

Post –Vaccination Subacromial Sub Deltoid Bursitis

Sarah Ali Alanazi, MBBS* Abdulaziz Tamim Alzauri, MBBS* Muhammad Mansur Salem Bajri, MD**

ABSTRACT

Adverse reactions to vaccination injection sites are typically mild and transient, and post-vaccination musculoskeletal symptoms such as myalgia and arthralgia are common. Shoulder injury related to vaccine administration (SIRVA), defined as shoulder pain and limited range of motion following the administration of a vaccine intended for intramuscular administration in the upper arm, is a well-known but underreported condition in the medical literature.

Subacromial-subdeltoid bursitis may develop in such cases, resulting in shoulder dysfunction and ongoing pain. During the pandemic, millions of doses of COVID-19 vaccine have been administered to adults worldwide.

BACKGROUND

Subacromial bursitis is a common cause of shoulder pain. It is an inflammatory condition. It is usually caused by repetitive overhead activities and minor trauma, such as falls, but the etiology can be complex. The subacromial-subdeltoid bursa (SASD) is a potentially pain-sensitive structure of the glenohumeral joint¹. The subacromial bursa, also known as the subdeltoid bursa, is the largest bursa in the human body and is located at the shoulder between the acromion, deltoid, and rotator cuff tendons. The bursa is in a clinically relevant location and is linked to an increasing number of musculoskeletal surgeries due to its anatomical positioning. Shoulder pain is one of the most common musculoskeletal complaints, particularly in an aging society, but it also affects younger people, such as athletes. The acromion, coracoid, coracoacromial (CA) ligament, and proximal deltoid muscle fibers border the subacromial bursa superiorly, and supraspinatus muscle fibers border it inferiorly. The subacromial space is approximately 1.0 to 1.5 cm in height. Bursa inflammation can occur for a variety of reasons, leading to the development of subacromial bursitis²⁻⁶.

Adverse reactions to vaccination injection sites are common, and symptoms are usually mild and transient, with pain, swelling, and redness at the injection site being the most common clinical findings⁷. Bursae are synovial-line sacs that cover areas where structures rub against one another, causing friction. The SASD bursa, an extra-articular synovial space, is located between the rotator cuff tendons and the undersurface of the acromion, the acromioclavicular joint, and the deltoid muscle, and it lies overlying the bicipital groove. In pathological conditions, the bursa is seen as a fluid-filled anechoic structure lined by a hyperechoic wall⁸⁻¹⁰.

Normally, there is no communication between the bursa and the joint; communication is realized in full-thickness rotator cuff tears; the SASD bursa may or may not communicate with the subcoracoid bursa¹¹.

DEFINITIONS

A bursa is a sack of synovial fluid rich in protein and collagen that acts as a cushion to protect soft tissue from friction and excessive pressure. Our bodies contain over 150 bursae (plural for bursa), the majority of which are located in our joints¹¹.

Bursitis is defined as inflammation or irritation of the bursa sac. When the bursa swells, the sac itself can develop small tears, which can

cause tears in the surrounding soft tissue. In some cases, the inflamed bursa becomes infected with bacteria (referred to as septic bursitis), necessitating medical attention to clear the infection^{11,12}.

Around the rotator cuff, there are three major bursae. The supraspinatus tendon is protected by the subacromial bursa from the coracoid process and acromion. Between the coracoid process and the joint capsule is the subcoracoid bursa. The subdeltoid bursa cushions the deltoid muscle from the bones in the shoulder joint capsule. The bursa in the shoulder most commonly affected by bursitis is the subacromial bursa. It serves as a cushion, allowing the supraspinatus tendon to glide smoothly over the surrounding soft tissue and bone. Because of its proximity to the acromion and supraspinatus, the subacromial bursa is the most vulnerable to impingement or irritation¹³.

HISTORY

The clinical condition of sudden pain and stiffness of the shoulder in 1872 and named it "periarthritus humeroscapularis." EA Codman's book "The Shoulder," published in 1934, laid the groundwork for a significant understanding of the subacromial bursa and the pathogenesis of bursitis, the painful inflammation of the subacromial bursa that leads to swelling and restricted movement of the shoulder joint. Codman was the first to shed light on the role of rotator cuff tendons in subacromial bursitis pathogenesis. He found a link between rotator cuff tears and pathological changes in the subacromial bursa, such as calcified particles, villus formation, inflammation, fluid, bursal adhesion, and strap formation^{13,14}. The majority of the papers at the time described the subacromial bursa in a clinical setting with pain and restricted movement. The studies describe the possible pathogenesis of subacromial/subdeltoid bursitis with the appearance of calcified deposits in the tendon and bursa, as well as immune cell invasion, based on clinical and radiographic observations of painful shoulders¹⁵.

TYPES

Chronic: shoulder bursitis can be caused by repeated injuries or episodes of acute bursitis. It is the most common type of bursitis in the shoulder. You may experience periods of no symptoms followed by symptom flare-ups (return of symptoms) that last several months. This ongoing inflammation can cause arm and shoulder weakness over time. Many people learn to cope with pain (term accommodation). This may

* King Abdulaziz University
Jeddah, Saudi Arabia.

E-mail: Sara_alanzi@yahoo.com

** King Fahad Armed Forces Hospital
Saudi Arabia.

result in additional regional pain (think different area of the shoulder, neck or elbow pain)¹⁶.

Acute: This type appears suddenly, often as a result of an accident or injury. Pain is caused by touching or moving the shoulder.

Infectious (septic) shoulder bursitis is caused by bacterial infections such as staph infections in rare cases. The shoulder may be red or purple in color and warm to the touch. You may have a fever and feel ill in this rare case. You may experience severe shoulder pain.

PREVALENCE

Shoulder pain is a common complaint, with lifetime and point prevalence estimates as high as 26 and 67%, respectively. Shoulder pain is common: roughly half of the population in the United States experiences at least one episode of shoulder pains each year. Bursitis is responsible for about 0.4% of all primary care visits. Gender equality exists. It is more common in people who engage in repetitive overhead activities, such as athletes, factory workers, and manual laborers. Older people are more likely to develop subacromial bursitis, most likely due to years of wear resulting in increased subacromial impingement^{17,18}. Shoulder complaints can have a negative outcome, with only about half of all new episodes of shoulder complaints presenting in medical practice demonstrating complete recovery within 6 months. After one year, this proportion rises to 60%¹⁹.

SIRVA

When a healthcare professional injects a vaccine too high or too deep into the shoulder, SIRVA occurs. It is a preventable and underreported event. Shoulder injections should typically enter the deltoid muscle. An incorrectly administered shot, on the other hand, can graze bone or nerve. It may also puncture the bursa, a fluid-filled sac that protects the shoulder tendons. Shoulder injections should typically enter the deltoid muscle. An incorrectly administered shot, on the other hand, can graze bone or nerve. It may also puncture the bursa, a fluid-filled sac that protects the shoulder tendons²⁰.

Etiology

Bursitis can be caused by a variety of pathological conditions, including acromioclavicular joint disorders, supraspinatus tendon tears, acute shoulder trauma, rheumatoid arthritis, infection, and pigmented villonodular synovitis²¹. Any process that causes inflammation of the subacromial bursa can lead to bursitis. Common etiologies include: Subacromial impingement

- Repetitive overhead activities/overuse
- Direct trauma
- Crystal deposition
- Subacromial hemorrhage
- Infection
- Autoimmune diseases (e.g., rheumatoid arthritis)

Symptoms

The most common symptom is pain when lifting something overhead. The humerus head is compressing the swollen bursa against the glenohumeral joint and the underside of the acromion. However, if you experience pain when lifting over your head, it could indicate one or more soft tissue injuries in the shoulder. Subacromial bursitis is frequently diagnosed in conjunction with other rotator cuff issues or impingement syndrome.

Some symptoms are:

Pain when lifting overhead or other movements in the shoulder.

Noticeable **tenderness and /or heat** when the outer shoulder area and/or upper arm is touched.

Pain that makes it **difficult sleeping at night**, especially while lying on the affected shoulder.

Possibly a **fever** if you are suffering from **septic bursitis** (You will need to see a doctor for medication to get rid of the infection).

Direct pressure on the bursa will exacerbate the pain and **should be avoided** if possible.

Weakness and/or swelling in the shoulder and/or top of the arm can develop as the pain worsens and the inflammation in the area spreads^{21,22}.

Anatomy

The main bursa of the shoulder is the subacromial bursa (SAB). It promotes normal movement and is frequently involved in shoulder disorders. Subacromial (SAB) Subdeltoid (SDB) Subcoracoid (SCB) Coracobrachial (CBB) Subtendinous bursa of subscapularis are among the bursa found around the glenohumeral joint (SSB).

The SAB is the largest of these and, in fact, the body's largest bursa. Because the SAB and SDB are frequently co-functional, they are frequently grouped as one large bursa - the SASD bursa²³.

Prognosis

Subacromial bursitis has a favorable prognosis. The majority of patients improve with conservative therapy, while those who do not benefit from surgery. Age also plays a role, with older patients having poorer outcomes on average. In most cases, the condition is self-limiting and has no long-term impact on the patient's daily life.

Patients with shoulder pain who work frequently come into contact with a variety of healthcare providers. This guideline's recommendations from all disciplines provide treatment advice based on the best evidence available^{19,20}.

Some preferable practices for treatment are as follows:

A diagnosis of SAPS can only be made after a battery of tests, including the Hawkins-Kennedy test, the painful arc test, and the infraspinatus muscle strength test.

It is preferable to treat SAPS non-operatively.

For a maximum of 2 weeks, treat acute pain with advice, explanation, and possibly analgesics (NSAIDs).

If symptoms persist for more than 6 weeks, take steps in the workplace to prevent the development of a chronic syndrome.

Limiting imaging to conventional radiographic examination.

Ultrasound examination with suboptimal technique and experience.

ESWT in the acute phase, and in absence of tendinosis or bursitis calcarea.

Surgical treatment without exhaustive non-operative treatment²⁰⁻²³.

Complications

Subacromial bursitis is not associated with many complications on the spectrum of shoulder pathologies. Theoretically, repeated steroid injections pose the risk of introducing an infection into the skin or shoulder joint. Recurrent injections may also cause damage to the rotator cuff muscles. However, one study found no significant difference in the incidence of rotator cuff tears between patients who received fewer than three subacromial corticosteroid injections and those who received more than three^{23,24}.

Bursitis and pain: A direct relationship

The role of inflamed bursa tissue in shoulder pain is widely acknowledged. This is supported by the fact that the subacromial bursa contains free nerve endings and is innervated by several nerves, including the suprascapular and lateral pectoral nerves. As a result, neural structures are absent in the intima and are found primarily in the bursa's subintima, close to blood vessels.

Bursal inflammation, necrosis, hypertrophy, and oedema were found to be associated with pain in rotator cuff tear patients, lending credence to the subacromial bursa's role as a pain generator^{24,25}.

Vaccination and bursitis

Shoulder injury from vaccine administration (SIRVA) is a serious, though uncommon, complication of vaccination. According to the Vaccine Adverse Event Reporting System, 731 patients self-reported bursitis or bursa infection from vaccination between 1990 and 2020, a small number of cases given that over 155 million doses are administered in the United States each year.

In some cases, the effects can last months or even years. Patients with subdeltoid bursitis frequently complain of pain and decreased function in the affected arm. Medication, physical therapy, and, in some cases, surgery may be used to treat these patients. Some, but not all, of the treated cases result in a painless return of function^{26,27}.

There have been few reports of SIRVA with the COVID-19 vaccine. However, because the injury is frequently underreported, it is difficult to determine how common SIRVA with the COVID-19 vaccine is. SIRVA has been reported in several case studies in people who received a COVID-19 shot. In the past 2 years, much has been studied about the multi-systemic involvement of COVID-19. However, potential adverse effects related to global COVID-19 vaccination still need to be further explored²⁸.

Patient teaching

A common cause of shoulder pain is subacromial bursitis. It is caused by inflammation of the bursa, a sack of tissue located beneath the acromion process of the shoulder. It is typically caused by repetitive overhead activities or trauma. The condition can be resolved by avoiding such activities, resting, and taking NSAIDs orally. In severe cases, steroid injections and, in rare cases, surgery may be required^{27,28}.

METHODS

Search strategy, and quality of studies

A systematic literature search of PubMed and Embase (Elsevier) databases was performed on July 8, 2022, and updated on August 9, 2020, using the keywords "subacromial, sub deltoid bursitis, pain, shoulder pain prognosis of subacromial" Since the emerging need of the topic, search was also performed using the same keywords on Google Scholar, web of science to include the most recently published articles.

Data extraction

Studies related to the objective of the i.e. showing relevance to the title, etiology, prevalence, prognosis, impact of vaccination on shoulders were included in this review.

Quality of studies included

All studies and news related to our objectives published /unpublished were included in the study. The searches were restricted to English-

language literature. Additional studies were sought based on the reference lists of the articles chosen. To identify potential systematic reviews and randomized clinical trials, search filters were used.

RESULTS

The author followed PRISMA methods of screening of articles. reviewed 35 studies and unpublished data, after removing the duplicate information, those article which full length PDF was not available were excluded finally 24 studies included in this review.

IMPORTANT POINTS AND RECOMMENDATIONS

Subdeltoid bursitis, also known as subacromial bursitis, can occur when the vaccine is injected higher than three fingerbreadths below the acromion, or if the injection is too deep, going through the muscle and into the bursa. It is now recognized as a known but uncommon cause of vaccine-related morbidity. Bodor and Montalvo studied the position of the subdeltoid bursae in adults and discovered that it is 3-6 cm past the acromion and 0.8-1.6 cm deep. The Centers for Disease Control and Prevention developed guidelines for proper administration to ensure that the vaccine is injected into the muscle.

CONCLUSION

Subacromial bursitis is a relatively harmless condition that is simple to identify and treat. Although it is a common presentation in the orthopedist's office, patients may first present to a primary care clinic, sports clinic, or emergency department. Treatment can be delivered efficiently and effectively in this setting. The patient's primary care providers, including the orthopedic nurse, should educate him or her on how to avoid this pathology. However, it is critical not to overlook other pathologies that may coexist, such as tendon tears, because leaving these untreated will have a greater impact on the patient's arm function, daily activities, and thus quality of life. Vaccination in the upper third of the deltoid region can have long-term consequences that are unrelated to the specific vaccine administered. When administering shoulder intramuscular vaccinations, it is important to be aware of the possibility of inducing a prolonged immune-mediated inflammatory response if a vaccine antigen is injected into synovial tissue structures underlying the deltoid muscle. It is also important to be mindful of proper injection technique.

Authorship Contribution: All authors share equal effort contribution towards (1) substantial contributions to conception and design, acquisition, analysis and interpretation of data; (2) drafting the article and revising it critically for important intellectual content; and (3) final approval of the manuscript version to be published. Yes.

Potential Conflict of Interest: None

Competing Interest: None

Acceptance Date: 23 August 2022

REFERENCES

1. Bancsi A, Houle SKD, Grindrod KA. Shoulder injury related to vaccine administration and other injection site events. *Can Fam Physician* 2019;65(1):40-2.
2. Cook IF. Subdeltoid/subacromial bursitis associated with influenza vaccination. *Human Vaccin Immunother* 2014;10(3):605-6.
3. Vaccine Adverse Event Reporting System. Vaccine Adverse Event Reporting System. 2017.

4. Summary of the 2017-2018 Influenza Season. Centers for Disease Control and Prevention. 2019.
5. ACIP Vaccine Administration Guidelines for Immunization. 2001.
6. Cross GB, Moghaddas J, BATTERY J, et al. Don't aim too high: avoiding shoulder injury related to vaccine administration. *Aust Fam Physician* 2016;45(5):303-6.
7. Cook IF. Best vaccination practice and medically attended injection site events following deltoid intramuscular injection. *Hum Vaccin Immunother* 2015;11(5):1184-91.
8. Bodor M, Montalvo E. Vaccination-related shoulder dysfunction. *Vaccine* 2006;25(4):585-7.
9. Behrens RH, Patel V. Avoiding shoulder injury from intramuscular vaccines. *Lancet* 2021;397(10273):471.
10. Hesse EM, Navarro RA, Daley MF, et al. Risk for subdeltoid bursitis after influenza vaccination: a population-based cohort study. *Ann Intern Med* 2020;173(4):253-61.
11. Walker-Bone K, Palmer KT, Reading I, et al. Prevalence and impact of musculoskeletal disorders of the upper limb in the general population. *Arthritis Rheum* 2004;51(4):642-51.
12. Ritchie H, Ortiz-Ospina E, Beltekian D, et al. Our world in data: coronavirus (COVID-19) vaccinations. Accessed March 16th, 2021, 2021. Regulatory approval of COVID-19 Vaccine AstraZeneca 2020.
13. Relatório: bases técnicas para decisão do uso emergencial, em caráter experimental de vacinas contra a COVID 19. 2021.
14. Agency EM. COVID-19 vaccine AstraZeneca - product information as approved by the CHMP on 29 January 2021, pending endorsement by the European Commission. Accessed March 16th, 2021. https://www.ema.europa.eu/en/documents/product-information/covid-19-vaccine-astrazeneca-product-information-approved-chmp-29-january-2021-pending-endorsement_en.pdf
15. Bliddal H, Torp-Pedersen S, Falk-Riecke B, et al. Bursitis after vaccination in the shoulder region. *Ugeskr Laeger* 2017;179(43).
16. Dickens V, Williams JAB. Role of physiotherapy in the treatment of subacromial impingement syndrome: A prospective study. *Physiotherapy* 2005;91(3):159-64.
17. Diehl P, Gerdsmeyer L, Gollwitzer H, et al. Calcific tendinitis of the shoulder. *Orthopade* 2011;40(8):733-46.
18. Dinnes J, Loveman E, McIntyre L, et al. The effectiveness of diagnostic tests for the assessment of shoulder pain due to soft tissue disorders: A systematic review. *Health Technol Assess* 2003;7(29):1-166.
19. Donigan JA, Wolf BR. Arthroscopic subacromial decompression: Acromioplasty versus bursectomy alone--does it really matter? A systematic review. *Iowa Orthop J* 2011;31:121-6.
20. Dorrestijn O, Stevens M, Winters JC, et al. Conservative or surgical treatment for subacromial impingement syndrome? A systematic review. *J Shoulder Elbow Surg* 2009;18(4):652-60.
21. Institute of Medicine. Adverse effects of vaccines: evidence and causality. [Accessed June 3, 2019]. <http://www.nationalacademies.org/hmd/~media/Files/Report%20Files/2011/Adverse-Effects-of-Vaccines-Evidence-and-Causality/Vaccine-report-brief-FINAL.pdf>. Published August 2011.
22. Health Resources and Services Administration, Health and Human Services Administration. National vaccine injury compensation program: revisions to the vaccine injury table. [Accessed June 3, 2019]. <https://www.federalregister.gov/documents/2017/01/19/2017-00701/national-vaccine-injury-compensation-program-revisions-to-the-vaccine-injury-table>. Published January 19, 2017.
23. Arias LHM, Sanz Fadrique R, Sáinz Gil M, et al. Risk of bursitis and other injuries and dysfunctions of the shoulder following vaccinations. *Vaccine* 2017;35(37):487-96.
24. Centers for Disease Control and Prevention. Reports of shoulder dysfunction following inactivated influenza vaccine in the Vaccine Adverse Event Reporting System (VAERS), 2010-2016. [Accessed June 3, 2019]. Published January 4, 2018.
25. McGarvey MA, Hooper AC. The deltoid intramuscular injection site in the adult. Current practice among general practitioners and practice nurses. *Med J* 2005;98(4):105-7.
26. Cook IF. An evidence based protocol for the prevention of upper arm injury related to vaccine administration (UAIRVA) *Hum Vaccin* 2011;7(8):845-8.
27. Hochberg MC, Silman AJ, Smolen JS, et al. *Rheumatology*. 5th Ed. Philadelphia: Mosby Elsevier 2011;686.
28. Feng H, He Z, Twomey K, et al. Epigallocatechin-3-gallate suppresses pain-related and proinflammatory mediators in the subacromial bursa in rotator cuff tendinopathy. *Discov Med* 2019;27(147):63-77.