

Is There a Role for Sonography in the Diagnosis of Tears of the Knee Menisci?

Roberto Azzoni, MD, Paolo Cabitza, MD

Orthopedic and Trauma Surgery Department, Policlinico San Donato Institute, University of Milan, Via Morandi 30, 20097 San Donato Milanese, Milan, Italy

Received 2 November 2001; accepted 5 June 2002

ABSTRACT: *Purpose.* The aim of this study was to investigate the usefulness of sonography in diagnosing tears of the knee menisci.

Methods. In this retrospective study, we reviewed the sonographic examinations of the knees of 321 patients diagnosed with a torn meniscus on the basis of clinical findings. Of the 321 knees imaged, 216 were also examined using MRI or CT. Arthroscopic meniscectomy was performed on 126 knees.

Results. MRI or CT did not confirm 48% (71 cases) of the positive sonographic diagnoses (ie, false positives) and 72% (50 cases) of the negative sonographic diagnoses (ie, false negatives). Thus, the sonographic diagnosis was correct in 95 cases (44%) and incorrect in 121 cases (56%), yielding low rates of sensitivity (60%) and specificity (21%). Among the 126 cases in which arthroscopic meniscectomy was performed, arthroscopy confirmed 100% of the MRI or CT diagnoses of meniscal tears.

Conclusions. Our results indicate that sonography is not accurate enough to be used as the only imaging modality for diagnosing tears of the knee menisci. © 2002 Wiley Periodicals, Inc. *J Clin Ultrasound* 30:472–476, 2002; Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/jcu.10106

Keywords: ultrasonography; meniscus; knee; arthroscopy

Tears of the knee menisci frequently occur not only in young people suffering a traumatic sports injury but also in individuals involved in motor vehicle and domestic accidents. A clinical examination is often sufficient for making the diagnosis, but diagnostic difficulties or legal rea-

sons may necessitate confirmatory imaging. MRI allows a precise diagnosis of tears of the knee menisci, and CT also plays an important role. However, examinations performed with these modalities are expensive¹ and often unavailable.

Sonography has been used for several years to evaluate muscles and tendons,^{2,3} including the rotator cuff.⁴ In the knee, sonography has been used in cases of quadriceps or patellar tendon pathology; suspected bursas, articular effusion, Baker's cysts and lesions of the collateral ligaments.^{5–7} Since the mid 1980s, the use of sonography in the study of disorders of the knee menisci,^{8,9} and particularly tears of these structures,^{10,11} has been proposed, mainly by German authors. However, the accuracy of sonographic diagnoses of tears of the knee menisci remains controversial.

In this retrospective study, we reviewed the sonographic examinations of the knee for 321 consecutive patients who had been referred to our hospital because of suspected traumatic meniscal tear. MRI or CT was performed in 216 cases and arthroscopic meniscectomy in 126 cases, allowing assessment of the correlation between the results of these imaging modalities and the sonographic findings.

PATIENTS AND METHODS

We retrospectively reviewed the sonographic examinations of the knee for all patients with clinically suspected traumatic meniscal tears who were referred to us between June 1, 1992, and January 30, 2001. These patients were identified through a search of our patient database. Sonography had been performed using an HDI 5000 ultrasound scanner with sonoCT (ATL-Philips, Bothell, WA) in 63% of the cases and an Eidos EUB-525 ultrasound scanner (Hitachi, Tokyo, Ja-

Correspondence to: R. Azzoni

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pan) in 37% of the cases. Both scanners had been equipped with a 7.5–10-MHz linear-array transducer. The images had been recorded using a UP-895 CE video printer (Sony, Tokyo, Japan).

For each sonographic examination, the knee had been positioned at 45° of flexion for examination of the anterior horn and fully extended for examination of the posterior horn (Figure 1). All the sonograms were obtained longitudinally; no coronal images were taken because the menisci are difficult to visualize in this plane. A stand-off pad had not been used. All sonographic examinations of the anterior horn of the knee menisci had included dynamic evaluation at rest and under internal-varus stress for the lateral meniscus and at rest and under external-valgus stress for the medial meniscus.

All sonographic diagnoses had been made at

the time of the sonographic examination. A meniscus that appeared on sonography as a triangular, homogeneously echogenic structure with no internal hypoechoic or anechoic areas was considered normal¹² (Figure 2). The appearance of an irregular triangular structure that had nonhomogeneous echotexture with internal hypoechoic or anechoic areas was diagnosed as a meniscal tear (Figure 3). An echogenic area through the transverse plane and extending longitudinally through the superior and inferior margins of the meniscus was considered a horizontal tear, whereas a hypoechoic cleft through the meniscus was considered a vertical tear¹² (Figure 4).

All the sonographic examinations had been performed by the same sonographer, who had not known the results of any previous MRI or CT studies. All sonograms and MRI and CT scans of

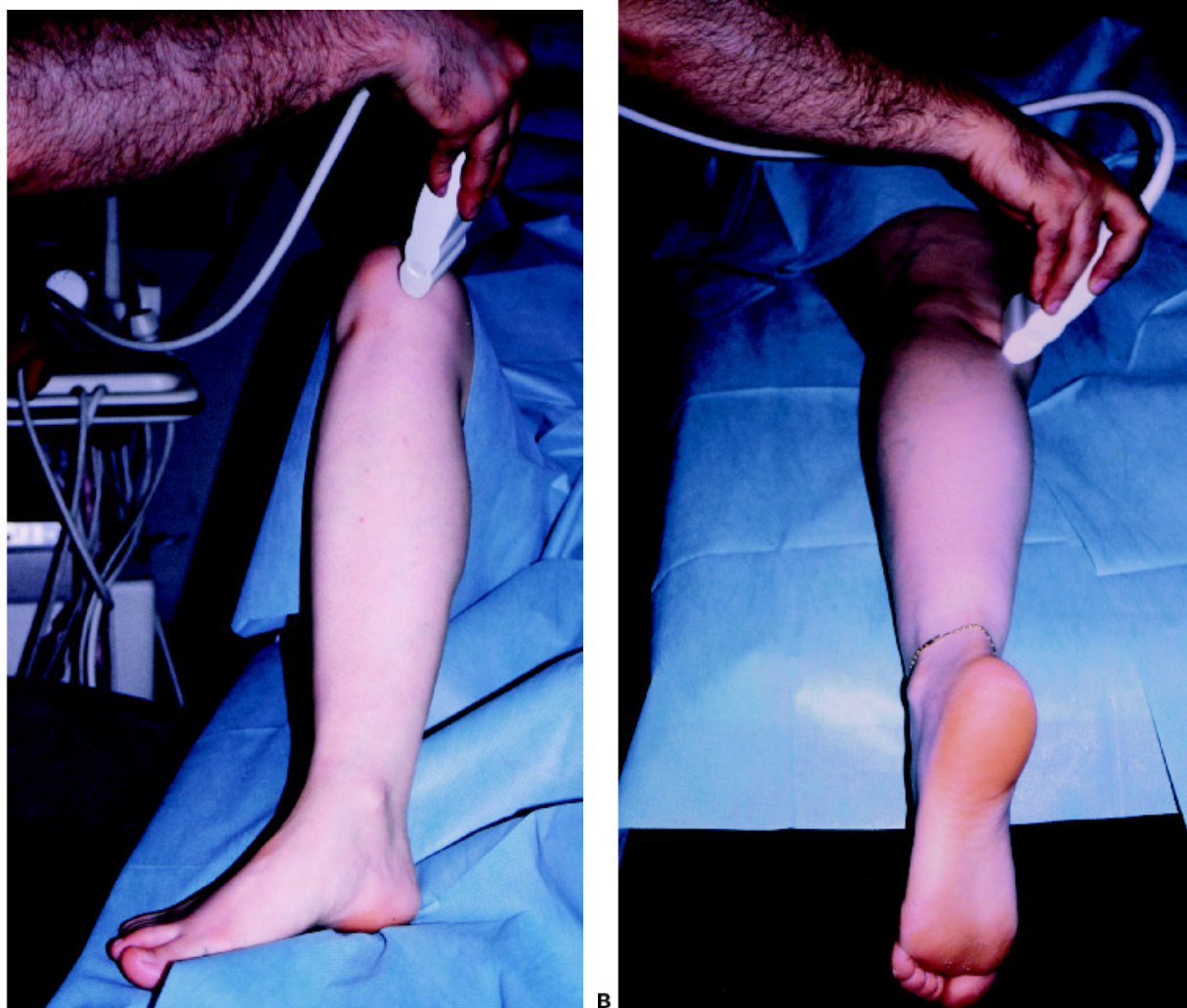


FIGURE 1. Technique used for sonographic examination. (A) Photograph shows the position of the transducer on the knee in 45° of flexion and in external rotation for the study of the anterior horn of the medial meniscus. (B) Photograph shows the transducer on the knee in full extension for the study of the posterior horn of the medial meniscus.

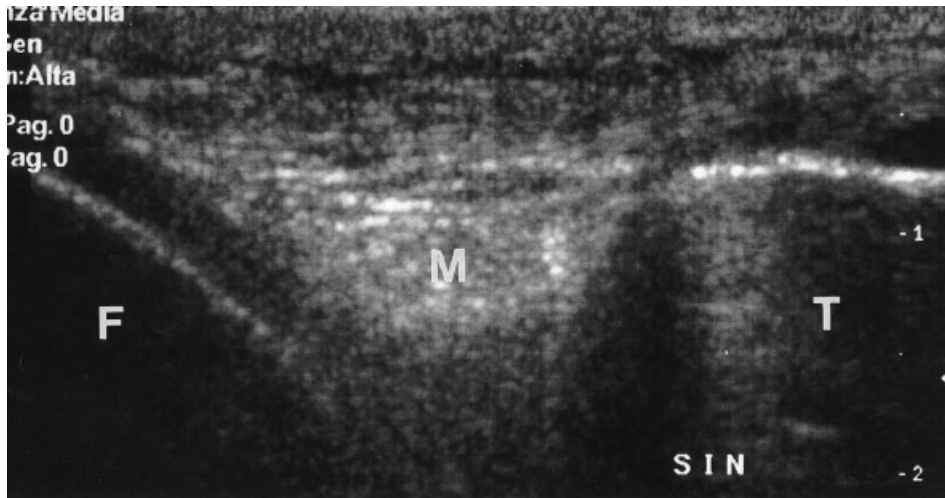


FIGURE 2. Normal medial meniscus in a 28-year-old man. Longitudinal sonogram shows the anterior horn of the meniscus (M), which appears as a homogeneous echogenic triangle without any internal hypoechoic or anechoic areas. F, medial femoral condyle; T, tibial plateau.

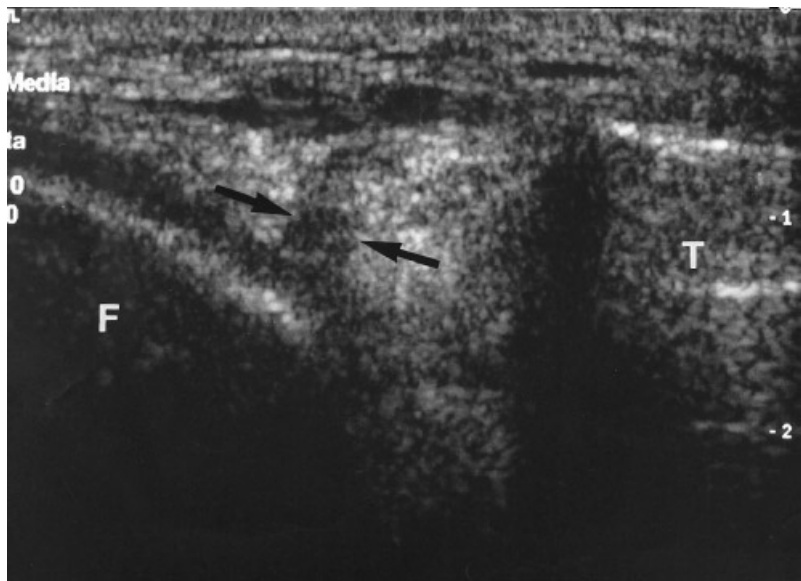


FIGURE 3. Horizontal tear of the anterior horn of the medial meniscus in a 55-year-old man involved in a traffic accident. Longitudinal sonogram shows a horizontal hypoechoic band (arrows) in the echogenic meniscal triangle. F, medial femoral condyle; T, tibial plateau.

patients included in this study had been reviewed by the authors and orthopedic team before arthroscopy was performed. For the purposes of the present study, we reviewed the images again. In the rare cases in which the imaging diagnoses were inconsistent, the arthroscopic diagnosis, if available, was considered valid; cases for which arthroscopy had not been performed were excluded from the analysis.

RESULTS

The study group consisted of 233 male and 88 female patients 13–57 years old (median, 27.5

years). In 184 cases, the lesion was related to the practice of a sport: soccer in 60 cases (18.7%), tennis in 43 cases (13.4%), skiing in 42 cases (13.1%), cycling in 23 cases (7.2%), track and field in 11 cases (3.4%), and basketball in 5 cases (1.6%). Lesions were due to motor vehicle accidents in 94 cases (29.3%) and domestic accidents in 43 cases (13.4%). The clinically suspected meniscal tear involved the medial meniscus in 130 cases (40.5%) and the lateral meniscus in 191 cases (59.5%).

In 105 (33%) of the 321 cases, the knee menisci could not be visualized on sonography for various reasons, including osteoarthritis, articular effu-

sion, technical difficulties, difficulty in bending the knee or rotating the tibia, difficulty in discerning the inner margins of the meniscus, and operator error; these cases were excluded from our analysis. In the other 216 cases (67%), the sonographic findings were compared with those of MRI (135 cases; 62.5%) or CT (81 cases; 37.5%).

In 126 cases (58%), arthroscopic meniscectomy had been performed, also allowing comparison of the findings of arthroscopy with those of sonography. Of those 126 cases, 80 (63%) had been previously examined using MRI and 46 (37%) using CT.

Of the 216 cases in which sonography was successfully performed, 147 (68%) had sonograms suggesting meniscal tear, mainly involving the medial meniscus (102 cases; 69%) (Figures 3 and 4); the sonographic findings of the other 69 cases (32%) were normal. Of the 147 cases that showed a tear, 98 (67%) involved the anterior horn of the medial meniscus (78 cases) or the lateral meniscus (20 cases), and 49 cases (33%) involved the posterior horn of the medial meniscus (24 cases) or the lateral meniscus (25 cases). Forty tears (27%) were horizontal, and 107 tears (73%) were vertical, including 13 tears of the capsular attachment of the medial meniscus (8.8%).

All 216 knees in which sonography had been successful had also been examined using MRI or CT. Of the 147 cases sonographically diagnosed with a meniscal tear, 94 (64%) had also been examined using MRI, which confirmed the sonographic diagnosis in 50 cases (53%) but not in the other 44 cases (47%). Of the 69 cases with normal sonographic findings, 41 had also been examined using MRI, which identified tears in 30 cases

(73%) and confirmed the absence of tear in the other 11 (27%). Arthroscopy had been performed in the 80 cases that had been diagnosed with meniscal tear on MRI, 50 (63%) of which had been diagnosed with meniscal tear on sonography and 30 (38%) of which had appeared normal on sonography. The tear was confirmed in all 80 cases.

Of the 147 cases diagnosed with meniscal tear on sonography, 53 (36%) had also been examined using CT, which confirmed 26 tears (49%) and normal meniscus in 27 cases (51%). In 28 cases with normal sonographic findings, CT identified meniscal tear in 20 cases (71%) and confirmed the normal sonographic result in 8 cases (29%). Arthroscopy had been performed in 46 cases that had been diagnosed with meniscal tear on CT, 26 (57%) of which had been diagnosed with meniscal tear on sonography and 20 (43%) of which had appeared normal on sonography. Therefore, among the 216 cases in which confirmatory MRI or CT had been performed, 76 cases had true-positive (35%), 19 true-negative (9%), 71 false-positive (33%), and 50 false-negative sonographic findings (23%). The sensitivity of sonography in the diagnosis of meniscal tear was 60% (76 of 126 cases), and the specificity was 21% (19 of 90 cases), for an overall sonographic accuracy rate of 44% (96 of 216 cases).

DISCUSSION

The usefulness of sonography in the diagnosis of tears of the knee menisci remains controversial. In a review of 179 patients with suspected meniscal tear, Mattli et al¹³ concluded that sonography is an experimental method without any clinical application for this condition. In contrast, Richter et al¹⁴ found sonography very useful in the diagnosis of meniscal tears in a study of 64 cadavers. Riedl et al¹⁵ performed 3-dimensional sonography of the knee in 60 patients and found this imaging modality useful for excluding the presence of a torn meniscus. These authors found no difference between 2- and 3-dimensional sonographic findings but stated that examinations for meniscal tears must be performed by experienced operators.¹⁵ De Maeseneer et al¹⁶ compared sonographic and MRI findings in the knees of 8 cadavers and concluded that sonography is not accurate in diagnosing tears of the knee menisci. In a study of 52 patients by Petersen and Rasmussen,¹⁷ the sonographic diagnoses of tears of the knee menisci were confirmed by arthroscopy in 42 cases (81%). Grobbelaar and Bouffard¹ stated that sonographic evaluations of intra-articular elements such as the meniscus are very limited. In

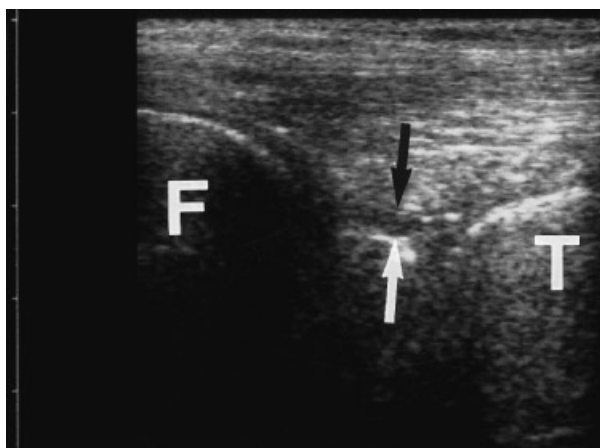


FIGURE 4. Vertical tear of the anterior horn of the medial meniscus in a 29-year-old man. Longitudinal sonogram shows a vertical hypoechoic band (arrows) in the echogenic meniscal triangle. F, medial femoral condyle; T, tibial plateau.

another recent study, Lee and Bouffard¹² stated that most meniscal pathologies can be visualized sonographically if the patient is correctly positioned and the appropriate transducer is selected. However, a torn portion of the meniscus dislodged in the intercondylar notch of the femur can be difficult to demonstrate sonographically because of limited penetration of the ultrasound beam.¹²

Although we agree with Riedl et al¹⁵ that sonography may be useful for excluding the presence of meniscal tear, our results are consistent with those of Grobbelaar and Bouffard,¹ who found that sonography is not a reliable means of visualizing the meniscus because of its intra-articular anatomic location.

Sonographic studies of the knee menisci are limited owing to the inability to visualize the entire meniscus, to the presence of artifacts that originate in adjacent bone surfaces, and to the difficulty in imaging the inner margins of the meniscus.¹² MRI and CT did not confirm the sonographic finding of a meniscal tear in 33% of cases (false positive) or the sonographic finding of a normal meniscus in 23% of cases (false negative). In our series, therefore, the sonographic diagnosis was incorrect in 56% of the cases, whereas findings of meniscal tear on MRI and CT were confirmed by arthroscopy in all cases (100%).

Our conclusions are not consistent with those of Petersen and Rasmussen,¹⁷ who found that sonography had a sensitivity rate of 90% and a specificity rate of 80% in the diagnosis of tears of the knee menisci and who emphasized that the results largely depend on the experience of the operator. We have been using sonography to study joints, muscles, and tendons for more than 10 years and have considerable personal experience in the field of orthopedic surgery. Although we have found sonography very useful in the diagnosis of other orthopedic diseases (eg, congenital dysplasia of the hip in neonates and tears of the shoulder rotator cuffs), we believe sonography is not yet a reliable means of diagnosing tears of the knee menisci.

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