

# Clinical Experience

## Four Cases of "Milwaukee Shoulder," with a Description of Clinical Presentation and Long-term Treatment

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"Milwaukee shoulder" was first described by McCarty et al.<sup>1,2</sup> in 1981. Features of this condition include: 1) an occurrence predominately in older women; 2) shoulder pain and marked limitation of motion; 3) recurrent and large shoulder effusions, with a bland synovial fluid characterized by a low leukocyte count, composed chiefly of mononuclear cells; 4) concomitant glenohumeral osteoarthritis and/or rotator cuff tear; and 5) the presence of hydroxyapatite on crystal analysis of the aspirated synovial fluid.

This paper presents four patients with "Milwaukee shoulder" in order to: illustrate the clinical presentation, discuss the treatment, and point out unresolved questions concerning the etiology of this disorder.

### Materials and Methods

The four women who form the basis of this report were seen over a 16-month period in the office of J.W., a solo practitioner in a general rheumatology community practice.

All four presented with shoulder pain, limited shoulder motion, and the following: a) large and recurrent shoulder effusions in the affected shoulder, b) absence of other causes for their pain and immobility such as aseptic necrosis, joint infection, rheumatoid arthritis, and primary or secondary carcinoma, c) arthrographic evidence of rotator cuff tear and/or adhesive capsulitis, d) persistently low leukocyte counts on analyses of synovial fluid from the involved shoulder, and e) the finding of hydroxyapatite crystals in the synovial fluid on analysis by electron microscopy.

Routine synovial analysis was done by the

method of Cohen et al.<sup>3</sup> Evaluation for hydroxyapatite crystals was performed using light microscopy with alizarin red S staining and electron microscopy.<sup>4</sup>

Arthrography was undertaken from the posterior approach with 5 ml of Renografin 60® and 5 ml of air injected into the joint. Immediately thereafter roentgenograms of the involved joints were taken in the anterior-posterior position, and these views were repeated after exercise.

### Results

The clinical features of the four patients with Milwaukee shoulder who form the basis for this report are presented in Tables 1-4.

A summary of the patients' presenting complaints and physical examination appears in Table 1. Note that onset was gradual and that an episode of recent shoulder trauma was identified in only one patient.

The characteristics of synovial fluid obtained at time of arthrocentesis are summarized in Table 2. The number of aspirations varied from as few as five per shoulder to as many as 22, but all fluids continued to consist of large volume and low leukocyte count. Apatite crystals were suggested by alizarin red S stain and confirmed by electron microscopy.

An account of the x-ray findings, including results of arthrography, is shown in Table 3. As in McCarty's original paper,<sup>1</sup> roentgenographic findings included moderate to severe osteoarthritis and arthrography revealed derangements of the rotator cuff (Figs. 1 and 2). Further x-rays of patient M.Y., taken after repeated injections of intra-articular steroids, indicated mild progression of osteoarthritis, but revealed no changes compatible with aseptic necrosis.

The intra-articular steroid treatment these four patients received is summarized in Table 4. This therapy apparently permitted patients to continue self-care functioning and community living, a state of independence that was endangered prior to diagnosis and appropriate treatment.

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**TABLE 1.** Presenting Features of Four Patients with Milwaukee Shoulder

| Patient | Age | Shoulder | Duration | Physical Exam                  | Other Arthritis |
|---------|-----|----------|----------|--------------------------------|-----------------|
| M.A.    | 86  | R&L      | "Years"  | Marked loss<br>ROM bilaterally | No              |
| M.Y.    | 73  | R&L      | 5 Years  | Marked loss<br>ROM bilaterally | Osteo<br>C5-C7  |
| J.B.    | 66  | R        | 6 Months | Marked loss<br>rotation        | Osteo<br>Knees  |
| M.F.    | 76  | R        | 3 Months | Loss of rotation               | Osteo<br>Hands  |

R, right; L, left; ROM, range of motion.

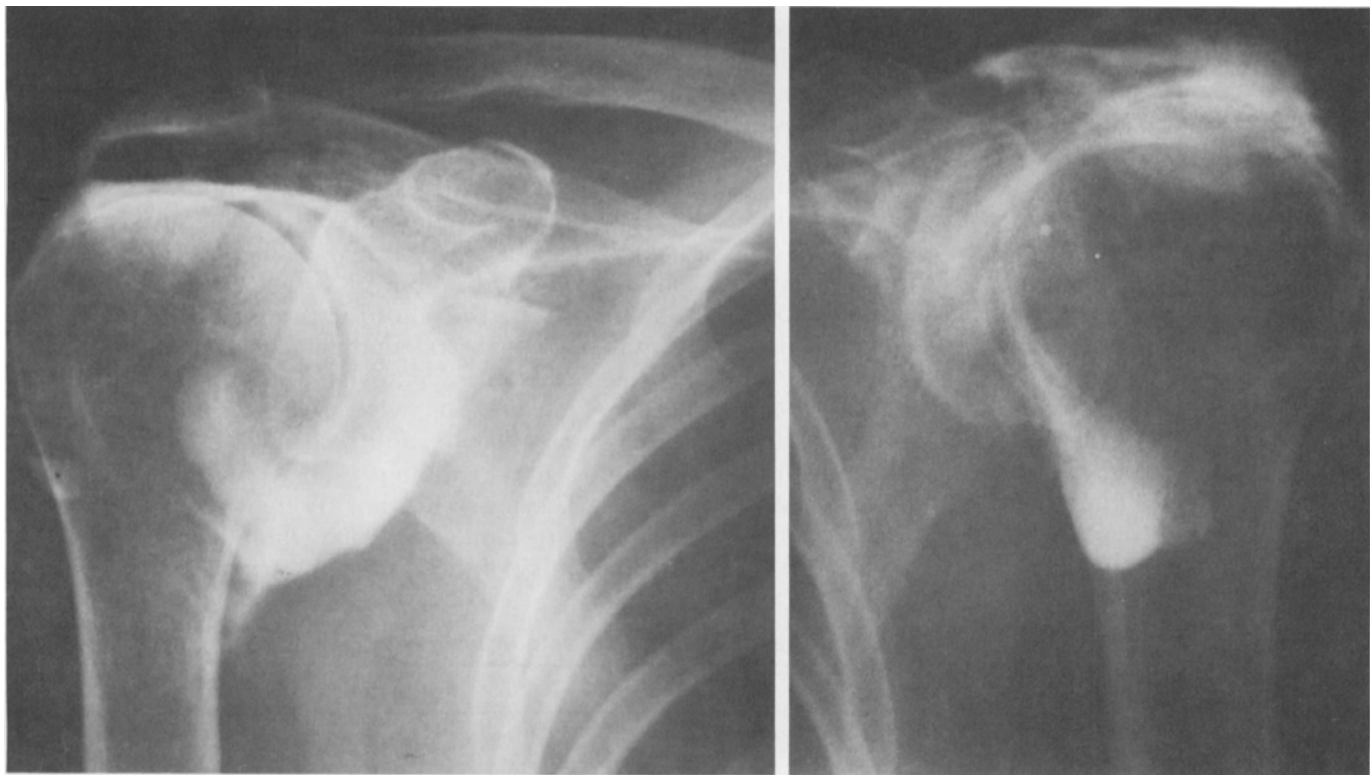
### Discussion

It appears that "Milwaukee shoulder" is not as rare as previously thought. Three of the four patients in this report presented in a three-month period, and all four patients were seen in a community-based general rheumatology practice.

McCarty proposes that hydroxyapatite crystals released from tendinous calcification into the shoulder joint initiate a process that leads to phagocytosis of these crystals by synovial cells lining the shoulder joint cavity. According to these investi-

gators, ingestion of such crystals causes release of large amounts of the enzymes collagenase and neutral protease from the synovial cells into the surrounding joint fluid; in turn these enzymes are responsible for effusion and the shedding of more crystals. These fresh crystals then perpetuate the cycle of phagocytosis and enzyme release.<sup>1,2</sup>

However, the role hydroxyapatite crystals play is not settled, as these crystals do not necessarily elicit a similar response in other joints.<sup>5,6</sup> In addition Bridgeford et al.<sup>7</sup> recently presented a preliminary report of patients with hydroxyapatite



**FIGURE 1 (left).** Arthrogram of the right shoulder of patient M.Y. Notice the global loss of joint space as outlined by the contrast medium. This shrinkage of the joint space occurring uniformly about the joint is characteristic of adhesive capsulitis.

**FIGURE 2 (right).** Arthrogram of the left shoulder of patient M.Y. Note the presence of contrast medium in the subacromial bursa. This finding indicates a tear in the rotator cuff muscle that allows contrast medium injected into the shoulder joint to enter the surrounding tissue.

**TABLE 2.** Characteristics of Synovial Fluid Aspirated from Four Patients with Milwaukee Shoulder\*

| Patient | Shoulder | Synovial Fluid Findings |                            |                  |                |
|---------|----------|-------------------------|----------------------------|------------------|----------------|
|         |          | Amount (ml)             | WBC (per mm <sup>3</sup> ) | Apatite Crystals | Other Crystals |
| M.A.    | R        | 2-15                    | <100                       | +                | CPPD           |
|         | L        | Same                    | Same                       | +                | —              |
| M.Y.    | R        | 2-25                    | <200                       | +                | None           |
|         | L        | 2-15                    | <200                       | +                | None           |
| J.B.    | R        | 35-55                   | <100                       | +                | None           |
| M.F.    | R        | 15-55                   | <50                        | +                | None           |

\* All four patients had multiple aspirations.  
R, right; L, left; CPPD, calcium pyrophosphate dihydrate.

crystals in asymptomatic shoulder joints. Furthermore, Good et al.<sup>8</sup> noted recurrent effusions similar to "Milwaukee shoulder" in male patients on dialysis in whom hydroxyapatite crystals were persistently absent.

As noted in Table 2, both calcium pyrophosphate dihydrate (CPPD) and apatite crystals were found in the synovial fluid of patient M.A. The presence of both crystals in patients with a clinical presentation compatible with apatite-induced arthritis is a common finding.<sup>4</sup> The significance of CPPD crystals in such cases requires further investigation.

Therapy in most cases remains supportive, with shoulder joint aspiration and steroid injection recommended as the treatment of choice.<sup>1,9</sup> Support for the use of intra-articular steroids comes from McCarty et al., who observed a marked decrease in synovial fluid collagenase concentration following steroid injection.<sup>9</sup> Furthermore, aspiration may exert an important effect by removing fluid whose large volume is obstructing movement.

We have found that pain and effusion re-occur rapidly, and that repeated intra-articular aspiration and injection are necessary if the patient is to maintain function.

Thus, one patient (M.Y.) presented in this paper has needed arthrocentesis every six weeks for the past 14 months. Radiographs of her shoulder at the beginning of her treatment and 12 months later indicate that in her case, such treatment has not produced destructive articular change.

It appears that no arbitrary figure exists as to the number of aspirations and injections a patient may receive. What determines that number is the patient's need for relief from shoulder pain and/or immobility.

We performed the arthrocenteses by the posterior approach.<sup>10</sup> However, the shoulder effusions encountered in "Milwaukee shoulder" usually are large, so that a physician using the traditional anterior shoulder approach should expect satisfactory results.

The question of a role for nonsteroidal agents and physical therapy remains unresolved. No studies to date have investigated such forms of therapy. Furthermore, because the patients present with substantial volumes of shoulder fluid, it is inevitable that shoulder joint aspiration will play a prominent role in any treatment regimen.

In summary, the "Milwaukee shoulder" syndrome should be considered the diagnosis of elderly women who present with shoulder swelling, pain, and limited mobility. X-rays should show osteoarthritis of the shoulder, and arthrography should uncover a concomitant rotator cuff tear or adhesive capsulitis. Synovial fluid aspiration findings include copious, viscous, often bloody fluid with a low leukocyte count. Electron microscopy of this fluid will reveal the presence of hydroxyapatite crystals. These crystals are thought to be responsible for the clinical picture, though controversy exists on this point. At present, treatment consists

**TABLE 3.** Shoulder X-ray Findings in Four Patients with Milwaukee Shoulder

| Patient | Shoulder X-ray  | Shoulder Arthrogram  |
|---------|---|--|
| M.A.    | Severe osteoarthritis R & L   | Adhesive capsulitis R<br>Rotator cuff tear L                     |
| M.Y.    | Mild osteoarthritis bilaterally<br>Repeat one year later shows mild progression | Adhesive capsulitis & rotator cuff tear R<br>Rotator cuff tear L |
| J.B.    | Mild osteoarthritis R   | Rotator cuff tear R  |
| M.F.    | Mild osteoarthritis R   | Rotator cuff tear R  |

**TABLE 4.** Response to Treatment in Four Patients with Milwaukee Shoulder\*

| Patient | Therapy   | How Improved  |
|---------|---|---|
| M.A.    | Aspiration and injection<br>q 6 weeks               | Continues self care;<br>able to live with relatives                                     |
| M.Y.    | Aspiration and injection<br>q 4-6 weeks x 14 months | Able to continue to live<br>alone independently   |
| J.B.    | Aspiration and injection<br>q 8-12 weeks            | Self-care function adequate<br>between injections; able to<br>care for self and husband |
| M.F.    | Aspiration and injection<br>q 4-8 weeks             | Relief of pain permits self-care<br>function between injections                         |

\* Injections consisted of 1 ml of triamcinolone acetonide, 40 mg/ml.

of repeated shoulder aspiration, followed, when needed, by injection of an intra-articular steroid preparation.

Awareness of "Milwaukee shoulder" is important for physicians caring for the elderly. Prompt recognition allows exclusion of other potentially confusing problems such as infection or fracture. Appropriate therapy has allowed elderly patients who were otherwise faced with nursing home placement to continue self-care and independent living.

### References

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