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## Patient perception of magnetic resonance arthrography

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**Abstract** *Objective.* Magnetic resonance (MR) arthrography has been demonstrated to be more accurate than MR imaging alone in the identification of a variety of musculoskeletal pathology. While the complication rate of intra-articular gadolinium: saline injection has been shown to be relatively low, MR arthrography is more invasive, painful, and costly, and less convenient, than MR imaging alone. The purpose of this study was to evaluate patients' perception of the fear and discomfort, and to assess their overall acceptance of the intra-articular gadolinium injection.

*Design and patients.* Between October 1997 and January 1998, 113 outpatients who were referred to Yale-New Haven Hospital for MR arthrography of the ankle, elbow, hip, knee, shoulder, or wrist were asked to complete a questionnaire rating their fear of factors most commonly associated with the procedure including "pain", "needles", "complications", and "discovery of results that

would lead to surgery". In addition, after having undergone the intra-articular gadolinium:saline injection, patients were asked to rate their perception of pain.

*Results.* While many patients expressed fear of "pain" and "needles", after having undergone the injection their overall pain rating score was low. Only 6% actually found gadolinium arthrography more painful than expected.

*Conclusion.* Despite the fact that patients expressed apprehension about certain aspects of MR arthrography, subjects who underwent the intra-articular gadolinium injection considered the discomfort less than expected. Clinicians should not hesitate to order MR arthrography because the accuracy of the procedure is high enough that patients accept the discomfort.

**Key words** MR arthrography · Joint injection · Gadolinium (intra-articular) · Pain-rating scores · Arthrogram · Complications

### Introduction

Magnetic resonance (MR) arthrography has been increasingly utilized to identify musculoskeletal disorders which, if corrected, may improve the quality of patients' lives by diminishing pain and allowing them to participate in desired work or recreational activity.

MR arthrography has been demonstrated to be useful and more accurate than MR imaging alone in a variety of musculoskeletal applications including detection and

staging of labral abnormalities of the hip [1, 2], depiction and classification of osteochondral injuries and identification of intra-articular loose bodies in several joints, postoperative evaluation of the knee after meniscal repair [3], characterization of ligament injuries in the ankle [4] and in the elbow [5, 6], demonstration of glenoid labral lesions and variants that may simulate labral pathology [7, 8], and distinguishing full-thickness rotator cuff tears from partial-thickness tears [9]. MR arthrography, however, is more time-consuming, invasive,

and costly than non-contrast MR musculoskeletal imaging.

Intra-articular gadolinium injection has been shown to have a relatively low morbidity, with a 3.6% total complication rate comprised overwhelmingly of "minor occurrences" recently reported in a large multi-institutional survey [10].

Despite these reassuring statistics, some patients at our institution have exhibited anxiety regarding the added time, risk, and discomfort intrinsic to intra-articular injection. Such concern may result in a technically more difficult procedure for the radiologist to perform or in a patient declining the test altogether.

Information regarding aspects of arthrography feared by patients and their true perception of pain after having undergone the procedure might be utilized in the future by radiologists and referring physicians to better counsel their patients. We therefore felt it important to identify which factors our patients feared most about arthrography. We also wished to determine whether the average patient, after having undergone the arthrogram, considered the procedure as painful as anticipated. The authors also sought to investigate how well MR arthrography had been explained to patients by their referring orthopedic surgeons.

The factors which patients feared most about MR arthrography and pain rating scores were analyzed in an effort to understand their responses to the injection.

## Subjects and methods

Between October 1997 and January 1998, 113 outpatients who were referred to two musculoskeletal radiologists at our tertiary care hospital by orthopedic surgeons for MR arthrography of the ankle, elbow, hip, knee, shoulder, or wrist were asked to complete a survey. The total number of patients referred for the procedure during that time was 152. Therefore, 75% of patients who presented for MR arthrography completed the questionnaire. Authorization for this procedure had been approved by the Yale Human Investigation Committee. Those who had been referred only for conventional arthrography were excluded.

Prior to the arthrogram, in the waiting room, radiology technologists, without the radiologist or resident present, asked patients to answer a written questionnaire (Fig. 1) in order to rate their fear about certain aspects of MR arthrography including pain, needles, complications, and discovery of an operable lesion. Informed consent with a brief explanation of its potential benefits and risks of the procedure including bleeding, infection, contrast allergy and alternatives, including noncontrast MR imaging, was then obtained by the radiologist. The patients were told that MR arthrography had been ordered by their orthopedic surgeons because the procedure might offer greater accuracy than MR imaging alone in arriving at the correct diagnosis. No specific statistics or studies were quoted to the subjects regarding the potential differences in accuracy between the two types of tests. In addition, patients were asked to indicate in what detail the procedure had been explained to them by their referring orthopedic surgeon ("not at all", "briefly", or "in detail").

After completing the arthrogram, the radiologist left the fluoroscopy room. Patients were then asked by a technologist (not necessarily the same one who administered the first part of the questionnaire) to complete the second part of the questionnaire. This consisted of two questions: Patients were asked to rate the procedure according to the following pain score: 0=less painful than expected, 1=about the same as expected, or 2=more painful than expected. In addition, the participants were asked whether, having undergone the arthrogram, would they again opt for MR arthrography (possibly more accurate) or a less invasive test (possibly less accurate but no needles). Each patient was then es-

**Fig. 1** Questionnaire

Medical Record Number:

Date:

1. Before I came to my appointment today, my orthopedic doctor explained the procedure to me:
- A. In detail                      B. Briefly                      C. Not at all

2. What about the procedure has worried you most?

	Very much	Somewhat	Not at all
Pain	_____	_____	_____
Needles	_____	_____	_____
Complications	_____	_____	_____
Finding a diagnosis that will lead to surgery	_____	_____	_____

3. How was the procedure compared with what you expected?

A. More painful                      B. Same as expected                      C. Less painful

4. After having undergone this procedure, which would you choose?

A. A noninvasive test (one that doesn't require needles) that is slightly less accurate in diagnosing your bone/joint problem

B. This test (more accurate but requires an injection)

**Table 1** Patient population

Total number of patients referred for MR arthrography (n=113)<sup>a</sup>

Knees	52
Shoulder	49
Hip	4
Ankle	4
Elbow	3
Wrist	1

Population on whom rating scores were based (n=100)<sup>b</sup>

Knees	47
Shoulder	42
Hip	4
Ankle	4
Elbow	3

<sup>a</sup> Two refused the procedure and one cancelled due to the presence of metal; therefore a total of 110 arthrograms were performed. There were 10 incomplete questionnaires

<sup>b</sup> Average age 39.8 years (range 11–81 years); 62 males, 38 females

corted to the MR Imaging Center located in another part of the hospital.

The patient population (Table 1) consisted of 113 non-sedated patients, 13 of whom were excluded because they filled out the questionnaire incompletely. Two of these 13 patients refused the arthrogram after learning more about the procedure during the informed consent. Another in this group had his examination cancelled because of the presence of metal near the joint that was thought to preclude useful MR imaging. Exclusion of these patients yielded a total of 100 subjects from whose surveys the data was tabulated. No patient refused to participate in the questionnaire.

There were 62 male and 38 female patients, with an average age of 39.8 years (range 11–81 years). Data were tabulated from written worksheets and organized in table form.

Of the 113 patients MR arthrography had been scheduled in four ankles, three elbows, four hips, 52 knees, 49 shoulders, and one wrist. Three examinations were cancelled (two shoulder and the wrist arthrogram), yielding a total of 110 arthrograms performed by two musculoskeletal radiologists and eight diagnostic radiology residents within an academic teaching hospital setting.

All procedures were performed using standard aseptic technique, 1% locally infiltrated lidocaine hydrochloride anesthetic, fluoroscopic guidance, and 3.5 inch (8.9 cm) 20 gauge spinal needles for the shoulder and hip, or 1.5 inch (3.8 cm) 22 gauge needles for the elbow and knee, and either 22 or 25 gauge 1.5 inch needles (3.8 cm) for the ankle arthrograms. Intra-articular position was confirmed upon injection of 1–2 ml of a 1:1 mixture of 1% lidocaine and a Hypaque Meglumine 60% (Diatrizoate Meglumine Injection USP, Nycomed, Princeton, N.J.) and documented on a single fluoroscopic spot radiograph. Once proper intra-articular position was established, between 4 and 14 ml, depending upon the capacity and size of each joint, of a 1:250 dilution of gadolinium:saline [1 ml gadoterinol (ProHance, Bracco Diagnostics, Princeton, N.J.) diluted in 250 ml of saline solution] was injected. Patients were then escorted to the MR Imaging Center in a different part of the hospital.

## Results

The aspects of the procedure most feared by the 100 subjects were pain (15% very much, 36% somewhat, and

**Table 2** Factors that patients (n=100) feared prior to arthrography (%)

	Very much	Somewhat	Not at all
Pain	15	36	49
Needles	14	30	56
Surgery	9	49	42
Complications	6	19	75

49% not at all), and needles (14% very much, 30% somewhat, and 56% not at all) (Table 2). Other factors were results that would lead to surgery (9% very much, 49% somewhat, 42% not at all) and complications of arthrography (6% very much, 19% somewhat, and 75% not at all).

Only 6% (6 of 100) of patients considered the procedure more painful than expected. The average pain rating score of patients after having undergone arthrography was low (0.48). This score was calculated by adding the total pain rating of the 100 subjects and dividing by 100.

Ninety-six percent of patients who completed the arthrogram favored MR arthrography over noncontrast MR imaging. Even in the subgroup which felt that the procedure was more painful than expected, there was preference for MR arthrography. Of six patients who rated the procedure more painful than expected, five underwent shoulder arthrography and one knee arthrography. Five of these six patients still demonstrated a preference for MR arthrography over a noninvasive test that might offer less useful diagnostic information. Five surgical lesions were discovered in this subgroup.

Two patients, both male, experienced vagal reactions during the arthrogram which resolved spontaneously. One of these considered the procedure as painful as expected and the other less than expected.

Of those who completed the first portion of the survey, 30 patients said their referring physician had explained the procedure to them in detail, 36 briefly, and 30 not at all. However, we felt that the perception of pain in these groups did not correlate with the extent of explanation by the referring physician.

## Discussion

The notion that MR arthrography is more accurate than MR imaging alone for various diagnoses is debatable and beyond the scope and intended purpose of this study. At our institution, orthopedic surgeons prefer MR arthrography for evaluation of all suspected lesions in the postoperative knee; shoulder instability, labral pathology, or rotator cuff tears; the hip labrum; and ankle or elbow ligament injury; also for detection of loose bodies and osteochondral lesions in any of these joints.

Prior to this study, the authors thought that subjects might, after having undergone an injection, have opted for a less invasive test such as noncontrast MR imaging because of the anxiety or discomfort they might have experienced. The data suggest the opposite: that patients are willing to undergo discomfort, fear of needles, or pain in an effort to achieve the most accurate diagnosis of their musculoskeletal problems.

The overall pain rating was less than expected – useful information with which to counsel patients fearful in this regard. While it was not the purpose of this study to analyze subgroups, it is possible that pain rating might have differed between older and younger patients, males and females, non-athletes and athletes, those who underwent large versus small joint injections, and those without surgical lesions compared with those with an operable lesions. Given our sampling method, we felt that such multivariate analysis would not have been statistically significant.

Since both the residents and staff radiologists perform parts of the procedure that differ from case to case, we did not attempt to correlate pain rating with experience level.

There are several improvements that might have yielded greater significance to the data, including a larger sample size. In gathering responses relating to levels of fear or pain, the use of a visual analog rating scale with increments from 1 to 10 rather than the 0 to 2 numerical scale that we utilized would have been preferable. A visual scale on which patients could chart a relative response might have yielded a smoother continuum of choices and, therefore, more accurate data.

It is possible that there was a selection bias because perhaps only the most motivated patients with the most severe symptoms had been referred. Theoretically, these patients might have been willing to undergo more discomfort than those that had first refused the procedure in orthopedic or sports medicine clinics and, therefore, were not referred.

Despite our efforts to inform each patient and to obtain legal consent in a complete manner without influencing responses to the survey, it is possible that physician interaction and reassurance might have lessened patients' willingness to admit that we might have caused pain. Furthermore, patients might have perceived that the radiology technologists who had administered the survey were part of our radiology team and, therefore, might not have felt as free to report discomfort or fear in their presence. Potential staff influence might have been avoided had a study coordinator been available.

In addition, the phenomenon of "doctor knows best" might have influenced answers, particularly regarding preference of tests or willingness to express pain [11]. Patients may have been less inclined to state their true preferences in order not to conflict with their referring orthopedists' preferences and biases. It is also possible

that after having endured arthrography, patients experienced a sense of relief or "accomplishment" and thus were less inclined to suggest a preference for a noninvasive test. And, finally, patients might assume that a more invasive examination intrinsically provides more information than a noninvasive study and therefore would tend to rate the experience more favorably than expected.

Orthopedic surgeons at our institution have noted that some patients seen in their clinic within a week of arthrography report exacerbation of their symptoms or pain at the injection site which may exceed that of their underlying condition. Some surgeons suggest that the lidocaine hydrochloride that we administer delays the onset of pain. Therefore, the survey might have been more accurate if administered a few days after the MR arthrogram.

In spite of these limitations, the data suggest that patients accept MR arthrography, because subjects considered it less painful than expected. Even in the six of 100 patients who reported the procedure more painful than expected, five still demonstrated a preference for MR arthrography over a less invasive test. We discovered surgical lesions in five of these six patients.

Most patients indicated that their referring physicians had not spent much time informing them about MR arthrography. Thirty patients in the study group had been referred by their orthopedic surgeon without prior discussion or explanation of the procedure. Prior to receiving informed consent, several patients were unaware that an injection would take place. Since the majority had little or no explanation of the procedure by their referring physician, patients might benefit from a more detailed explanation by radiologists.

## Conclusion

While patients expressed fear of certain aspects of MR arthrography, including pain and needles, the actual average pain rating score after having undergone the arthrogram was low. Only six of 100 patients (6%) perceived the procedure as more painful than expected and 96% of all patients preferred MR arthrography over a noninvasive test that might offer less accuracy. Therefore, despite its invasiveness, MR arthrography is accepted by patients. Clinicians who feel that it would be helpful should not hesitate to order the test. These data could be used in counseling patients who are referred for MR arthrography.

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