Meniscal Tears: MR and Arthrographic Findings after Arthroscopic Repair

Magnetic resonance (MR) imaging was performed on 29 previously repaired menisci and one conservatively treated meniscus (total, 30 menisci). Intermediate- and T1-weighted MR sequences revealed persistent signal intensity extending to an articular surface (grade 3 signal intensity) in 27 of the 30 menisci. On T2-weighted images, seven of the 30 menisci were found to contain unequivocally higher signal intensity, defined by a full-thickness defect (grade 3 signal intensity involving two articular surfaces) increasing in signal intensity to a level equivalent to that of joint fluid. The MR imaging and arthrographic appearances of 23 of the 30 menisci were compared. Arthrographic examination revealed partial or complete healing in 13 menisci and tears in 10. The presence of grade 3 signal intensity on intermediate- and T1-weighted MR images did not reliably predict a tear seen at arthrography. Unequivocally higher signal intensity on T2-weighted images is a useful sign in the prediction of a persistent meniscal tear (sensitivity, 60%; specificity, 92%; P < .02). Since presence of grade 3 signal intensity on intermediate- and T1-weighted images does not reliably predict a tear and unequivocal T2 increase in intensity has a sensitivity of only 60%, arthrography should be considered for assessment of the symptomatic, previously repaired meniscus.

WITHIN the past decade, a selective approach to the treatment of meniscal tears has evolved with the goal of preserving the meniscus within the knee (1). Arthroscopic repair of the meniscus has become standard practice by many orthopedic surgeons when presented with a peripheral tear. With the popularity of meniscal repair we have occasionally been asked to evaluate the meniscus for nonhealing or for possible retearing. Evaluation of the nonoperated meniscus with magnetic resonance (MR) imaging is very accurate (2,3). MR imaging evaluation of the post-surgical meniscus is proving to be less accurate for the diagnosis of a meniscal tear (4-6).

Although arthrography has been used in the past for evaluation of the previously sutured meniscus (7), to our knowledge, no investigation comparing arthrography and MR imaging of the arthroscopically repaired meniscus is available (7). This study compares findings of arthrography and MR examination of the previously sutured meniscus. Asymptomatic, fully functional patients as well as those who were clinically symptomatic of meniscal tear or injury are included.

The purpose of this study was to clarify the proper imaging approach or modality of choice for the evaluation of the postoperative meniscus for nonhealing or persistent tearing. An algorithm describing useful MR imaging findings for evaluation of the postoperative meniscus is formulated.

MATERIALS AND METHODS

Patients were chosen from operative records maintained by three different orthopedic surgeons experienced in arthroscopic surgery of the knee in treatment of sports injuries. Orthopedic operative records from August 1987 to August 1990 were chronologically reviewed for performance of an arthroscopic meniscal repair. Thirty-five patients with prior meniscal repair were contacted between July 1989 and August 1990 for follow-up interview and examination; 29 responded. The patient population consisted of 27 men and two women with an average age of 24.5 years at the time of surgery. Twenty-one medial and eight lateral unstable full-thickness (two surfaces involved) meniscal tears had been arthroscopically repaired by means of previously described techniques (8). One patient had a medial meniscal tear left to heal with conservative treatment.

In all cases, the operative note described the site of sutural repair, number of sutures used, condition of the meniscus, and other operative findings or procedures (eg, ligamentous reconstructions per-formed at the time of surgery). The site of the meniscal tear was annotated on a drawing similar to that used by Cooper et al (9). Twenty-five patients had undergone reconstructive surgery of the anterior cruciate ligament (ACL) at the time of meniscal repair. Patients who had returned to a normal activity level with a clinically stable knee and lack of pain were considered to be asymptomatic. An asymptomatic knee was defined as one with no persistent pain (mild pain of less than 2 weeks duration per year) and no history...
of clicking, giving-way, or catching. Symptomatic patients were defined as those with joint line tenderness, persistent knee pain, a positive or painful McMurray maneuver, or symptoms of clicking, catching, or locking during movement of the knee. All patients were assessed by an experienced orthopedic surgeon for ligamentous instability before undergoing arthrography. Criteria for ACL instability included a positive Lachman test result or a positive result of the pivot-shift maneuver.

Twenty-nine patients underwent MR examination of the knee. After being informed of the findings, twenty-two patients consented to arthrographic examination of the knee, and seven patients declined or were unavailable for arthrographic examination. Patients were informed that MR imaging and arthrographic findings would not be used as a basis for surgery or other treatment. MR examinations were performed with a 1.5-T superconducting magnet (Gyroscan; Philips Medical Imaging, Amsterdam, Holland) with a Philips wraparound (WI) surface coil. A spin-echo coronal sequence with T1-weighting (short repetition time [TR] and short echo time [TE]) and a sagittal sequence with intermediate- (long TR and short TE) and T2- (long TR and long TE) weighting were used. This technique is similar to one previously described (6). Coronal imaging parameters were as follows: 550/15 (TR msec/TE msec), two acquisitions, and 5-mm section thickness with a 0.5-mm gap. Sagittal imaging parameters were as follows: 2,000/20,70, two acquisitions, and 4-mm section thickness with a 0.4-mm gap. All coronal and sagittal sequences had a 16-cm field of view with a 256 x 256 matrix providing a spatial resolution of 0.625 mm per pixel in the phase-encoded direction and 0.625 mm per pixel in the frequency-encoded direction. The last five examinations were supplemented with an additional intermediate- and T2-weighted coronal sequence with the following parameters: 2,000/20,70, two acquisitions, and 4-mm section thickness with a 0.4-mm gap. The intermediate- and sagittal and T1-weighted coronal images were displayed with conventional and meniscal windows. MR examination was performed prior to arthrographic examination in all cases.

MR images were interpreted by consensus of two radiologists experienced in musculoskeletal imaging (C.H.N., T.E.F.). Menisci were graded according to the classification used by Crues et al (3): grade 0 = normal, grade 1 = intrameniscal focus of signal intensity, grade 2 = intrameniscal linear or wedge-shaped signal intensity, and grade 3 = linear or globular signal intensity extending to an articular surface.

A meniscus was described as healed if no linear signal intensity extended to the articular surface (grade 0, 1, or 2). A persistent tear (nonhealing) was diagnosed if grade 3 signal intensity extended to an articular surface of the meniscus on intermediate-or T1-weighted images. If grade 3 signal intensity extended to only one surface at the site of prior repair this was specifically noted; since every meniscal tear in the operative group consisted of a full-thickness unstable tear extending to two articular surfaces, the finding that only one surface was involved in a vertical tear may be an indication of partial healing.

Grade 3 signal intensity on the intermediate-weighted images was examined for a relative increase in signal intensity on the T2-weighted sagittal images. The meniscal defect seen on intermediate- or T1-weighted images was then classified in this study as having (a) unequivocal T2 increase in signal intensity (if the signal intensity was equal to that of any fluid in the joint and extended in a continuous fashion to two articular surfaces); (b) partial T2 increase in signal intensity (if the area of increased signal intensity extended to only one surface or if it was discontinuous); or (c) no T2 increase in signal intensity (if defects seen on intermediate-weighted images did not have increased signal intensity on T2-weighted images).

The extent and type of the tear was described by noting its nature (vertical, horizontal, or complex), surfaces involved (superior, inferior, or both), and portions of the meniscus involved (posterior horn, middle one-third, or anterior horn). When a preoperative MR image of the knee was available, comparison with subsequent postoperative MR images was made.

Arthrography was performed in 22 patients (23 menisci) after receiving informed consent. Mean time between surgery and arthographic examination was 60 weeks; in one meniscus, the time between surgery and arthrographic examination was 12 weeks. The remaining menisci were examined more than 16 weeks after surgery (maximum, 154 weeks [one patient]). Nineteen of the patients underwent arthrography immediately after (same day) MR imaging, and three patients underwent arthrography within 1 week of MR imaging. Arthrography was performed with a single- and double-contrast technique, as described by Wolfe (10). After injection of 10 mL of contrast material (Hyqiopae-M 75%; Winthrop-Breon Laboratories, New York) and 10 cm³ of air into the joint, fluoroscopic spot radiography with the patient in prone and supine positions was immediately performed. A radiologist skilled in knee arthrography (R.D.W. or T.E.F.) performed and interpreted the examinations. After initial arthrographic spot radiography, information about the site of prior surgical repair and the previously obtained MR image was given to the arthrographer to ensure that the site of the meniscal repair was specifically profiled and evaluated. As determined by means of the arthrogram, the meniscus was classified as being healed (the meniscus had a normal contour with no more than mild notching of the meniscal surface), partially healed (contrast-enhanced radiographs showing a partial-thickness defect in the intrameniscal region, without evidence of disruption of the normal contour or loss of apposition at the repair site), or not healed (contrast-enhanced radiographs showing a full-thickness defect in the intrameniscal region). When a meniscal tear was found, the extent and type of the tear was described by noting its nature (vertical, horizontal, or complex), surfaces involved (superior, inferior, or both), and portions of the meniscus involved (posterior horn, middle one-third, or anterior horn). The menisci were observed for abnormal displacement or change in con-
not correlate with healing or a persistent tear. The number of sutures used in the repair of a meniscus did influence the rate of healing. The number of the repair site in the 23 menisci did not correlate with MR imaging and arthrography, 17 were asymptomatic patients. Two of these three patients have undergone arthroscopic surgery, and a peripheral tear at the site of prior repair was confirmed. The remaining seven tears identified with arthrography were in asymptomatic individuals with clinically stable knees. Four of the asymptomatic tears involved less than one-fourth of the meniscal periphery and had no evidence of disruption of the normal meniscal contour or loss of apposition at the repair site. Mild notching of the meniscus (defect less than one-fourth the thickness of the meniscus) was seen in five cases near the repair site (Fig 2b). The notch was located in the central two-thirds of the meniscus in four cases and in the peripheral one-third in one case.

Comparison of Arthrography and MR Imaging

Findings of the menisci examined with both arthrography and MR imaging are listed in Tables 1 and 2. Repairs that were healed or partially healed were considered successful. Table 1 shows that 21 of 23 menisci had grade 3 signal intensity on intermediate- and T1-weighted images, which, with conventional criteria, is compatible with a persistent tear. One meniscus had grade 3 signal intensity extending to only one surface; this was found to be partially healed at arthrography. In comparing the MR findings on intermediate- and T1-weighted images of those patients with tears at arthrography, six menisci appeared to have a greater portion of the meniscus involved with the tear with MR imaging than with arthrography. In the remaining four menisci with a tear at arthrography, the tears appeared to involve an equivalent portion of the meniscus. Two of the tears that appeared equivalent in size present on the postoperative examination. This occurred in an 18-year-old patient who had been treated conservatively for a menisco-capsular separation. A preoperative MR image from this patient showed a menisco-capsular separation, which was healed at a postoperative examination performed 19 weeks after arthroscopic surgery for ACL reconstruction. Arthroscopy confirmed the menisco-capsular separation seen at the preoperative examination.

Results of Arthrography

At arthrography, nine menisci showed complete healing, four showed partial healing (Fig 2b), and 10 showed persistent tears at the repair site (as defined by contrast material extending through a full-thickness defect of the meniscus). The overall rate of healing or partial healing at arthrography was 57%. Among the 10 menisci with tears at arthrography, three were in symptomatic patients. Two of these three patients have undergone arthroscopic surgery, and a peripheral tear at the site of prior repair was confirmed. The remaining seven tears identified with arthrography were in asymptomatic individuals with clinically stable knees. Four of the asymptomatic tears involved less than one-fourth of the meniscal periphery and had no evidence of disruption of the normal meniscal contour or loss of apposition at the repair site. Mild notching of the meniscus (defect less than one-fourth the thickness of the meniscus) was seen in five cases near the repair site (Fig 2b). The notch was located in the central two-thirds of the meniscus in four cases and in the peripheral one-third in one case.

Results of MR Imaging

Intermediate-weighted sagittal and T1-weighted coronal images of the 30 postoperative menisci showed grade 3 signal intensity extending to at least one surface in 27 (90%) menisci, grade 2 signal intensity in two (7%) menisci, and grade 0 signal intensity in one (3%) meniscus. Two menisci with grade 2 signal intensity were imaged at 67 and 80 weeks, respectively, after arthroscopic repair. The 27 menisci with persistent grade 3 signal intensity on intermediate- and T1-weighted images were imaged an average of 59.7 weeks after arthroscopic repair of the meniscus (Fig 1). Twenty-six of the 27 menisci with grade 3 signal intensity had extension of the signal to two surfaces; one meniscus had extension of the signal to one surface (Fig 2a). All of the imaged knees contained at least a small amount of fluid that was observed with the T2-weighted sequence. Among all 30 menisci examined with MR imaging, seven (23%) showed a defect with unequivocal T2 increase in signal intensity on the T2-weighted image, 13 (43%) showed a partial increase, and nine (30%) showed no increase. No menisci showed significant displacement.

Fifteen patients underwent more than one MR examination after surgery; three patients showed some improvement or diminished conspicuity of grade 3 signal intensity with intermediate- and T1-weighted sequences. Five patients underwent preoperative MR imaging of the menisci. Comparison with the initial postoperative MR images revealed no difference in four cases; all demonstrated grade 3 signal intensity at the site of meniscal repair on intermediate- and T1-weighted images. One meniscus showed improvement with no abnormal signal intensity tour on the spot radiographs or during fluoroscopy. Observations made at spot radiography and fluoroscopy were recorded.

Findings at MR imaging and arthrography were compared. As arthrography has previously been successfully used for evaluation of the postoperative medial meniscus, the findings at arthrography were the standard of reference. Menisci with complete or partial healing at arthrography were grouped together for statistical analysis, as the outcome for both of these groups may be considered successful (7,11). MR findings of all menisci evaluated with arthrography were statistically analyzed. Statistical analysis was performed on the medial and lateral menisci together and on the medial meniscus separately. The Fischer exact test and the Mann-Whitney U test were used where applicable for analysis. Confidence intervals were calculated by means of inferences about a single proportion (12).

RESULTS

Twenty-four (83%) of the 29 patients were asymptomatic, and five (17%) were symptomatic or had signs of meniscal tear. All knees assessed with both MR imaging and arthrography were stable with no evidence of ACL deficiency as determined by means of a negative pivot-shift maneuver and a negative Lachman test result. All menisci that had undergone sutural repair were peripheral tears, with the unstable fragment having no significant degeneration or maceration at surgery. Among the 23 menisci examined with MR imaging and arthrography, 17 were medial and six were lateral. The location of the repair site in the 23 menisci did not influence the rate of healing. The number of sutures used in the repair of a meniscus did not correlate with healing or a persistent tear.

Figure 2. Images obtained in a 19-year-old man who had undergone arthroscopic repair of the posterior horn and middle one-third of the medial meniscus 133 weeks before MR imaging and arthrography. (a) Sagittal MR image (2,000/20) shows subtle grade 3 signal intensity to the superior surface (arrow). The grade 3 signal intensity seen in successful repairs was often subtle if the repair was more than 1 year old. (b) Arthrogram of the medial meniscus shows a smooth defect on the superior surface compatible with partial healing of the meniscus. A smaller defect was seen on the inferior surface (arrowheads).
at MR imaging and arthrography were in symptomatic individuals. Intermediate- and T1-weighted MR imaging had a sensitivity of 100% and a specificity of 23% (P > .05) for the prediction of a meniscal tear at arthrography.

Table 2 shows that six of the seven menisci with unequivocal T2 increase in intensity were found to represent tears at arthrography. Two have been confirmed with second-look arthroscopy. The one meniscus with unequivocal T2 increase in intensity that did not demonstrate a tear at arthrography had undergone arthroscopic repair 12 weeks earlier. Partial increase in intensity of the repair sites was commonly seen at persistent defects in partially healed menisci.

One asymptomatic patient had a medial meniscus with grade 3 signal intensity compatible with findings of a horizontal tear in the anterior horn and grade 3 signal intensity compatible with findings of a vertical tear in the posterior horn. This meniscus had undergone sutural repair of the posterior horn 136 weeks before the examination. A tear of the anterior horn of the medial meniscus was not present at arthroscopy and was not a site of sutural repair. At arthroscopy, a horizontal tear was confirmed in the anterior horn of the meniscus, but no tear was present at the previous site of repair posteriorly. The tear within the anterior horn, remote from the site of sutural repair, was not included in statistical analysis of the previously sutured menisci.

**Second-Look Arthroscopy**

Two patients have undergone second-look arthroscopy. The first patient, a 32-year-old man, had arthroscopic repair of an unstable peripheral medial meniscal tear of the posterior horn 5 months after an acute injury. When contacted 40 weeks after surgery for our investigation, the patient was complaining of joint line pain. MR imaging demonstrated unequivocal T2 increase in signal intensity at the repair site that was shown to represent a tear at arthrography. Arthroscopic surgery was elected by the patient and his orthopedic surgeon, given the nature of his symptoms. Second-look arthroscopy confirmed an unstable meniscal tear at the repair site.

**Statistical Analysis**

Figure 3a illustrates unequivocal T2 increase in signal intensity of a full-thickness defect extending to two articular surfaces of the meniscus. This finding predicted a meniscal tear with a sensitivity of 60% and a specificity of 92% (P < .019) (Table 2). The 95% confidence intervals for the sensitivity and specificity as calculated by inferences about a single proportion are 25%-95% for sensitivity and 73%-100% for specificity. If only the medial menisci are used in analysis, T2 increase in intensity enabled prediction of a meniscal tear at arthrography with a sensitivity of 65% and a specificity of 87% (P < .05). Patient symptoms showed a statistical trend in predicting a tear of the meniscus, with a sensitivity of 30% (P < .059) with the Fischer exact test.

The mean age of patients with partial or complete healing of the meniscus was 21.8 years at the time of surgery, and the mean age of patients with a tear at the site of prior sutural repair was 27.9 years. Mann-Whitney analysis showed this to be statistically significant (P < .006). Mann-Whitney analysis showed no significant association between the length of time from surgery to arthrography and the presence of a tear or healing.

**DISCUSSION**

The functional significance of the meniscus has been increasingly realized since Fairbank’s study (13) re-porting premature degenerative changes in a population with prior meniscectomy. This has been supported by numerous other investigators (14-16). The menisci have important roles in shock absorption, maintenance of joint congruity and functional stability, and increasing the area of load transmission within the knee to help preserve the hyaline articular cartilage (16,17). Since the meniscus has an important functional role in the knee, the problem of how to preserve it after injury has arisen.

One solution is to perform a partial meniscectomy, but this is not optimal (1,9).
Numerous studies now confirm suture of peripheral tears as an important option for preservation of the meniscus (1,8,18,19). In addition, techniques are being developed to repair more central tears (20). In our experience, arthroscopic repair of the meniscus is a relatively common procedure. It is likely the radiologist working with an orthopedic surgeon will be consulted in the evaluation of a symptomatic patient with prior arthroscopic repair of a meniscus.

The combined rate for healing or partial healing of the meniscus has previously been reported to be 78.7% (7). This figure is higher than that reported in our study. This may be due in part to a difference in the definition of a nonhealed or torn meniscus at arthrographic examination. In the investigation by Scott et al (7), a meniscus classified as not healed or persistently torn showed a full-thickness defect on one or more contrast-enhanced radiographs and evidence of disruption of a normal meniscal contour or loss of apposition at the repair site. In this investigation, four of the 10 menisci diagnosed as having a tear clearly contained a full-thickness defect filled with contrast material, but showed no disruption of the normal meniscal contour and likely represented stable tears. If these four menisci are considered partially healed, then the overall healing rate in our study is 74%, comparable with that previously reported.

It is interesting to note that the menisci with partial or complete healing were in the younger patients in our study. This suggests that better results may be expected in younger patients; however, this has not been found in several other studies and this finding may need further confirmation (7,21). We found this statistically significant association through Mann-Whitney analysis of our data.

Since the first report of MR imaging of the knee, the value and reliability of MR imaging in enabling diagnosis of internal derangements of the non-operated knee is now well established (2,3,22,23). Crues et al (3) reported that if only grade 3 signal intensity on MR images is considered consistent with a meniscal tear, then MR imaging findings agreed with surgical findings in 91.3% of menisci. Several reports, however, now indicate that evaluation of menisci that have undergone surgery is less reliable or specific, particularly when diagnosing a tear by linear signal intensity (grade 3) extending to an articular surface on intermediate- or T1-weighted images (4-6). Deutsch et al (6) have recently described this finding and gave a pathologic explanation. This study confirms that MR imaging is not as accurate in diagnosing healing or a persistent tear in a previously sutured meniscus with a protocol found to be very accurate in assessment of the virgin (nonrepaired) meniscus. The typical repair is performed in the periphery of the meniscus or in the red zone, a portion of the meniscus that will bleed upon rasping. Prior studies in dogs have demonstrated that peripheral tears heal with fibrovascular scar tissue within 10 weeks (24). The healing meniscal tear was found to contain very cellular fibrovascular scar tissue. Remodeling of this scar tissue to a normal appearing fibrocartilage probably takes much longer or may not occur. The human meniscus has been demonstrated to be healed by 4 months; weight bearing and return of activity are usually allowed by 3 months (7,8). The only MR imaging finding predictive of a persistent tear in a previously sutured meniscus was unequivocal T2 increase in signal intensity to two articular surfaces had only 60% sensitivity for meniscal tears in this study. This finding may represent free joint fluid tracking through the tear site and, thus, depends on adequate fluid in the joint and lack of watertight apposition of the tear margins.

This study includes one example of a tear accurately diagnosed with MR imaging at a location different from that arthroscopically repaired. This suggests that tearing may be accurately diagnosed with conventional criteria if it is not near the surgical repair site. One finding previously reported as useful in evaluation for a persistent or recurrent tear is displacement of an unstable meniscal fragment (5); however, this was not found in any patient in our series.

One shortcoming of this study is that we based the outcome of the meniscus on the arthrographic examination instead of the second-look arthroscopy. Reported overall accuracy of arthrography in helping to diagnose meniscal tears is greater than 90% (25-27). Arthrographic examination of the medial meniscus has long been considered diagnostically accurate, with very little risk to the patient. Two of the three symptomatic patients in our study have undergone second-look arthroscopy, which helped confirm the tears seen at arthrography. Evaluation of the lateral meniscus is complicated by the popliteus tendon and its sheath (28). Those portions of the lateral meniscus attached to the popliteus tendon sheath require experienced fluoroscopic observation of the meniscus for abnormal motion or displacement with application of varus and valgus stress in flexion and extension as well as evaluation with spot radiography examination.

Although sometimes questioned, arthrography of a virgin lateral meniscus is accurate in experienced hands (27,29,30), and we did not believe evaluation of an asymptomatic lateral meniscus required second-look arthroscopy (which requires general or spinal anesthesia and its associated risks). Arthrography has been previously used to demonstrate healing of a conservatively treated peripheral lateral meniscal tear (26); however, we could not find a prior study that addressed the accuracy of arthrography in assessing the previously repaired lateral meniscus with use of results of arthroscopy as a standard of reference. Since arthrography of the lateral meniscus is less well established as an accurate procedure, it was elected as a means to also analyze the medial meniscus separately. When the lateral menisci are excluded from our analysis, the finding of T2 increase in signal intensity on MR images for predicting a meniscal tear was still statistically valid.

An interesting observation is that of finding meniscal tears in seven asymptomatic individuals. This fact, along with information from several other studies, indicates that not all meniscal tears are symptomatic (7,11,31). The asymptomatic tears probably have a stable configuration and may continue to have a protective function in the knee. Another question raised is if the addition of a T2-weighted coronal sequence will increase detection of short asymptomatic tears in the middle one-third of the meniscus not seen with the sagittal T2-weighted sequence because of the short periphery of the meniscus involved. These questions, however, will have to be evaluated with further research and follow-up.

Arthrographic examination frequently showed mild notching or surface irregularity at the site of sutural repair in a successfully healed meniscus. This was seen more
frequently on the central 75% of the meniscus, which is not unexpected given the avascular nature of this portion of the meniscus and its diminished tendency to heal (18,24).

Potential pitfalls and shortcomings of this study include a natural bias for patients with some symptoms or pain (regardless of stating they are symptom free) to undergo further diagnostic examination. This may alter the frequency of finding a nonhealed or torn meniscus, but should not significantly alter correlation between MR imaging and arthrographic findings.

CONCLUSION

The results of this study suggest that (a) arthrography is more accurate than MR imaging in the evaluation of the previously arthroscopically repaired meniscus; (b) the T2 sequence may be useful, but it has a relatively low sensitivity for enabling the diagnosis of retear or nonhealing; and (c) asymptomatic, stable meniscal tears may be encountered in imaging. We have proposed an algorithm of MR findings useful in evaluation of the previously repaired meniscus in which there is a question of a new meniscal tear, a retear, or an unsuccesful outcome (Fig 4). If the symptom complex is unclear, then MR imaging should be performed because of the thorough global evaluation it gives the knee. If the MR image shows a tear at a site different from that previously repaired or an obviously displaced meniscal fragment (5), then a diagnosis of tear can be safely made. If unequivocal T2 increase in signal intensity of a full-thickness defect is visualized, then a diagnosis of a tear may be made. If only abnormal grade 3 signal intensity is seen extending to the meniscal surface at the site of repair, caution should be used when diagnosing a tear and possibly subjecting the patient to another surgical procedure. When grade 3 signal intensity is the only abnormality present, then arthrography is recommended before the diagnosis of a meniscal tear is made. If the patient clearly has signs or symptoms of a meniscal tear, arthrography may be offered to the referring physician as the examination of choice in evaluation of the previously repaired meniscus.

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References