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Meniscal Tears After Anterior Cruciate Ligament Reconstruction

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Abstract

The aim of this study was to follow patients in whom preoperative MRI demonstrated grade-3 lesions in the medial meniscus but no visible tears at arthroscopic ACL reconstruction, and to ascertain whether these meniscal lesions would progress to definite tears after reconstruction. The Study population consisted of 19 patients with a mean age of 23.2 years. Intraoperative arthroscopy showed normal appearance in 16 of 19 menisci and mild degree superficial legions in 3 menisci. None of the patients had any special treatment for the menisci at surgery. As controls, 39 patients who showed no tears on MRI and arthroscopy were studied. All MR studies were performed on a 0.5 T MR unit with field echo pulse sequences. A slice thickness of 1.5 mm was used with no interslice gap. Grade-3 legions progressed to definite tears in 8 of the 19 studied patients (42.1%) 12 to 33 months after ACL reconstruction. The Remaining 11 patients showed only symptoms or signs suggesting meniscal tears during a mean follow-up of 26.1 months. In the controls, medial meniscal tears occurred in 2 of the 39 patients (5.1%) 15 to 18 months after reconstruction. The studied patients were divided into a tear group (n=8) and a no-tear group (n=11). When the number of slices with grade-3 lesions was compared between the 2 groups, the mean slice number in the tear group (5.8 slices) was significantly greater than that in the no-tear group (3.1 slices) ($P<0.05$). These results suggest that even if no visible tear is found at surgery, patients in whom grade-3 lesions are identified in many slices have a high risk of developing definite tears after ACL reconstruction. (J Nippon Med Sch 2001; 68: 24—28)

Key words: meniscal tear, anterior cruciate ligament reconstruction, MRI, arthroscopy

Introduction

With increased knowledge of meniscal anatomy and function[1-4], the current trend in the treatment of meniscal lesions is to preserve the menisci as far as possible: meniscectomy as partial as possible, but also whenever possible, meniscal suture or conservative treatment (the lesion left in place). Also in cases with anterior cruciate ligament reconstruction (ACL) reconstruction, mild meniscal damage has been generally left untreated in anticipation of spontaneous healing.

Magnetic resonance imaging (MRI) is widely accepted as an accurate means of evaluating meniscal abnormalities. Crues et al.[5] classified meniscal abnormalities from grade-1 to grade-3: grade 1, an irregular marginated intrameniscal signal; grade-2, a primary linear area of increased signal intensity that does not extend to an articular surface; grade-3, a linear or globular area of increased signal that extends to an articular surface (**Fig. 1**). They stated that if grade-3 lesions were defined as meniscal tears, the diagnostic accuracy of MRI was more than 90%.

However, in recent reviews, DeSmet et al.[6] and Rubin et al.[7] have stated that the diagnostic accuracy of

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MRI for meniscal tears decreases in the presence of ACL injury. In our experience, some patients show conflicting results between MRI and arthrosopy in that a meniscus suspective of tears on MRI appears intact at the time ACL reconstruction. On the basis of arthroscopy as the golden standard, these meniscal lesions have been left untreated in our clinic. However, a possibility exists that these lesions may progress to definite tears after ACL reconstruction.

The aim of this study was to follow patients in whom preoperative MRI demonstrated grade-3 meniscal lesions but no visible tears at arthroscopic ACL reconstruction, and to ascertain whether these meniscal lesions would progress to a definite tears after reconstruction.

Material and Methods

(1) Study population

The Study population consisted of 19 patients from among 115 patients who underwent arthroscopic ACL reconstruction between 1995 and 1997. The mean age was 23.2 years (range: 16～34 years), and the mean interval between ACL injury and surgery was 9.1 months (range: 3 to 36 months). In all patients, a grade-3 lesion on MRI was identified in the medial meniscus. Intraoperative arthroscopy showed normal appearance in 16 of the 19 menisci and a mild degree superficial legion in 3 menisci, but these menisci were confirmed to be stable by a probing technique. None of the patients had special treatment for the menisci at surgery. As controls, 39 patients who showed no tears on MRI and arthroscopy were studied. The mean age was 26.5 years (range: 16～54 years), and the mean interval between ACL injury and surgery was 8.4 months (range: 1 to 45 months).

(2) Surgical procedures and rehabilitation programs

Semitendinousus and gracilis tendons (STG) were harvested through a 3 cm skin incision. Woven polyester (Leeds-Keio, Biomet, Bridgend, UK) was sutured tightly around double-looped STG to make a composite graft with a diameter of 8～10 mm. A tibial bone tunnel was made in the posteromedial portion to the center of the anatomic ACL insertion. A femoral bone tunnel was made in the posterosuperior margin of the lateral intercondylar notch. The graft was passed through bone tunnels, and fixed to the femur and tibia with staples. A notch plasty was performed if the graft impinged into the intercondylar notch.

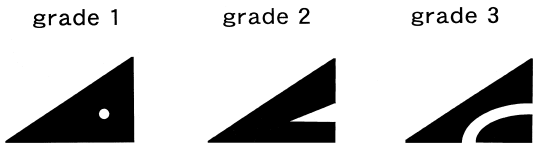

Fig. 1 The grading system for meniscal abnormalities by Crues et al.
Grade-1: an irregular marginated intramenisical signal, grade-2: a primary linear area of increased signal intensity that does not extend to an articular surface, grade-3: a linear or globular area of increased signal intensity that extends to an articular surface

On the second postoperative day, ROM exercises on a continuous passive motion device were begun, and full weight bearing was allowed at 2 to 4 weeks. Agility training and sports-specific training were started at 12 weeks. A return to sports practice was allowed at 5 months, and a return to fully competitive sporting activities was permitted at 5 to 12 months.

(3) MRI and clinical evaluations

All MR studies were performed on a 0.5 T MR unit (MRT, Toshiba, Tokyo) with field echo pulse sequences (flip angle 45°, TR 51 msec/TE 14 msec). A slice thickness of 1.5 mm was used with no interslice gap. MR images of the meniscus were obtained in both coronal and saggital planes. Encoding and reconstruction were performed by the three-dimensional (3-D) Fourrier transformation technique.

Clinical results were assessed from sport level, pivot shift tests, KT-2000 arthrometer measurements of anterior knee laxity and range of motion (ROM). KT-2000 arthrometer measurements were performed at 20° knee flexion with 90 N of force. Statistical analysis was performed by variance and chi tests, and $p < 0.05$ was accepted as the minimum level of significance.

Results

Grade-3 meniscal lesions progressed to definite tears in 8 of the 19 studied patients (42.1%) 12 to 33

Table 1 Comparison of clinical results of the Tear groups with the No-Tear and Control groups

	Tear(n = 8)	No Tear(n = 11)	Control(n = 39)
Age	22.5 yrs	23.7 yrs	26.5 yrs
Disease period	8.2 mos	10.0 mos	8.4 mos
Rate of athletes	63 %	64 %	72 %
ROM	no limitaion	no limitaion	no limitaion
KT-2000	2.7 mm	2.5 mm	2.5 mm

No difference was found among the 3 groups.

Table 2 Comparison of MRI results between the Tear group and the No-Tear group

	number of slices with a grade-3 lesion
Tear group(n = 8)	5.8 slices(3—8 slices)*
No-Tear group(n = 11)	3.1 slices(2—5 slices)

15 slices per a meniscus, * $p < 0.05$

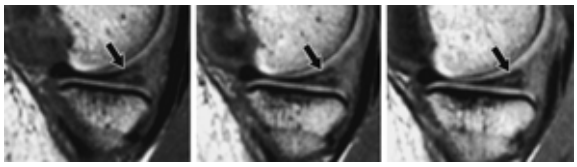

Fig. 2 Preoperative MRI in Case 1. A grade-3 lesion was visualized in the posterior segment of the medial meniscus on 3 of 15 slices obtained.

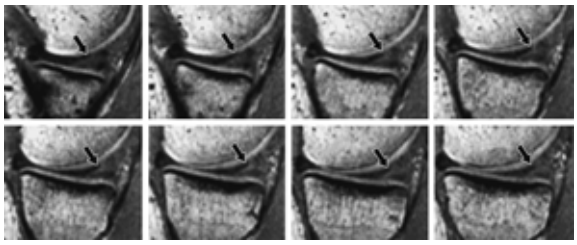

Fig. 3 Preoperative MRI in Case 2. A grade-3 lesion was visualized in the posterior segment of the medial meniscus on 8 of 15 slices obtained.

months after ACL reconstruction (mean: 20.3 months). Five of the 8 patients ruptured the meniscus while sports, and the cause of the ruptures was unclear in the other 3. The type of tears included 7 bucket handle tears and one flap tear. The Remaining 11 patients showed any symptoms and signs suggesting meniscal tears during a mean follow-up of 26.1 months (range: 12 to 44 months). In the controls, meniscal tears occurred in 2 of the 39 patients (5.1%) 15 to 18 months after ACL reconstruction. Both patients had bucket handle tears in the medial meniscus while sports.

The studied patients were divided into a tear group (n=8) and a no-tear group (n=11). When the clinical results of the tear group were compard with those of the no-tear group and the control group, no difference was found.(**Table 1**). When the number of slices with grade-3 lesions were compared between the tear group and the no-tear group, the mean slice number in the tear group was significantly greater than that in the no-tear group ($P<0.05$) (**Table 2**). These results suggest that even if no visible tear is found at arthroscopy, patients in whom a grade-3 lesion is identified in many slices have a high risk of developing definite tears after ACL reconstruction.

1. Case presentation

The first case was a 34-year-old female patient. On MRI, a grade-3 lesion was visualized in the posterior segment of the medial meniscus on 3 of 15 slices obtained (**Fig. 2**). She showed no symptoms or signs suggestive of meniscal tears during a 23-month follow-up.

The second case was a 21-year-old male patient. A grade-3 lesion was visualized in the posterior segment of the medial meniscus on 8 of 15 slices obtained (**Fig. 3**). He had a bucket-handle tear of the medial meniscus without any injury 13 months after ACL reconstruction, and subsequently underwent menisectomy.

Discussion

It has been stated that ACL injury is "the beginning of the end for the knee". Resultant knee instability

due to untreated ACL injury frequently causes secondary meniscal tears and eventual post-traumatic osteoarthritis[8]. ACL reconstruction has been advocated to improve the knee functions as well as to prevent meniscal tears. In recent reviews, despite good clinical results, meniscal tears have been reported to occur in some patients after ACL reconstruction.

Corry et al.[9] stated in a study of hamstring tendon grafts that 5 of 90 intact menisci (5.5%) ruptured at 7 to 23 months postoperatively. Aiba et al.[10] reported in a study of Leeds Keio artificial ligaments that 6 of 99 intact menisci (6.1%) ruptured 6 to 19 months after surgery. The incidence of meniscal tears obtained in our control population (5.1%) was in close agreement with that reported by these authors. In contrast, the incidence of meniscal tears in the studied patients (42.1%) was significantly higher than that in the controls, suggesting that a grade-3 legion, even if it appears intact at subsequent arthroscopy, has a high possibility of progressing to a meniscal tear.

Many factors have been thought to relate to these delayed or progressive meniscal tears, such as residual knee instability, insufficient muscle recovery and high level sports. Sekiya et al.[11] reported in a study of hamstring tendon grafts that posterior segment tears in the medial meniscus (9 bucket handle tears and one flap tear) occurred in 10 of 122 patients (8.2%), and found that 8 of these 10 patients showed good muscle strength and knee stability. Also in this study, no differences in sports level, KT-2000 measurements or range of motion were found between the tear group and the no-tear group, suggesting that these factors may have little effect on the incidence of meniscal tears in patients.

The reasons for the discrepancy between MRI and arthroscopic findings remain unclear. Some explanations for the cause of false-positive MRI interpretations have been truncation artifacts, vacuum phenomena and increased conspicuity of intrameniscal signal intensity at on gradient-echo imaging.

Justice et al.[12] stated other errors may be related to the problem of arthroscopy as the standard of reference. Compared with MRI, the use of arthroscopy has limitations in the assessment of some tears. Posterior segment tears in the medial meniscus, which are frequently associated with ACL injuries, are difficult to detect at arthroscopy with the anterior portals approach. Gold et al.[13] identified posterior segment tears in 60% of 400 knees by the posteromedial approach. Approximately 60% of these patients had no definite tears when investigated by the conventional anterior portal approach.

Stoller et al.[14] investigated the correlation between MRI and histology that 8 meniscal segments with a grade-3 signal were classified histologically as stage 3 (fibrocartilagenous separation). Six of 8 segments showed macroscopic evidence of a tear extending to an articular surface, and the remaining 2 segments demonstrated a tear not extending to the meniscal surface (intrasubstance tear). They speculated that these intrasubstance tears may be overlooked at arthroscopy, and is related to false-positive interpretations of a grade-3 signal.

In summary, this study demonstrated that even if no visible tears are found at arthroscopy, patients in whom a grade-3 lesion is identified in many slices have a high risk of developing definite tears after ACL reconstruction. Special attention should be given to the possible existence of intrasubstance tears. In patients with these latent tears, modifications in rehabilitation programs, delays in return to high level sports or preventive meniscal sutures may be required to reduce meniscal tears after reconstruction.

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