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Arthroscopic surgical management of shoulder secondary to shoulder injury related to vaccine administration (SIRVA): a case report

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Over the last decade, the proportion of Americans receiving the influenza vaccine has increased across all age groups and is increasingly mandated by employers.[5] Minor injection site reactions after intramuscular administration of the inactivated influenza vaccine in the deltoid, such as transient pain and erythema, are frequently reported in both children and adults.[4] However, a small proportion of patients report persistent shoulder pain and shoulder dysfunction after inactivated influenza vaccine administration. These sequelae after vaccine administration may present as subacromial or subdeltoid bursitis,[1,6,12,16,20] glenohumeral joint effusion with synovitis,[1,18] tendinopathy of the rotator cuff,[1,12,19] or bone lytic lesions.[8] This adverse reaction after vaccine administration has collectively been categorized as ''shoulder injury related to vaccine administration'' (SIRVA), and was officially added to the National Vaccine Injury Compensation Program's Vaccine Injury Table in 2017.[10]

Currently, literature on surgical management of SIRVA is limited. In this case, we describe a patient who presented with significant rotator cuff bursitis and bursal foreign body reaction 12 weeks after influenza vaccine administration managed with arthroscopic surgical intervention after failed conservative management.

Case report

A 51-year-old right-handed female schoolteacher presented for evaluation of her right shoulder. She reported 3 months of severe right shoulder pain that began after a flu vaccination administered into the right deltoid. She described the experience as being traumatic because of multiple redirections of the needle while injecting the vaccine. She developed severe shoulder pain and weakness over the next 48 hours; the pain was most pronounced with attempted shoulder elevation. She was evaluated and diagnosed with rotator cuff bursitis and impingement syndrome. Oral medication consisting of therapeutic doses of nonsteroidal anti-inflammatory drugs were prescribed but did not result in any appreciable benefit. She was subsequently treated with a cortisone subacromial injection and referred to physical therapy for rotator cuff–specific exercises.

This resulted in only temporary reduction in her symptoms, so a magnetic resonance image (MRI) of the shoulder was ordered. The MRI revealed evidence of severe shoulder bursitis with a large volume of fluid and solid-appearing heterogeneous bodies that extended throughout the subacromial space. There was no evidence of rotator cuff tear (Fig. 1).

On review of the MRI, she was sent to the shoulder subspecialty clinic for evaluation. Her physical examination was unchanged from the initial visit. Specifically, she had significant evidence of shoulder bursitis and shoulder pain with minimal motion especially when attempted overhead. She had limited range of motion as a result of pain; this was most pronounced with attempted forward

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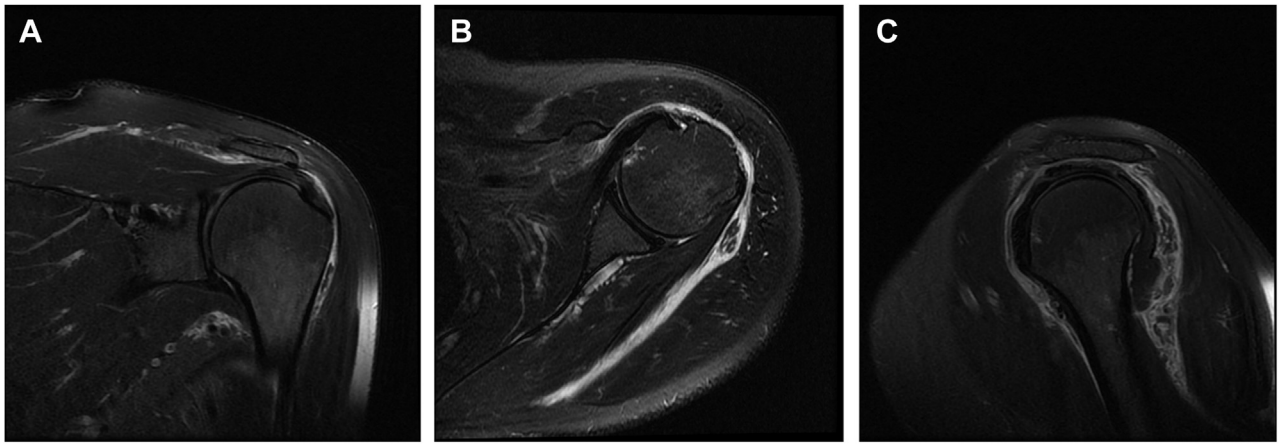

Figure 1 (**A**) Coronal, (**B**) axial, (**C**) sagittal oblique T2-weighted magnetic resonance image (MRI) slices showing significant subacromial bursitis with heterogenous bodies noted within the bursal fluid. No evidence of rotator cuff tear is noted.

flexion and/or abduction. Her active elevation, neutral external rotation, and abduction were 90°, 25°, and 70°, respectively. Her external rotation strength was 4/5 and she was neurovascularly intact. No erythema or warmth was noted. She had a positive empty can shoulder test.

After discussing with the patient, it was determined that the best course of action would be to perform an extensive arthroscopic surgical débridement of her subacromial space and biopsy of heterogenous loose bodies noted on the MRI.

Therefore, the patient underwent an arthroscopic shoulder débridement, subacromial bursectomy, and intraoperative cultures of the bursal tissue. At the time of surgery, she was noted to have extensive inflammation in the bursal space. In addition, she had multiple white, hardened caseous-appearing material in the shoulder (Fig. 2). This material was distinct from the bursae. These relatively large bodies were evacuated from the shoulder subacromial space and sent for culture and histologic analysis. Next, the rotator cuff was evaluated and noted to be intact. Her glenohumeral joint was evaluated and found to have a normal appearance without any significant abnormality.

The patient noted significant relief in her symptoms after surgery. At her 3-month postoperative checkup, her active forward flexion, neutral external rotation, and abduction were 165°, 70°, and 130°, respectively. She had no pain with shoulder motion in any plane, and her external rotation strength at neutral was 5/5. She progressed through physical therapy without significant difficulty. Histologic analysis of the loose bodies was revealed to have reactive changes and with areas of tissue necrosis (Fig. 3). This was noted to be atypical of synovial or bursal tissue. Cultures were negative for bacterial or fungal growth.

Discussion

The deltoid is the primary site of administration of the inactivated influenza vaccine for children and adults. Transient pain at the injection site and deltoid muscle are the most common chief complaints after vaccine administration.[1] However, persistent pain and limited range of motion are uncommon and should raise suspicion for a reactive inflammatory process in the shoulder joint.[8] Since

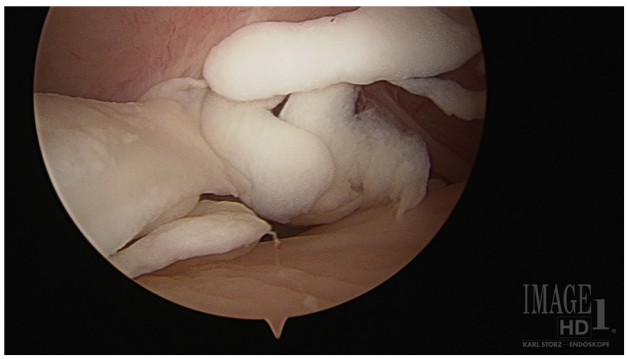

Figure 2 Intraoperative arthroscopic shoulder image of the subacromial space, viewing from posterior. Multiple white, hardened caseous-appearing material were encountered and removed.

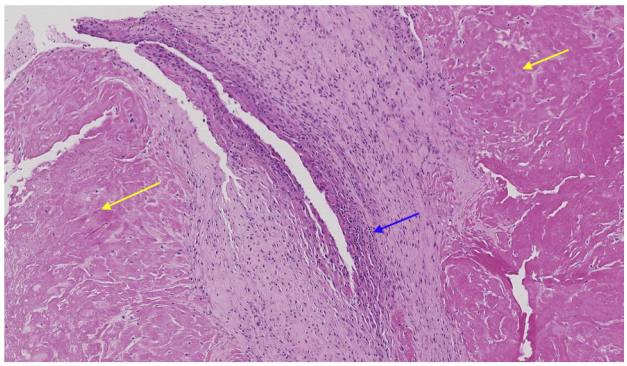

Figure 3 Evidence of tissue necrosis: pink hypocellular area (⟵) and surrounding inflammatory cells (⟵).

the mid-2010s, claims of SIRVA to the National Vaccine Injury Compensation Program have increased substantially.[13] In addition, orthopedic surgery has been shown to be the most common secondary provider in evaluation of SIRVA.[11] Thus, it is pertinent that orthopedic surgeons are aware of the presentation and management of SIRVA.

Currently, literature on medical and surgical management of SIRVA is limited. SIRVA should be suspected when a patient, without prior shoulder complaints, reports a history of rapid-onset, persistent shoulder pain possibly associated with weakness and decreased range of motion within 48 hours of vaccine administration. The literature shows that SIRVA is often related to vaccine administration ''too high'' in the deltoid muscle, which can increase the risk of injecting into the shoulder joint or bursa[1-3,7,11,12,15,20] or improper injection angle or redirection[2,9] as seen in our patient. SIRVA also appears to occur significantly more often in women than in men, which may occur secondary to differences in deltoid muscle mass between men and women.[7] The mass difference is especially relevant in the context of selecting correct needle length for vaccine injection based on the patient's size. These factors of improper deltoid muscle referencing, angle of injection, and needle selection have led several groups to propose vaccine administration guidelines specifically to prevent SIRVA.[2,7,9] Of note, although SIRVA is most often caused by the influenza vaccine, it is not isolated to the inactivated influenza vaccine alone and has been shown to be caused by other vaccine types delivered in the deltoid muscle such as the pneumococcal polysaccharide (PPSV23), herpes zoster, Tdap (tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis), and human papillomavirus vaccines.[1,3,7,14,17]

Evaluation of SIRVA typically involves shoulder imaging. Radiographic imaging is unlikely to show changes associated with SIRVA[19] and can be normal in the setting of SIRVA.[12] Although MRI may be sensitive for shoulder pathology, as seen in our patient, MRI findings are generally nonspecific. These can include subdeltoid edema or subacromial bursitis,[1,6,7,12,16,20] tendinitis and tenosynovitis,[1,12,18,20] and rotator cuff tears.[1,7,8,12] The nonspecific MRI findings reflect the diffuse inflammatory process that affects various synovial structures, leading to symptoms that mimic other common shoulder dysfunction etiologies such as rotator cuff tear, impingement, adhesive capsulitis, or bursitis.

Conservative treatment of SIRVA with a combination of nonsteroidal anti-inflammatory medications, corticosteroid injections into the glenohumeral or subacromial space, and physical therapy, can lead to partial or full resolution of persistent shoulder symptoms.[7,14,16] However, a subset of patients fail to improve with conservative management alone for SIRVA and require surgical intervention. A review of SIRVA petitions to the National Vaccine Injury Compensation Program between 2010 and 2017 conducted by Hesse et al[11] found that one-third of patients (32.6%, 155 patients total) required surgical intervention.

A search of the current literature revealed only 2 case reports of SIRVA documenting surgical intervention and outcomes.[8,12] In both cases, the patients underwent arthroscopic bone and soft tissue débridement similar to our patient followed by postoperative physical therapy leading to full functional resolution of the affected shoulder. This is consistent with our patient's experience of significant improvement of symptoms almost immediately following surgery. In addition, our patient had the unique finding of hardened, chalklike flakes that represented reactive changes and fibrinoid necrosis that had not previously been described in the literature. It is likely that this was the resultant effect of inadvertent injection of influenza vaccine into the subacromial bursa. We recommend removal of these foreign bodies if surgery is performed.

Conclusion

SIRVA is an uncommon complication of deltoid vaccine administration that can present with symptoms and imaging that mimic other etiologies of shoulder dysfunction. Failed conservative management could be treated with arthroscopic shoulder debridement of inflamed soft tissue and bone, while obtaining cultures and pathology to rule out infection. In addition, we recommend postoperative physical therapy to achieve functional and symptomatic recovery.

Disclaimer

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