intervals. Continuous variables were analyzed using parametric tests and presented as means with standard deviations. A mortality-adjusted Kaplan–Meier survival analysis, with survival defined as not undergoing knee arthroplasty, was conducted and stratified by patient age group.

Statistical analysis was performed using SPSS (SPSS Inc., Chicago, USA). The results were considered significant if the p value was < 0.05.

Results

During the study period at the institution, a total of 1284 patients underwent arthro-CT. Among them, 375 patients were over 60 years old. After data cleaning and excluding patients with a history of ligament reconstruction and meniscal surgery, previous arthroscopic interventions, or arthroplasty, a final cohort of 194 patients with a diagnosis of internal degenerative meniscal tear were included (Fig. 1). A total of 125 were included in the arthroscopy group and sixty-nine in the conservative treatment group. The overall rate of knee arthroplasty was 16.5% at five years, with 11.9% within two years. The mean age of the whole population was 67.8 ± 5.3 years, with predominance of women (104 among 195, 54%). There were no observed differences between the two groups in terms of age, sex ratio, and ICRS grade of all compartments (Table 1). The rate of arthroplasty was

Fig. 1 Flow chart of the study

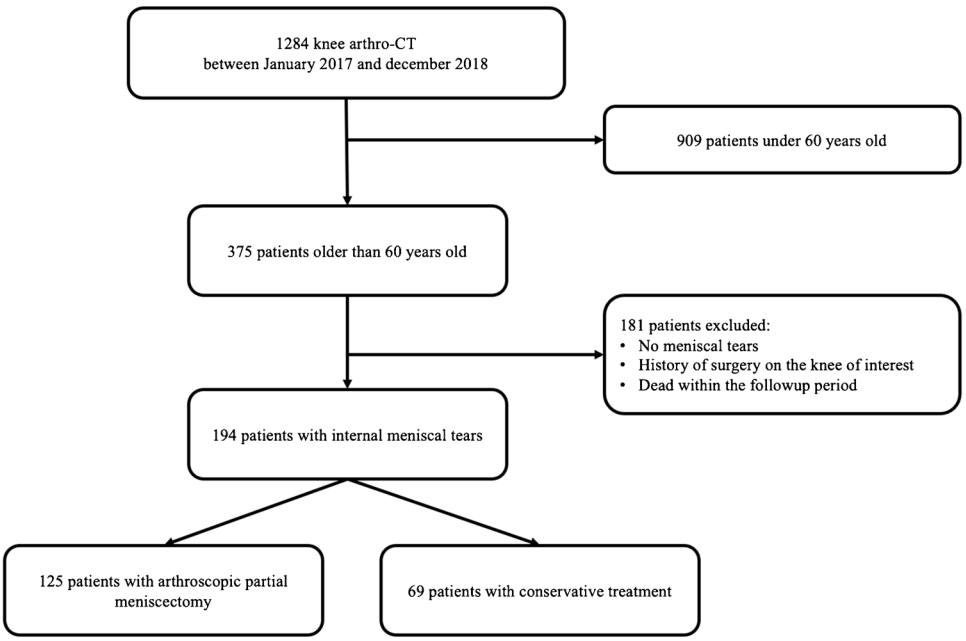

Table 1 Population description

	Meniscectomy (125 patients)	No meniscectomy (69 patients)
Age (years)	67.5	68.3
Sex W/M	67/58	37/32
TKA at 60 months	24 (19.2%)	8 (11.6%)
Mean time TKA (months)	16.4	19.7
FT int	2.4	2.8
FT ext	1.4	1.7
FP	2.5	2.7

W Women; *M* men; *TKA* total knee arthroplasty; *FT* femoro tibial; *FP* femoro patellar

Table 2 Risk of TKA depending of the treatment of the meniscal tear, stratified by age

		No menisectomy	Menisectomy	Total	*p*
<70yo	No TKA	38	75	113	*p*=0.87*
	TKA	7	15	22	
	Total	45	90	135	
>70yo	No TKA	23	26	49	*p*=0.038**
	TKA	1	9	10	
	Total	24	35	59	
Total	No TKA	61	101	162	*p*=0.17*
	TKA	8	24	32	
	Total	69	125	194	

TKA Total knee arthroplasty; *Khi^2; **Fisher's exact test

the same in patients less or more than 70 years old (16.2% versus 17% $p>0.05$).

After a five year follow-up, it was found that 19.2% (24 patients) in the APM (arthroscopic partial meniscectomy) group and 11.6% (8 patients) in the conservative group underwent knee arthroplasty. At the two year mark, the arthroplasty rates were 14% in the APM group and 7% in the conservative group. However, there were no statistically significant differences between the two groups regarding the rates of arthroplasty at both two and five years ($p>0.05$). The rate of arthroplasty over time was analyzed by age-group, and it was observed that older patients undergoing APM were more likely to undergo subsequent arthroplasty (Table 2). Specifically, patients over 70 years old had a higher risk of TKA after APM compared to conservative management (25.7% vs. 4%; odds ratio = 7.9, IC95 [1.2; 51.9]; p=0.038 — exact Fischer test). In patients younger than 70 years old, APM was not linked with a higher risk of TKA (15% vs. 17%; $p>0.05$). Figure 2 demonstrates survival rates (TKA define as event) of groups stratified by age, respectively younger than 70 years and older.

After comparing the degree of cartilage wear, it appears that patients who underwent meniscectomy and were later converted to total knee arthroplasty (TKA) had less wear in the internal compartment compared to patients in the conservative treatment group who received TKA (Table 3). The average International Cartilage Repair Society (ICRS) grade was 3.1 for the meniscectomy group with 21% of the patients who underwent TKA having an ICRS grade lower than 3. The ICRS was 3.8 for the conservative treatment group (p=0.023) for patients who underwent TKA, and all had an ICRS score of 3 or

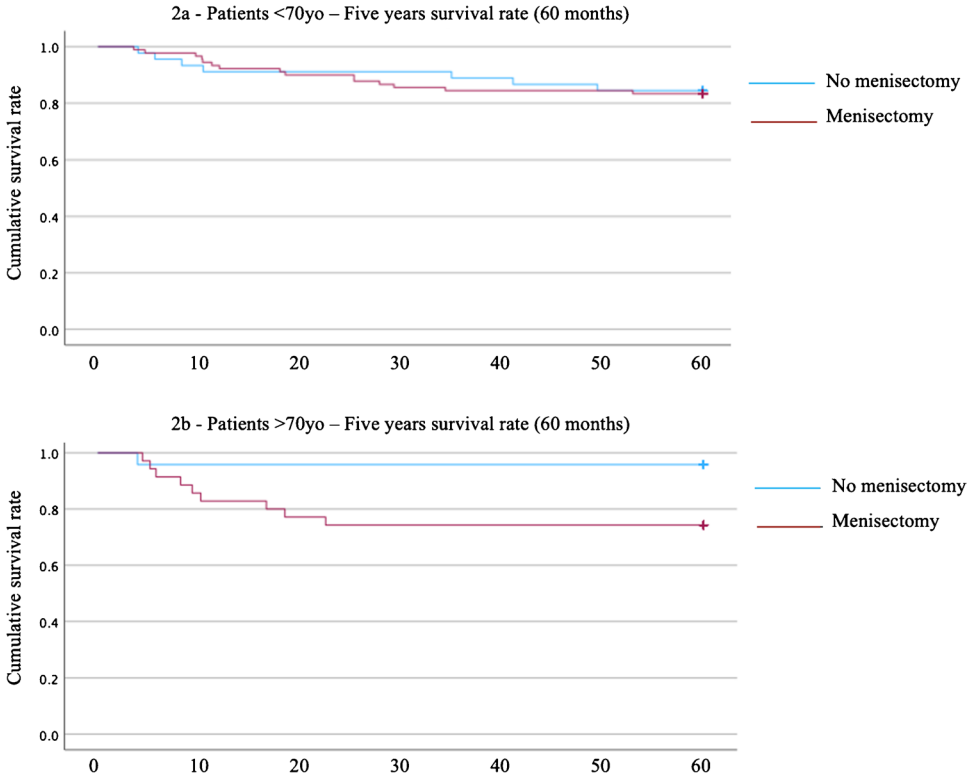

Fig. 2 **a** Kaplan–Meyer curve of conversion to TKA during the first 5 year for patients younger than 70 years old ($p = 0.87$ – log rank). **b** Kaplan–Meyer curve of conversion to TKA during the first 5 year for patients older than 70 years old ($p = 0.038$ – log rank)

Table 3 Comparison of ICRS score in patient operated of TKA between APM and conservative groups

		N	Mean	Std. Deviation	*p*
FT internal	Menisectomy	24	3.1	1.227	0.023
	No menisectomy	8	3.8	0.463	
FT external	Menisectomy	24	1.7	1.301	0.43
	No menisectomy	8	1.6	1.061	
FP external	Menisectomy	24	2.5	1.351	0.15
	No menisectomy	8	3.0	1.069	

ICRS International Cartilage Repair Society; *TKA* total knee arthroplasty; *APM* arthroscopic partial meniscectomy; *FT* femoro-tibial compartment

higher. The wear in the other compartments was comparable between the groups and did not have any impact on the risk of conversion to TKA. In the conservative treatment group, none of the patients who received a TKA had a ICRS score lower than 3 while 21% (5/24 patients) of the patients in the APM group who received TKA had a score inferior or equal to 2.

Regarding the mean time of conversion to TKA, there was no difference between the APM group and the conservative groups (16 versus 19 months p=0.6), even after age stratification.

Discussion

Even if there is an abundant literature on the limits of arthroscopy and partial meniscectomy to treat a degenerative meniscal lesion, this practice continues to be performed regularly; patients with mechanical symptoms resulting from knee osteoarthritis may require knee arthroscopy. Recent publications have attempted to determine the optimal time interval between knee arthroscopy and subsequent total knee arthroplasty (TKA) if needed, particularly due to the risk of occult infection [16, 17]. In our series, the rates of septic revision, when defined as patients requiring revision surgery due to infection, demonstrated no difference after arthroscopy. This risk appeared to remain insignificant according to the number of patients of this series.

Our study aimed to compare two groups of patients based on time intervals, who underwent TKA after an ipsilateral knee arthroscopy for regularization of a degenerative tear with mechanical symptoms, with a control group consisting of patients who had not previously undergone knee arthroscopy and had medical treatment with or without rehabilitation. Our study has defined the middle-term (5 years) risk of undergoing knee arthroplasty in patients with a meniscal tear who had undergone arthroscopy in comparison to a control group with a meniscal tear, but without a recorded history of arthroscopy. This control group may appear as a selected general population, but according to the frequency of meniscal tears [18] and the fact [19] that in a population

of 60–80 years old, the frequency of a degenerative tear is 80% and in a population of more than 80 year the frequency is 95%, we can consider that our control group correspond to the general population of this age. Overall, 19% of patients underwent knee arthroplasty within five years in the group with arthroscopy and 12% in the control group. In a recent systematic review [20] of knee arthroplasty rates after knee arthroscopy, the absolute annual rate of arthroplasty varied from 2% overall to 4% in patients according to the degree of osteoarthritis. Therefore, our rate of conversion to TKA after partial meniscectomy is in concordance with the literature.

Previous studies investigating the overall relative risk of knee arthroplasty following meniscal damage are scarce. In one relatively small cohort [21], patients with meniscal tears, undergoing arthroscopy, were found to be at three-times increased risk of knee arthroplasty. The relative risk in our study was higher than in the control group, but not really significant in comparison to the general population if we admit that our control group represents the general population.

Although the absolute risk of undergoing a knee arthroplasty after meniscectomy was low as compared to the general population, the relative risk was markedly elevated for elderly patients in comparison to the general population. There is evidence that, at a population level, elderly patients are usually less likely to undergo arthroplasty than younger patients due to comorbidity. Our study does not determine the causative pathobiology that may underlie this observation of more arthroplasty after meniscectomy in the elderly population. One possible reason could be the higher rate of progressive osteoarthritis after meniscectomy in elderly population, but this does not correspond to the stage of osteoarthritis that were lower at the time of TKA after meniscectomy as compared to those who had TKA in the general population. The reasons for these observations are likely to be multi-factorial, as related to differences in care seeking, behaviour or differences in access to treatment since these patients had a previous surgery. It must be noted, however, that all patients in our cohort had already "sought care", undergoing arthrography at the point of inclusion, and therefore, we caution that the observed differences in subsequent arthroplasty rates should not be solely attributed to differences in care seeking behaviour or access to healthcare. Even if we were unable as many experts [22] to predict and identify in this study the reasons which lead to the installation of a total knee prosthesis, there is evidence that the patients who have undergone a prior meniscectomy arrive at the total knee prosthesis with a lower threshold of osteoarthritis than those who have undergone conservative treatment even in the elderly population. This finding may rather suggest that the cause of TKA after partial meniscectomy is not progression of osteoarthritis and that meniscal arthroscopy does not accelerate osteoarthritic progression, causing individuals to reach an endpoint of advanced osteoarthritis quicker than otherwise susceptible individuals in the general population.

If we now accept that osteoarthritis is independent of the patient's knee score and pain, another conclusion is that the perception of pain after partial meniscectomy may be different in this population as compared to the general population; this may explain why this population was asking a partial meniscectomy and why the same population was asking for total knee prosthesis with a lower threshold of osteoarthritis.

Author contributions All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Jacques Hernigou. The first draft of the manuscript was written by Jacques Hernigou and Dylan Lechien. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Declarations

The ethics committee of the institution approved the study (P2023/032).

Conflict of interest The authors declare no competing interests.

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