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ORIGINAL ARTICLE

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The therapeutic outcome of minimally invasive synovectomy assisted with arthroscopy in the rheumatoid knee

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Abstract The purpose of the present study was to retrospectively evaluate the therapeutic outcome of minimally invasive synovectomy assisted with arthroscopy (MISAA). From 1995 to 2003, MISAA was performed on 30 knees of 18 rheumatoid arthritis patients. The mean follow-up period was 74.4 months. Radiographic assessment according to Larsen's radiological classification, the conversion ratio to total knee arthroplasty (TKA), and postoperative change of the range of flexion were evaluated retrospectively. There were 10 knees in grade I, 14 knees in grade II, and 6 knees in grade III, preoperatively. All the knees in grade I and 8 of 14 knees in grade II maintained the same grade until the latest follow-up. The other 6 knees in grade II and all the knees in grade III deteriorated to grade IV and were converted to TKA after MISAA. The mean range of flexion significantly increased postoperatively except the knees that were converted to TKA. MISAA is effective for rheumatoid knees in grade I or II, and improves range of flexion.

Key words Knee · Minimally invasive surgery · Rheumatoid arthritis · Synovectomy

Introduction

The etiology of rheumatoid arthritis (RA) locates in the synovial membrane. The knee joint contains synovial membrane, and therefore is a frequent focus of RA. If the joint symptoms are ignored, destruction and deformity of the joint can progress quickly, and this deterioration results in restriction of the activities of daily living of the RA patients. To prevent deterioration of joint destruction or deformity, synovectomy is an established procedure involving resection of the focus of the synovial membrane.[1,2] Recently, arthroscopic synovectomy has become the most popular surgical technique in synovectomy in rheumatoid knees because of minimum invasion and little contracture,[3–7] but recurrence is a major complication of arthroscopic synovectomy.[2] On the other hand, open synovectomy is used less frequently because of the postoperative loss of range of motion and the longer hospitalization period. We have therefore developed and performed minimally invasive synovectomy assisted with arthroscopy (MISAA) to employ a superior surgical technique in arthroscopic synovectomy. This technique was designed to decrease the postoperative loss of range of motion although it is a sort of open synovectomy, having some advantages; e.g., shorter operative time and lower recurrence rate, in comparison with arthroscopic synovectomy. The purpose of the present study was to evaluate the mid-term therapeutic outcome of MISAA retrospectively.

Materials and methods

From 1995 to 2003, MISAA was performed on 30 knees of 18 RA patients. There were two men and 16 women, and their mean age at operation was 48.06 ± 3.39 years (range; 21–71 years). Sixteen patients had adult-onset RA and two patients had juvenile RA. The mean period from the onset of RA to MISAA was 91.56 ± 20.37 months, and the patients underwent various conservative therapies. MISAA was indicated for patients whose rheumatoid knee was resistant to conservative treatment for a few months with obvious swelling, pain, hotness, and ballottement of the patella. The mean postoperative follow-up period was 74.4 ± 7.75 months (range, 25–141 months).

The following parameters were evaluated in the present study. (1) Radiographic assessment by Larsen's radiological

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classification[8]: all the knees were evaluated preoperatively and at the latest follow-up according to Larsen's radiological classification. (2) Conversion ratio to total knee arthroplasty (TKA): the conversion ratio to TKA was examined by preoperative grade of Larsen's radiological classification. (3) Range of flexion: the range of flexion of the knee was examined preoperatively and at the latest follow-up. The patients were classified by Larsen's radiological classification into grade I as group 1, grade II as group 2, and grade I + II as group 3.

Surgical technique

A tourniquet was applied high around the thigh under spinal anesthesia, and the synovial membrane only around the cruciate ligaments was carefully resected as in standard arthroscopic synovectomy using an anteromedial approach and an anterolateral approach. Then, the anteromedial portal was extended up and down by 2 cm parallel to the medial border of the patella, and an upper-lateral parapatellar, 2-cm incision was made (Fig. 1a). Through the upper-lateral incision, the synovial membrane in the suprapatellar pouch and the lateral pouch was resected, and through the lower-medial incision (the anteromedial portal), the synovial membrane in the medial pouch and the infrapatellar pouch was resected, too (Fig. 1b). Synovectomy was performed thoroughly including the articular capsule, and care was taken to avoid injuring the patellar retinaculum and meniscus during resection. When the recesses of the joint could not be observed directly, arthroscopy was available to recognize and resect the pannus (Fig. 1c). Finally, the patellar retinaculum and skin were closed in the routine fashion.

Postoperative management

Active exercises for the knee were started on the first postoperative day. Crutch gait or cane gait was permitted on the same day.

Statistical analysis

Statistical analysis was performed using the Student's *t*-test to assess the difference in the range of flexion preoperatively and at the latest follow-up. Statistical significance was set at $P < 0.05$.

Results

Radiographic assessment

There were 10 knees in grade I, 14 knees in grade II, and 6 knees in grade III preoperatively according to Larsen's classification. All the knees in grade I and 8 of 14 knees in grade II maintained the same grade until the latest follow-up. The other six knees in grade II and all the knees in grade III

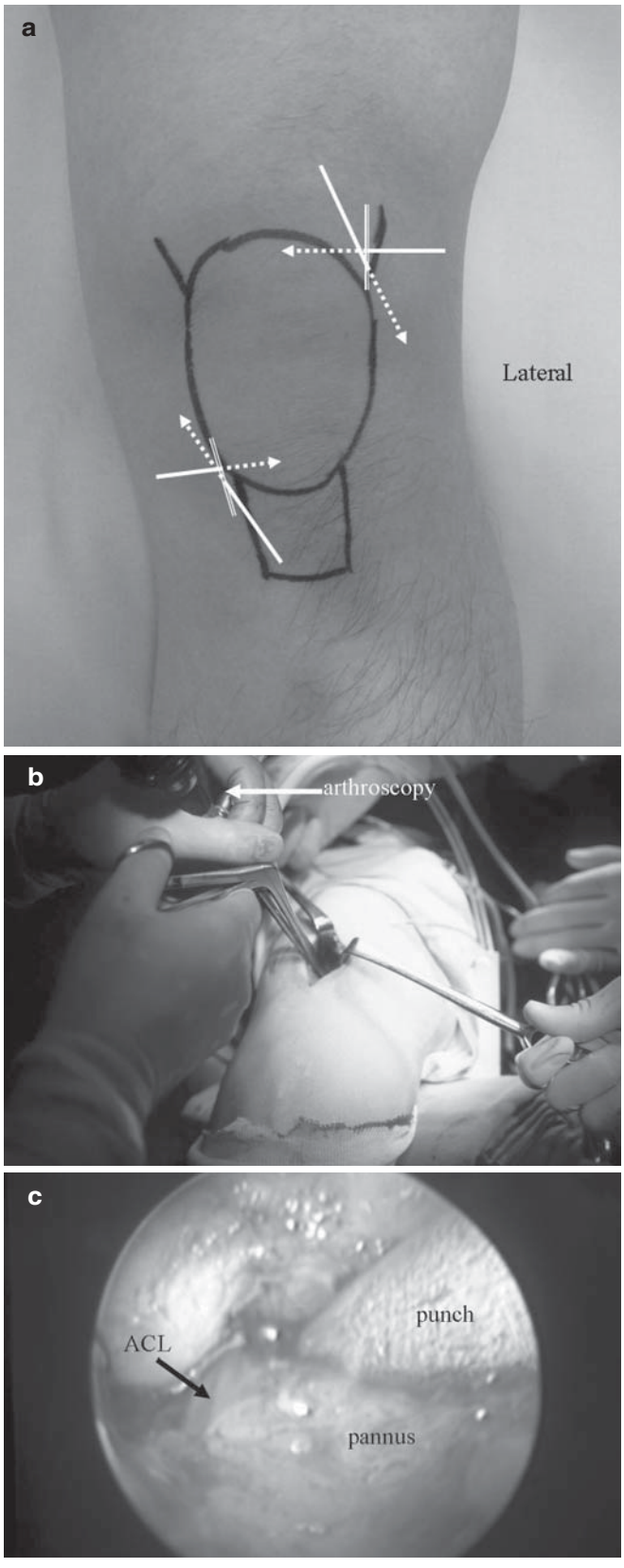

Fig. 1. **a** Upper-lateral and lower-medial incisions, each approximately 2 cm (*double lines*), and the approach through the two incisions (*white arrows*). **b** A scene of minimally invasive synovectomy assisted with arthroscopy; synovectomy is assisted with arthroscopy to approach recesses. **c** A view of synovectomy assisted with arthroscopy that is rather different from a normal arthroscopic view

Table 1. Clinical outcome

Preoperative Larsen's grade	Follow-up period	Larsen's grade at the latest follow-up	Time to TKA
I: 10 knees	66 months	I→I 10 knees	(–)
II: 14 knees	59.9 months	II→II 8 knees	(–)
		II→IV (TKA) 6 knees	55.3 months
III: 6 knees	75 months	II→IV (TKA) 6 knees	29.5 months*

* $P < 0.05$ compared to grade II

Table 2. The change of range of flexion

	Preoperation	Latest follow-up	*P* value
Group 1	120.5 ± 4.1	117.0 ± 6.0	0.399*
Group 2	113.8 ± 8.0	120.6 ± 6.2	0.025**
Group 3	117.5 ± 4.4	118.6 ± 4.2	0.035**

* Not significant, ** $P < 0.05$

deteriorated to grade IV and were converted to TKA after MISAA (Table 1). One patient (3.3%) showed recurrence and underwent MISAA again. All the cases but one deteriorated in radiographic assessment although they did not express obvious recurrence of synovitis. Some cases suddenly deteriorated from grade II to IV for a short period.

Conversion ratio to TKA

Six of 14 knees in grade II and all six knees in grade III were converted to TKA. The mean period from MISAA to TKA was 55 months in grade II and 29 months in grade III. The mean period from MISAA to TKA in grade III was significantly shorter than in grade II, and all knees in grade III were converted to TKA within 3 years postoperatively.

Range of flexion

There were significant increases in the mean range of flexion in the latest follow-up in groups 2 and 3 together as compared with the preoperative status. The mean range of flexion in group 1 did not change with the full range. All patients who had undergone TKA up until the latest follow-up were excluded (Table 2).

Discussion

Recently, new disease-modifying antirheumatic drugs have become available on the medical market, and some reports have indicated that these drugs are successful in treating RA patients.[9–11] Yet many patients suffer greatly from RA, and for these patients surgery is sometimes necessary. In cases of severe destruction of rheumatoid knee, TKA is often performed as a conclusive procedure. However, TKA in the RA patient who is younger than 60 years should be avoided if possible, because TKA revision will be needed in the future and is technically demanding and difficult.[8,12]

To keep patients with rheumatoid knee healthier at least until they reach a suitable age to undergo TKA, synovectomy is effective as pre-TKA surgery. There are many reports concerning the effectiveness of synovectomy to delay deterioration of rheumatoid joints.[1–5,7] Before the era of arthroscopy, open synovectomy was widely used for treating the rheumatoid knee. However, now arthroscopic synovectomy is replacing open synovectomy because arthroscopic synovectomy is a superior procedure in terms of shorter hospitalization period, earlier recovery of the wound, and minimal loss of range of motion.[3–7] However, open synovectomy is superior to arthroscopic synovectomy in terms of lower recurrence rate and earlier effect of pain relief.[1,2,13,14] The reason for the low recurrence rate in open synovectomy is that the synovial membrane can be thoroughly resected, including the articular capsule in one case.[13,15] Recurrence and reoperation are stressful for the RA patient, and reasonably all patients and medical staffs hope for no recurrence. Low recurrence rate is one of the most important advantages in synovectomy.

Regarding a new method for synovectomy, we developed MISAA, aiming at low recurrence and no loss of the range of motion. In terms of the recurrence rate, open synovectomy, in which the synovial membrane can be thoroughly resected, is superior to arthroscopic synovectomy because the main cause of recurrence is the residual synovial membrane, and it may be technically difficult to completely resect the synovial membrane in arthroscopic synovectomy. The recurrence rate in MISAA is provisionally similar to that of open synovectomy, because MISAA is a kind of open synovectomy where the synovial membrane and articular capsule are thoroughly resected. In this study, recurrence of arthritis was actually observed in only one of 30 knees during the mean postoperative period of 74.4 ± 7.75 months, and this patient underwent MISAA again with good results. Concerning recurrence, there were actually some knees that deteriorated without knowledge although obvious synovitis was not seen. This may be then reason why synovectomy should be performed at an early stage as described in previous reports.[13]

Using MISAA, only two, small (2 cm) incisions are made, and therefore there is a minimal effect on the extension mechanism, thus maintaining the range of motion postoperatively. In this study, the range of flexion in group 1 improved much more than in group 2 because the range of flexion in group 1 was already almost full preoperatively and so did not improve postoperatively. Paradies[16] reported some loss in the range of motion in 64% of rheumatoid knees after open synovectomy. On the other hand, several reports indicated that arthroscopic synovectomy did not cause any loss in the range of motion.[6] MISAA is equivalent to arthroscopic synovectomy in terms of improvement of the range of motion, which was evident in this study (Table 3). Another merit associated with using the two incisions in MISAA is that the approach to the lateral and medial pouches allows quick and easy resection. MISAA never

Table 3. Comparison during MISAA, open synovectomy, and arthroscopic synovectomy[4,7,13,14]

	MISAA	Open synovectomy	Arthroscopic synovectomy
ROM	Improved	Stable	Improved
Arthroplasty			
Early stage	0%	2%–4%	0%–5%
Late stage	60%	39%–67%	25%–46%
Time to arthroplasty (years)	3.5	2.8–7.3	8–8.9
Deterioration of Larsen's scores except cases of TKA	0%	19%–40%	49%–100%

Early stage, Larsen score ≤1; late stage, Larsen score ≥2

takes more than 1 h of operative time, although in arthroscopic synovectomy it often takes more than 1 h to resect the synovial membrane thoroughly, especially in the lateral and medial pouches. Moreover, in difficult cases adequate synovial membrane resection cannot be achieved.

Concerning the conversion ratio to TKA, no knee in grade I, 6 of 14 knees in grade II (43%), and all 6 knees in grade III (100%) deteriorated to grade IV and were converted to TKA. The mean duration from MISAA to TKA was 55 months in grade II and 29 months in grade III, and that in grade II was significantly longer than in grade III. The other knees that did not convert to TKA did not deteriorate in radiographic assessment at the final follow-up in our study (Table 3). This result is similar to a result of open synovectomy,[13,14] which may be superior to arthroscopic synovectomy, and it is also proposed that MISAA should be performed as early as possible. MISAA is effective for patients with rheumatoid knee in grade II or less to postpone TKA until reaching a suitable age and to avoid TKA revision. In six knees of grade II that were converted to TKA, none of the patients complained of obvious swelling, hotness, or ballottement of the patella in their rheumatoid knees after MISAA, but deterioration of the knee progressed to TKA. This deterioration may depend on medical control before and after synovectomy. It therefore seemed impossible to prevent the deterioration of the knee completely by any synovectomy. However, even for patients with rheumatoid knee of grade III, MISAA was clinically effective in reducing the pain that disturbed the activities of daily living, although this efficacy lasted for only a short period. In our series, medical control with drugs was not normalized before and after MISAA, so this may have influenced the outcome to a greater or lesser extent. Drug control should be considered before resorting to surgery in RA patients.

In summary, the benefits of MISAA include the following:

The procedure takes no more than 1 h in most cases
Low recurrence rate
Increases the range of motion
Allows RA patients to walk on the first postoperative day

As well, MISAA should be performed at an earlier grade in rheumatoid knee. Based on the favorable mid-term results found in this study, we suggest that MISAA is an effective procedure for patients with rheumatoid knee. We intend to continue our follow-up of these patients and evaluate the long-term results.

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