# Long-term outcome of meniscal degeneration in the knee

## Poor association between MRI and symptoms in 45 patients followed more than 4 years

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**ABSTRACT** **Knee joint-related symptoms are frequent and the use of MRI as a diagnostic tool is common. About 25% of MRIs show meniscal degeneration (MD). As the natural history of MD has not been well described, we studied the long-term outcome of 50 MDs. 45 patients were initially evaluated by a MRI, and clinical examination and later by another MRI. After 5 years, 38 of the MDs were unchanged, 8 had progressed and 4 regressed. Progression of MD was associated with age over 40 years, trauma during the follow-up period and/or other knee lesions, such as osteoarthrosis and ligament rupture. The clinical findings were consistent with MDs only in 8 cases.**

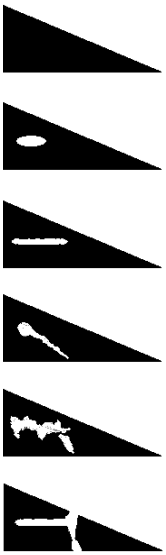
One reason for knee pain can be meniscal degeneration (MD). MD in the knee has been well described on histological (Noble and Hamblen 1975, Nawata et al. 1999) and MRI examinations (Crues et al. 1987, Munk et al. 1998). Close correspondence has been shown between MD on MRI (MRI-MD) and MD on histological examination (Nawata et al. 1999). The frequency of MRI-MD is 25% (LaPrade et al. 1994, Munk et al. 1998), but the long-term outcome of MD is unknown. Day et al. (1985) found dense innervation of the anterior and posterior horns of the meniscus, which may explain the knee pain. We studied the long-term outcome of MRI-MD and the possible relation to clinical signs.

## Patients and methods

From December 1997 to December 1999, 45 consecutive patients with at least one MD in one or both knees, which had been assessed by MRI 50 months or more before were included in the study after they signed an informed consent form. No patient less than 18 years of age or with arthritis was included. One patient was excluded because of a partial meniscectomy, where the part of the meniscus containing MD on the first MRI had been removed. The study group comprised 44 patients (21 men) with an average age of 42 (21–68) years. 43 MDs were in the medial and 7 in the lateral meniscus. The patients were evaluated by an interview, clinical examination and a second MRI. The average time between the clinical examination and the second MRI was 3 (1–4) months, and the average time between the first and second MRI was 63 (50–88) months. In the observation period 5 knees sustained a trauma.

The clinical examination were done by orthopedic specialists who knew which knee had been assessed by MRI, but not the result. Both clinically and at MRI, the meniscus was divided into three parts: anterior, middle and posterior. The MRI scans were performed at 1.5 Tesla, using T1 weighted and T2-weighted sequences, and then a three-dimensional gradient echo sequence. The MRIs were assessed blindly and meniscus pathology was graded I–III, where grade IV indi-

Drawing of coronal magnetic resonance imaging of meniscal degeneration grades 0–IV.



**Grade 0**: normal.

**Grade I**: signal intensity is focal and does not extend to the meniscal surface.

**Grade II**: linear signals do not reach the surface.

**Grade IIIA**: the signals are also of an internal linear nature that reach the superior or inferior surface, but without penetrating the meniscal surface.

**Grade IIIB:** like IIIA, a "closed" lesion, but of irregular nature.

**Grade IV**: the signals penetrate the surface of the meniscus, and the lesion is no longer a closed lesion but a real tear.

cated a tear (Figure) (Lotysch et al. 1986, Crues et al. 1987). The first MRI was compared with the second one, paying special attention to whether the MD had changed or not. In the evaluation of correspondence between the clinical findings and the MD found on the second MRI scan, we accepted only correspondence if there was agreement concerning the location of the tenderness found on clinical examination and the location of the MRI-MD.

## Results

The clinical data are listed in Table 1, and the figures for the location and grade of the 50 MDs found on the two MRI assessments are listed in Table 2. In only 8 knees was there correspondence between the location of the tenderness found on clinical examination and the location of the MD found on the second MRI scan. The degree of correspondence did not improve when comparing MRI-MD grade III to grade I or grade II.

38 of the MRI-MDs were unchanged, 8 had become more severe and 4 less severe (Table 3). Progression was associated with age over 40 years, trauma in the observation period and/or other knee lesions, such as osteoarthrosis and ligament rupture. 4 had progressed by 1 grade and 4 by 2 grades. The patients with a Grade IV lesion were

Table 1. Clinical data in the 45 knees investigated

| Symptoms/clinical findings | Knees |
|---|---|
| No pain | 6 |
| Only pain at rest | 2 |
| Only pain on activity | 19 |
| Pain both at rest and on activity | 18 |
| No tenderness found | 9 |
| Tenderness at one point | 29 |
| Tenderness at two points | 7 |

Table 2. Location and grade of the 50 meniscal degenerations found on the two MRI assessments

| Location/grade | 1. MRI | 2. MRI |
|---|---|---|
| Anterior third of the meniscus | 2 | 1 |
| Middle third of the meniscus | 2 | 1 |
| Middle and posterior thirds | 4 | 4 |
| Posterior third of the meniscus | 42 | 42 |
| Entire meniscus | 0 | 2 |
| Grade 0 | 0 | 0 |
| Grade I | 14 | 13 |
| Grade II | 23 | 21 |
| Grade IIIA | 13 | 12 |
| Grade IIIB | 0 | 0 |
| Grade IV | 0 | 4 |

Table 3. In the first 8 patients listed here, the severity of the meniscal degneration increased, and in the last 4, the severity declined during the observation period. All the grade III lesions were IIIA and therefore just called "III"

| Age | Trauma | MD grade at 1. MRI | 2. MRI | Other knee lesions |
|---|---|---|---|---|
| 56 | Yes | III | IV | P.-ACL, osteoarthrosis |
| 56 | Yes | III | IV | P.-ACL, osteoarthrosis |
| 27 | Yes | II | III | T.-ACL |
| 52 | No | I | II | Osteoarthrosis |
| 52 | No | I | III | Osteoarthrosis |
| 52 | No | II | IV | No |
| 41 | No | I | III | No |
| 40 | Yes | II | IV | No |
| 31 | No | III | II | No |
| 33 | No | II | I | No |
| 20 | No | III | II | No |
| 23 | No | II | I | Osteochondral lesion |

Age of the patient at the primary MRI scanning, trauma in the observation period, P.-ACL partial and T.-ACL total rupture of the anterior cruciate ligament.

offered an arthroscopy/partial meniscectomy, but none accepted. 4 showed a reduction of severity of 1 grade, none more or to a normal meniscus. The regression was associated with an age less than 40 years, absence of other knee lesions or trauma in the observation period.

26 knees had no other knee lesions, while 19 knees had 25 other knee lesions—i.e., osteoarthrosis (12), osteoarthrosis and ACL lesions (3), isolated ACL ruptures (2), osteochondral lesion (2), ganglions (2), osteoarthrosis and osteochondral lesion (1), ACL and PCL lesion (1), osteochondral and ACL lesion (1), and MCL lesion (1).

## Discussion

Are intrameniscal MRI signal intensities clinically relevant? In our study, 39 of the 45 knees with MD were reported to be painful, and 26 knees had no lesions other than the MD. This could indicate that we would find a majority of knees with a high degree of correspondence between the clinical findings and MRI-MD. Especially when we know, that there is a dense innervation of the posterior horn of the meniscus (Day et al. 1985), and we had 93% of the MDs located in the posterior horns. However, we did only find correspondence in 8 cases, and we must conclude that in a 5 years perspective the clinical significance of MRI-MD is low. To exclude the explanation that while grade I is asymptomatic there might be symptoms in the higher degrees of degeneration, we specifically pooled the 12 grade III MDs without being able to improve the correspondence. This lack of correspondence is in accordance with the large number of MRI-MDs found in asymptomatic knees. LaPrade et al. (1994) reported 24% grade 2 MRI-MDs in 54 patients with asymptomatic knees and others have found up to 41% (Jerosch et al. 1996). To avoid false positive MRI readings, one must be aware of adjacent normal anatomic structures that can simulate MD's/tears. These structures includes the popliteus tendon, transverse ligament and the lateral inferior geniculate artery (Herman and Beltran 1988, Watanabe et al. 1989). Another cause of misinterpretation is the patient's age as the vascular bundles of menisci in children and adolescents in some cases resemble MRI-MD (Quinn et al. 1988, Jerosch et al. 1996) but in our study, we included only patients older than 18 years of age. We could not verify our findings arthroscopically or histologically, but there is substantial evidence of a close correlation between MRI-MD and the histological findings (Stoller et al. 1987, Kaplan et al. 1991, Raunest et al. 1994, Gückel et al. 1995, Nawata et al. 1999).

Does MD progress to a complete tear? The determination of a shift to another grade depends on the accuracy of the MRI grading system. In closed meniscal lesions, we can not use arthroscopy as a reference, but in the borderline area of degeneration/tear, Dillon et al. (1990) found that signal abnormalities should extend to the meniscal surface on two or more images to correlate with a visible tear on arthroscopy. To eliminate interobserver variation and improve the accuracy of the MRI grading, we had only one experienced consultant, who directly compared all the images from the first and second MRIs. However, the risk of misinterpreting a grade II MD as a grade IIIA MD (or vice versa) can not be entirely avoided because the image slices may be distributed differently throughout the meniscus. We found that three quarters of the MDs showed no change after more than 5 years. In our opinion, this reflects the usual long-term outcome of MD in the knee. However, some data suggest that complete meniscal tears are the inevitable end result of a continuous gradual increase in the severity of meniscal degeneration (Noble and Hamblen 1975, Crues et al. 1987, Hajek et al. 1987, Stoller et al. 1987). Kornick et al. (1990) found a 25% prevalence of MRI-MD as early as the second decade of life, and a direct correlation between signal abnormalities of the meniscus and the age of the subjects. The correlation with age accords with our findings since we observed an increase in the severity of MD in those more than 40 years of age and a decline in MD in those less than 40 years (Table 3). In the group with regression, it is noteworthy that although these patients are young, none of the degenerated menisci have become normal. Apparently nature can not heal the lesion to the extent of removing a MD once it has developed. None of the patients in this group had sustained a trauma in the observation period and only one of them had a minor additional lesion in the knee. Only 5 traumas occurred

in the observation period and 4 of these were in the group of progressive MDs. Moreover, 5 of 8 had other knee lesions in this group. MD seems to show a poor correlation with symptoms or clinical signs, and most of the lesions did not become worse over a 5-year period.

No competing interests declared.

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