

## The Value of Sonography in Diagnosis of Meniscal Injury

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### ABSTRACT

**Background:** Regarding the high incidence of meniscal injuries, a cost-effective, noninvasive, and also accurate diagnostic modality is highly needed. This study was conducted to assess the diagnostic value of sonography in detecting meniscus tears in comparison with arthrography.

**Methods:** A total of 136 patients with symptoms of meniscal injury were examined with both sonography and arthrography by separate radiologists. The sensitivity, specificity, positive, and negative predictive values of sonography were calculated versus arthrography.

**Results:** The sensitivity of sonography in diagnosing meniscus tear was 75 percent, specificity 88 percent, positive predictive value 80 percent, and negative predictive value 85 percent.

**Conclusion:** Our results show that we can't yet replace other methods with higher diagnostic value with sonography completely but regarding its advantages, it can be used along with other routine modalities.

**Key Words:** Meniscus Tear, Sonography, Arthrography, Diagnostic Value.

Meniscal injury is one of the most common causes of referral to orthopedics<sup>1</sup>. Since on time treatment is extremely important to prevent chronic complications and disabilities, early and appropriate diagnostic evaluation should be respected for all patients with symptoms of meniscal injuries<sup>1,2</sup>.

Although the predominant diagnostic parameter for meniscal injuries is physical examination but in the acute phase, especially in adolescents, other modalities are often required<sup>3</sup>. Right now routine paraclinical methods used to establish meniscal injuries are arthroscopy, arthrography, and magnetic resonance imaging (MRI)<sup>4</sup>. Among them arthroscopy is invasive; arthrography has the disadvantage of using X-Ray; and MRI isn't available every time and everywhere and is expensive. Since trials should be performed to find a diagnostic tool that is noninvasive, inexpensive, and easily available, Sonography has all these advantages but it can substitute routine methods only if it has acceptable sensitivity and specificity.

Trials on the diagnostic value of sonography in evaluating knee injuries including meniscus tears has been performed from 1980s<sup>5,6</sup> but controversies are already present<sup>7</sup>. This study was conducted to assess the diagnostic value of sonography in detecting meniscus tears in comparison with arthrography.

### Materials and Methods

In a prospective study from May 2002 to Aug 2003 in Al-Zahra hospital, Isfahan, 136 patients with symptoms of meniscal injury (such as pain, knee lock and giving way) were evaluated. The mean age of patients was  $32 \pm 7$  years (range: 15-62 years) with male predominance (78% vs 22%). All subjects were assessed with both arthrography and sonography by separate radiologists.

#### *Method of Sonography*

The probes used for sonography were 5 MHz and 7.5 MHz. For sonographic examination at first the patient was lying in prone position with completely extended knee. Using sufficient gel, the

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probe was placed longitudinally in popliteal fossa. Scanning of the joint space was performed dynamically and from multiple views, initiating from paramedian area. With slight move of transducer into lateral and medial, both menisci were well assessed. In order to evaluate the posterior horn both probes were used.

Afterwards, the patient was placed in the lateral decubitus position with the knee slightly flexed (20°), and the joint space scanned longitudinally for evaluating pars intermedia. Then the patient was lying in the supine position with the knee flexed 60° to 90° (depending on the patient) and anterior horns were assessed from ventral parapatellar side. For assessing anterior horns only 7.5 MHz probe was used.

Any abnormal echogenicity detected in multiple sectional planes was recorded as meniscal injury (except the hypoechoic band normally observed in posterior horn).

Double contrast arthrography was performed for all patients by another radiologist, unaware of findings of sonography. In interpretation of arthrographies, only definite tears were recorded and doubtful cases were excluded.

## Results

In 136 patients, 52 meniscus tears (39%) were definitively diagnosed by arthrography, from which 39 meniscal injuries were detected by sonography, too. The results have been shown in detail in table 1. The false negative and false positive rates of sonography were 9% (13 cases) and 7% (10 cases), respectively. The sensitivity, specificity, and predictive values have been calculated and reported in table 2.

In sonographic examination, posterior horn and medial and lateral menisci were completely evaluated in all patients but assessment of anterior horn and pars intermedia was satisfactory in 95% of subjects. In remaining cases, because of patients inability to flex their knees (due to pain, edema, or deformity), sonography of anterior horn was impossible.

## Discussion

The sensitivity and negative predictive value of sonography in detecting meniscal injuries were 75% and 85%, respectively which is lower than

previous reports<sup>8,9</sup>. The higher rate of false negative can be due to the following factors:

a) Our radiologists were poor experience in evaluating meniscal injuries with sonography in comparison with former studies<sup>10</sup>.

b) Using a suitable probe will enhance the accuracy of sonographic examination which is especially important in evaluating the anterior horns. In our study the available probe was the linear form, while in most previous studies, convex and sector probes had been used. In addition water bag used in some former studies makes a better contact surface and thus reduces the false negative rate<sup>11,12</sup>.

c) The resolution of sonography is an important parameter in detecting small tears. While most cases of false negative of sonography were reported to be "tiny" in arthrography, other studies had detected tears as small as 2 mm in sonography<sup>11</sup>. This difference could be attributed to different resolution of sonographies.

d) Another problem is the chronicity of injuries. In chronic tears, degenerative changes around the lesion are difficult to be differentiated from pure degenerative process without meniscus tearing. The onset of symptoms in our patients was at least two months before sonographic examination while in previous researches most injuries were acute<sup>8,13</sup> which makes sonographic evaluation more easier and accurate.

The specificity and positive predictive value of sonography in our study were 88% and 79%, respectively which is comparable with previous studies<sup>8,14</sup>. Regarding the advantages of sonography, these value seem to be desirable in comparison with other methods. Multiple factors could influence the false positive rate in the present study:

Not desirable contact surface which makes artifacts is the first factor. Another parameter is the presence of degenerative changes in the tip of menisci, which is mainly responsible for 6 of 10 cases of false positive. In these subjects an echogenic area with unclear border in the tip of menisci was observed and reported as meniscus tearing. All these patients were older than 45 years and, based on radiological findings, degenerative changes in their articular cartilage was present. With respect to this finding, changes in the echo-

genicity of meniscus can also be attributed to degenerative joint disease. Therefore the wide range of patients age in this study could negatively influence the results.

Finally the results show that we can't yet use sonography instead of other methods with higher diagnostic value, completely, but regarding its

advantages, it can be used along with other routine modalities. Further investigations is suggested to establish an optimal protocol in order to reduce false positive and false negative rates in this method.

**Table 1.** True positive rates of sonography versus arthrography.

		Arthrography	Sonography
Medial meniscus	Pars intermedia	3	1
	Posterior horn	28	25
	Anterior horn	10	6
Lateral meniscus	Pars intermedia	-	-
	Posterior horn	6	4
	Anterior horn	5	3
Total		52	39

**Table2.** Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of sonography in diagnosing meniscus tears.

	Medial meniscus (n=73)	Lateral meniscus (n=63)	Overall (n=136)
Specificity (CI 95%)	80 (73.3-86.7)	92 (87.8-96.2)	88 (80.6-95.4)
Sensitivity (CI 95%)	78 (71.0-84.9)	64 (56.5-71.4)	75 (65.1-84.9)
PPV (CI 95%)	84 (77.8-90.1)	64 (56.5-71.4)	80 (70.9-89.1)
NPV (CI 95%)	73 (67.1-78.9)	92 (87.8-96.2)	85 (76.8-93.1)

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