The case:

An elderly woman presented with recurrent pain years after a surgical procedure was performed for advanced arthrosis of the carpometacarpal joint of the thumb. Magnetic resonance imaging was obtained.

Figure 1: Coronal fast spin echo T2-weighted fat-suppressed MRI through the volar aspect of the wrist.

Your diagnosis?
Silicone arthroplasties have been used for small and medium-sized joints since the 1940s. Since then, Swan-son Silastic (Dow Corning, Midland, Michigan) finger implants were developed in the 1960s, and silicone arthroplasty applications in the hand and wrist have expanded to the metacarpal-phalangeal (MCP) and carpal-metacarpal (CMC) joints, and scaphoid and lunate replacements.

Typically, these arthroplasties have been performed in patients with advanced rheumatoid arthritis and osteoarthritis (either from primary disease or posttraumatic causes) for the purpose of relieving pain, improving function, and improving cosmetic appearance. However, complications arising from silicone synovitis have proved to be problematic in these patients, and as a result, silicone has been used less frequently for small and medium joint arthroplasty.

**PATHOGENESIS**

Silicone synovitis is an entity in which microparticles dissociate from implanted silicone rubber and induce an inflammatory reaction in the patient. Silicone synovitis is the

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**Figure 2:** Silicone synovitis of the wrist due to fractured silicone implant in the CMC joint of the thumb. Coronal fast spin echo (FSE) T2-weighted fat-suppressed MRI through the volar aspect of the wrist demonstrates a fracture (arrow) through the low-signal CMC-1 joint implant. Note the fluid and synovitis (arrowheads) around the implant, as well as the more proximal carpus (A). Coronal T1-weighted MRI confirms the fracture plane (arrow) through the implant. The phalange extending into the first metacarpal is better visualized due to imaging plane (B). Axial FSE proton-density fat-suppressed MRI shows the implant in cross-section (asterisk), marked synovitis throughout the carpus (arrows), and areas of carpal osteolysis (arrowhead) (C).
result of a silicone spacer becoming broken, fragmented or bent, and loosened. Grossly, the implants may be discolored, have a pitted surface, or lose their shape. The shed silicone particles are typically \(<100 \mu m\), are created by compressive and shear forces that fragment the prosthesis, and can be detected by polarized light in the extracellular fluid, histiocytes, and giant cells. Hyperplastic synovitis with focal fibrosis and mononuclear inflammatory infiltrate, synovial invasion of the bones (either immediately adjacent to or slightly remote from the implant), and foreign body granulomas may ensue. Bones can be destroyed by the induction and proliferation of osteoclastic giant cells, along with the release of lysosomal enzymes by macrophages.

**Clinical Presentation**

Clinical features of synovitis caused by silicone synovitis are pain with motion, joint tenderness, marked loss of motion, and soft tissue swelling. Wrist pain related to pinching or grasping an object such as a pen or opening a jar is relatively common, although pain can occur during light activities or at rest. Silicone synovitis typically presents in a delayed fashion in patients with silicone implants, with reports in the literature ranging from 1 to 30 years after implantation.

Carpal joint replacements tend to receive greater wear over time compared to MCP and interphalangeal joint implants and have a higher likelihood of breakage. In a literature review by Foliart of 182 implants requiring revision surgery due to silicone synovitis, 36% were due to scaphoid and lunate implants, followed by trapezium (19%), ulnar head/wrist (15%), finger (5%), radial head (4%), and navicular (0.5%). In another literature review by Foliart, the overall incidence of complications of 15,556 Swanson finger joint implants in 70 articles included particulate synovitis (0.06%), lymphadenopathy (0.08%), bone changes (4%), implant fracture (2%), implant loosening (0.7%), infection (0.6%) and implant removal (1%). Complications from silicone interposition arthroplasty for osteoarthrosis of the carpo-metacarpal joint of the thumb also include dislocation of the implant.

**Diagnostic Imaging**

Imaging of patients with suspected silicone synovitis begins with radiography, in which well-margined erosions and subchondral cysts may be present. Although incidences vary in the literature, reports of osteolysis around the implants have been as high as 75%. Bone density is typically preserved, except in patients with underlying osteopenia from rheumatoid arthritis or senile osteoporosis. Although the differential diagnosis of synovial-based processes might include pigmented villonodular synovitis, deposition disorders such as amyloidosis, or infection (tuberculosis or fungal), the presence of a silicone implant should strongly suggest particle disease.

Magnetic resonance imaging is useful in evaluating the integrity of the implant, as well as the extent of synovitis and osteolysis. Fracture of the implant will be demonstrated as a cleavage plane through the otherwise uniformly, markedly hypointense structure (Figure 2). Granulomas may form adjacent to the silicone implants, evidenced by well-marginated soft tissue nodules (Figure 3). Magnetic resonance imaging can help quantify the extent of intracapsular synovial deposits about the implants (Figure 4), as well as eroded bone structures.

**Management**

The treatment options for synovial synovitis range from...
bone healing methods to surgery, depending on the severity, but none of these procedures has developed a clear long-term benefit for patients. Pugliese et al. found that patients with active synovitis in the vicinity of a silicone implant should be considered for resection of the implant for optimal results. However, Murray and Wood found the long-term results of the treatment of silicone synovitis were generally poor, with no clear benefit of removal of the implant, debridement, and reconstruction of the wrist.

Surgical approaches generally involve implant resection, debridement of the synovitis, and curettage of the lytic lesions, along with consideration for arthrodesis or reconstruction. In cases where partial scaphoid implants are removed, second-stage capitate-lunate fusion can provide added stability. Nonimplant salvage procedures, such as interposition of neighboring muscles, fascia, or tendon, can be used. Pyrocarbon implants can also be used as an alternative to silicone in the fingers, although they also have reported complications of subsidence and squeaking. Unfortunately, recurrent symptoms persist in most revision surgical cases in patients with silicone synovitis.

REFERENCES