Post-procedure pain following direct MR arthrography

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### Purpose

The purpose of our prospective study is to determine the incidence, time of onset, duration, and severity of pain after intraarticular injection of a gadolinium and epinephrine mixture diluted in bacteriostatic, and of a gadolinium mixture without epinephrine diluted in bacteriostatic saline for magnetic resonance arthrography.

### Methods and Materials

#### Patients:

This prospective, single-center nonrandomized study was approved by the institutional review board of the University of California San Francisco. From March until August of 2009, 120 consecutive patients underwent magnetic resonance arthrography for standard clinical indications at UCSF. Eleven patients were lost to follow up. Seventy nine shoulders, 19 hips, 5 wrists, 4 knees, and 2 elbows were injected with gadopentate dimeglumine and 1:1000 epinephrine diluted in bacteriostatic normal saline and followed by MRI.

We also investigated whether epinephrine had an influence on the incidence of postprocedural pain after magnetic resonance arthrography. From September 2009 through January 2010, 35 patients underwent magnetic resonance arthrography for standard clinical indications at UCSF. Eight patients were lost to follow up. Fifteen shoulders, 7 hips, 1 wrists, 2 knees, and 1 ankle were injected with dimeglumine gadopentate and 1% ropivacaine diluted in nonbacteriostatic saline and followed by MRI.

Patients were contacted by phone between 3 and 7 days after joint injection as part of routine clinical follow up. Patients were asked to report if they had experienced joint pain which was different or more intense than their pre-injection baseline, the severity of pain, the duration of pain, and time of onset of pain. The 11 point numeric pain rating scale was used.[6, 7]

Patient demographic data was recorded. Patient age ranged from 15-72 years old.

#### Injection Technique:

All injections were performed with fluoroscopic guidance in accordance to institutional standard operating procedures. All arthrograms were performed by five musculoskeletal radiology fellows or two attendings. Local anaesthesia was obtained by injecting a small
volume, ~2-5 mL of 1% lidocaine (Xylocaine- MPF; Astrazeneca) mixed with 8.4% sodium bicarbonate (84mg/ mL; Hospira Inc) subcutaneously and deeper down to the bone. The local anaesthesia mixture consisted of 4 mL of 1% lidocaine and 1 mL of 8.4% sodium bicarbonate. Approximately the same total volume of the MRA mixture was injected into each of the respective joints. Fluid was never injected into a joint past patient discomfort. By and large, each joint was injected until the patient reported a sense of fullness, to ensure joint distension, which accounted for some variability in the total volume injected into each joint.

Contrast Media Injection:

Our standard protocol for the shoulder, hip, elbow, and ankle involved first injecting a small volume of diluted iodinated contrast. The iodinated contrast mixture comprised of 10 mL of bacteriostatic saline (9 mg/ mL sodium chloride and 9 mg/ mL benzyl alcohol; Hospira Inc.) versus nonbacteriostatic saline (9 mg/ mL sodium chloride, 0.308 mOsmol/ mL; Hospira Inc.) and 10 mL of Isovue-M-200 (41% Iopamidol; Bracco Diagnostics Inc) in a 30 mL syringe. A small volume, ~ 2 mL, of this 50% dilute Isovue-M-200 was first injected into the joint to insure appropriate intraarticular needle tip localization. Subsequently, a standard volume of dilute gadolinium (469.01 mg gadopentate dimeglumine/ mL, Magnevist; Bayer) was injected into the joint, but never past the patient's subjective perception of joint fullness. The gadolinium mixture consisted of 10 mL of bacteriostatic versus nonbacteriostatic normal saline, 5 mL of 1% ropivacaine (Ropivacaine 10 mg/ mL,Naropin; APP Pharmaceuticals), 0.3 mL of 1:100 epinephrine ( Epinephrine 1mg/ mL; Hospira Inc), and 0.1 mL of Magnevist. Standard total injection volumes were 12 mL for the shoulder, 6 mL for the elbow, 4 mL for the radiocarpal joint, 10 mL for the hip, 25 mL for the knee, and 4 mL for the ankle.

Our injection technique for the wrist was slightly different than the other joints. For the wrist, we used only one mixture, which contained both iopamidol and dimeglumine gadopentate. Our wrist mixture consisted of 10 mL of Isovue-M-200, 5 mL of bacteriostatic versus nonbacteriostatic normal saline, 5 mL of ropivacaine, 0.3 mL of 1:100 epinephrine, and 0.1 mL of gadolinium. Approximately 4 mL of this one mixture was injected in between the radius and scaphoid into the radiocarpal joint.

Results

There was no significant difference in the incidence of pain between the groups of patients who underwent magnetic resonance arthrography with intra-articular injection of epinephrine compared with those without intra-articular injection of epinephrine, 64% vs 73% respectively, p- value = .36. When all the patients who underwent
magnetic resonance arthrography were pooled together, those who underwent magnetic
resonance arthrography with epinephrine and without epinephrine, the total incidence of
post-procedure pain was 66% (89 / 135). The average severity of post-procedure pain
was 4.84 ±2.4 (range 1-10). The average duration of post-procedure pain was 44.4 ±
30.5 hours (range 6-168). The average time to onset of post-procedure pain was 16.6
± 13.1 hours (range 4-72).

Of the 109 patients who underwent magnetic resonance arthrography via intra-
articular injection with iopamidol, gadopentate dimeglumine, 1% ropivacaine and 1:1000
epinephrine diluted in bacteriostatic normal saline, 39 patients experienced no pain after
intra-articular injection. 70 out of 109 patients experienced pain after magnetic resonance
arthrography; incidence of pain = 64%. Of the 70 patients who experienced pain after joint
injection with epinephrine, the average severity of pain was 4.8 ± 2.5 (range 1-10). 63
of the 70 patients with post-procedure pain reported the pain to have lasted an average
of 43.7 ± 28.2 hours (range 8-168). Twenty six of the 70 patients who experienced post-
procedure pain reported an average of 18.1 ± 14.4 hours (range 4-48) between joint
injection and onset of post-procedure pain.

Of the 26 patients who underwent magnetic resonance arthrography via intra-articular
injection with iopamidol, gadopentate dimeglumine, 1% ropivacaine without epinephrine
diluted in bacteriostatic normal saline, 7 patients experienced no pain. 19 out of 26
patients experienced pain after magnetic resonance arthrography; incidence of pain =
73%. Of the 19 patients who experienced pain after joint injection without epinephrine,
the average severity of pain was 4.9 ± 2.5 (range 0-10). Sixteen of the 19 patients with
post-procedure pain reported the pain to have lasted an average of 44.3 ± 39.4 hours
(range 6-168). Seven of the 19 patients who experienced post-procedure pain reported
an average of 10.9 ± 5.0 hours (range 6-16) between joint injection and onset of post-
procedure pain.

An extremely important result was that other than pain, we had no other reported
complications. Each patient's joint pain eventually resolved. Post-procedure pain was
experienced in all joints which were injected. Specifically, we had no cases of septic
arthritis after magnetic resonance arthrography performed on any of the 135 patients.

**Conclusion**

The incidence of post-procedure pain after intraarticular injection of gadolinium for
magnetic resonance arthrography is 66% (89/ 135), with an average severity of post-
procedure pain of 4.84 ±2.4 (range 1-10), average duration of post-procedure pain of
44.4 ± 30.5 hours (range 6-168), and average time to onset of post-procedure pain of
16.6 ± 13.1 hours (range 4-72).
We have also shown that magnetic resonance arthrography is extremely safe in the short term, with no complications other than pain which ultimately resolves. The significance of these findings is that patients and referring physicians need to be well informed of the morbidity of magnetic resonance arthrography so that they can make an informed decision about undergoing this diagnostic test.

References


12. Ng, H.P., et al., *Efficacy of intra-articular bupivacaine, ropivacaine, or a combination of ropivacaine, morphine, and ketorolac on postoperative pain relief after ambulatory*


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