Journal of Chiropractic Medicine (2015) 14, 285–289

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JOURNAL of CHIROPRACTIC MEDICINE

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Onset of Frozen Shoulder Following Pneumococcal and Influenza Vaccinations

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Received 28 January 2015; received in revised form 10 May 2015; accepted 24 May 2015

Key indexing terms:
Bursitis;
Shoulder joint;
Influenza vaccine;
Pneumococcal vaccine;
Adverse effects

Abstract

Objective: Adhesive capsulitis has been suggested as an adverse effect of vaccine administration into the shoulder area. The purpose of this case series is to report 3 cases of acute onset of adhesive capsulitis following pneumococcal and influenza vaccines.

Clinical Features: Patients reported painful shoulder and limited motion following routine vaccination. After clinical examination, a diagnosis of adhesive capsulitis was noted.

Intervention and Outcome: All 3 patients were treated conservatively with physical therapy (active ranges of motion and active-assisted motion), nonsteroidal anti-inflammatory drugs, and activity modification with eventual resolution of symptoms.

Conclusion: Reports implicating vaccination with adhesive capsulitis are rare. This case series raises the awareness of pneumococcal and influenza vaccinations as possible causes of adhesive capsulitis that appear to respond to standard treatment. Although vaccines are of tremendous importance in the prevention of serious illness, we emphasize the importance of administering them at the appropriate depth and location for each patient.

Introduction

The pneumococcal and influenza vaccines are usually given as single injections for 70% of the US adult population.[1,2] They are frequently injected intramuscularly in the deltoid muscle.[1] There are guidelines set for the depth of the needle to be used. According to Current Centers for Disease Control and Prevention, a needle length ranging from 5/8 to 1 inch and 1 1½ inches is suitable for adult patients weighing <152 and >152 lb, respectively. These guidelines aim to allow the vaccine contents to reach the muscle but not the underlying shoulder tissues.[3] The side-effects of these vaccines commonly include allergic reactions, fever, local soreness, and/or rash.[1] This paper presents three cases of shoulder stiffness with limited range of motion (ROM) that arose one day after the vaccines were administered.

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http://dx.doi.org/10.1016/j.jcm.2015.05.005
1556-3707/

Case Reports

Case 1

A healthy 67-year-old man presented with non-dominant right shoulder and upper arm pain of 3 months duration. He reports having had a pneumococcal vaccine and experienced severe arm pain the following day with markedly decreased range of motion. He reported that his ability to perform overhead activities was severely compromised. He also described a sense of weakness in his arm. His efforts to restore arm mobility by means of stretching and usage of the arm were not successful. He is a golf player but denied any previous trauma, injury, or excessive use, and his medications included simvastatin, iron, and one adult aspirin daily.

He visited his family physician who noted he was incapable of elevating his arm past 90° and had positive signs of impingement. The rest of the motor and neurologic exam was negative so he was diagnosed with right shoulder impingement syndrome for which he was given a subacromial cortisone injection containing 2 mL of Kenalog 40 mg and 6 mL of bupivacaine 0.5%. The patient was instructed to ice the shoulder frequently. His range of motion improved, but the pain persisted over the following 5 to 6 days. It seemed to be deep-seated and localized to the deltoid muscle. A magnetic resonance imaging (MRI) of the right shoulder without contrast was then ordered, which revealed mild acromioclavicular (AC) joint arthropathy and rotator cuff tendinopathy. Subsequently, he was referred to an orthopedic surgeon.

Upon presenting to the senior author, the physical exam revealed that there was no atrophy around the shoulder girdle. Abduction was painful at 60° to 80°. His range of motion with forward flexion was good with 5/5 rotator cuff strength with Jobe test, belly press, and bear hug. He had a negative O'Brien test and a positive Hawkins test. Shoulder radiographs demonstrated some degenerative changes of the AC and glenohumeral joints, no proximal humeral head migration, and no calcifications or osseous abnormalities. He was prescribed 4 weeks of rehabilitation treatments to attempt to improve his range of motion and pain.

At his follow-up appointment one month later, physical examination revealed increased weakness in rotator cuff strength (4/5) with Jobe test; however, he was able to flex forward to 155° and externally rotate to 80°. The source of his pain was localized to the lateral deltoid region where he was injected with the vaccine. An MRI without contrast showed no rotator cuff tear. Six weeks later, it was noted that his shoulder mobility was improving but the pain continued to persist. He continued physical therapy for six more weeks along with non-steroidal anti-inflammatory drugs (NSAIDs). After 50 days, he regained full mobility with full range of motion and rotator cuff strength (5/5). He was pain free, and resumed playing golf with no further limitations 20 months post injection.

Case 2

A previously healthy 30 year-old man presented with non-dominant left shoulder pain of approximately two years duration. According to the patient, the pain apparently began soon after receiving an influenza vaccine. Initially, he had trouble sleeping and felt sharp pain in the posterior subacromial region whenever he brought his arm up behind his head and tried to relax his elbow back. This pain was accompanied with a decrease in his range of motion, but this did improve over a period of several months.

Upon presenting to the senior author, physical exam revealed good range of motion in forward flexion and abduction (150° and 160°, respectively) but limited internal rotation (45°) and external rotation (50°). He had a negative O'Brien test and mild to moderate pain with Hawkins maneuver. There was no pain with cross chest adduction or over the AC joint. He had 5/5 strength with Jobe test, resistive external rotation, belly-press, and bear-hug test. There was no atrophy around the deltoid or shoulder girdle, and there was no scapular winging. A radiograph of the shoulder showed that he had a type II acromion with no joint abnormalities, no proximal migration of the humeral head, and no gross bony abnormalities. Clinical work-up for infection was negative.

Because his pain and stiffness had been improving with time, it was decided that expectant management would be the course of action. The senior author recommended activity modification and NSAIDs along with rotator cuff strengthening program. He also recommended a cortisone injection (by a 1-in needle which was appropriate for his body weight) and symptomatic treatment with possible need for shoulder arthroscopy if no improvement was noticed. At this time, the patient has no limitations with his activities of daily living except for very low-grade pain with activity.

Case 3

A 69-year-old woman with a history of hypertension, chronic obstructive pulmonary disease, and arthritis presenting with non-dominant left shoulder pain and stiffness of 6 weeks' duration. She reports symptoms started as pain and swelling of the left shoulder the day she was vaccinated with the influenza vaccine. The following day symptoms progressed to stiffness and severe pain that affected her ability to use her left arm. She denies any history of trauma and her medications included omeprazole, paroxetine, lisinopril, and monteleukest.

Upon presenting to the senior author, the physical examination revealed no erythema, warmth, or atrophy on inspection. Abduction was painful at 80°. There was decreased active and passive forward flexion to 90° with signs of weakness of the rotator cuff strength (4/5) with Jobe test, belly press, and bear hug. She could not hold her arm up and her arm ended up collapsing when brought to 90° (Fig 1). Internal and external rotation were limited to 45° and 30° respectively. There was no AC joint or sternoclavicular joint pain.

Shoulder radiographs showed a well preserved glenohumeral joint with mild degenerative changes, no calcifications or osseous abnormalities, and no proximal head migration. Patient had been on NSAIDs and was advised to continue treatment. Rehabilitation therapy targeting active and active-assisted range of motion was recommended 2 to 3 times per week.

Fig 1. A classic sign of frozen shoulder; inability to raise the arm past 90°. (Color version of figure appears online.)

Discussion

Vaccination has been adopted as one way of prevention against vaccine-preventable diseases among the general population and specifically among the elderly due to immunosenescence, healthcare workers due to exposure, and other populations who are at risk.[4] Regardless of the efficacy of these vaccinations, it has been established that such vaccinations are associated with few side-effects, namely, local symptoms and other less frequent symptoms such as headache, fatigue, fever, malaise, and myalgia.[5] However, to the best of our knowledge, this report is among the few case reports that link vaccination to acute onset of shoulder stiffness. The key finding of these case reports was that they bring attention and awareness to the issue of the development of an adhesive capsulitis or acute onset of shoulder stiffness and pain following pneumococcal and influenza vaccines. Although these vaccinations are paramount in preventing vaccine preventable diseases, this report serves to increase awareness of a rare but possible side-effect of receiving them.

The term *frozen shoulder* was first described by Codman as "difficult to define, treat, and explain from the view of pathology".[6] Shoulder stiffness can be primary (idiopathic) or secondary. When a known precursor causes shoulder pain and ultimately global stiffness, it is termed as secondary. Rotator cuff lesions are one of the most common known causes of secondary stiffness. Other predisposing factors for both primary and secondary forms include age, diabetes, cardiac diseases, pulmonary disorders, neurological conditions, and trauma.[6] While different entities such as rotator cuff lesions, arthritis, and frozen shoulder can all present in a similar manner, with shoulder stiffness and pain, frozen shoulder can be distinguished by having no radiological abnormalities. In frozen shoulder, the joint spaces are normal but the shoulder motion is limited and painful because the joint capsule has become inflamed and contracted. Hence, the diagnosis of frozen shoulder (adhesive capsulitis) is made by the clinical presentation of shoulder stiffness and pain along with absence of radiological, laboratory, and history findings supporting other pathologies. Therefore, the diagnosis is one of exclusion.[7] Treatment of frozen shoulder is based upon the duration and severity. It can generally be treated by different modalities, ranging from supportive medical treatment to surgical intervention.[8] The decision of how to treat in the cases presented in this report included physical

therapy, pain control modalities, NSAIDs, and time. The combination proved to be successful in relieving the symptoms and limiting the progression of this condition. In other case reports, corticosteroids were considered for treatment. However, because steroid use may lead to soft tissue atrophy and osteolysis of the humeral head, imaging prior to usage was recommended to identify existing abnormalities.[9]

Since frozen shoulder is a diagnosis of exclusion, other diagnoses need to be ruled out. Rotator cuff tears were ruled out by negative MRI findings. The history and physical exam findings were not suggestive of tendonitis or bursitis either. Although Parsonage-Turner Syndrome could also be a reason of unilateral shoulder pain post-vaccination, the history and physical exam lacked signs and symptoms of neuralgias, sensory changes, atrophy, and arm weakness.[10] Additionally, as 2 out of 3 patients were elderly, age-related degenerative changes could have attributed to the pain and limitation of motion. However, given the acute onset of these changes and timely association with vaccination, age-related changes were unlikely to be the cause even with radiologic evidence of mild degenerative changes. Other differential diagnoses were ruled out similarly, either by history, physical exam, or imaging.

After having negative radiological findings and ruling out a number of other possible causes, it was concluded that the influenza or pneumococcal vaccinations led to the development of secondary shoulder stiffness as the patients reported that the pain started the day after they had the injections. The outcomes of these patients also suggest that frozen shoulder attributed to influenza and pneumococcal vaccinations can be managed with a combination of treatment modalities currently accepted for other causes of frozen shoulder, namely NSAIDs and physical therapy. For all 3 patients, the physical therapy was focused on pain control modalities and active/active-assisted ROM, mostly performed on a home program 3 to 5 times per day. These exercises consisted of using finger-to-wall climbing exercises, both front and sideways to improve forward flexion and abduction respectively, until symptoms subsided. Pendulum exercises and anterior/posterior capsular stretching were also included. Upon follow-up presentations, the patients were weaned away from supervised physical therapy and educated about a home program.

Similar cases have been reported previously, and the majority of these case reports suggest that the reason for frozen shoulder following vaccination was improper administration of the vaccine.[2,11,12] In addition to the pain and decreased range of motion, one case report revealed that the shoulder dysfunction was accompanied by osteolysis and surface chondrolysis that may require surgical intervention; this was also associated with incorrect placement of the injection.[13] In an attempt to support this hypothesis, Lippert studied the deltoid fat pads through MRI imaging and showed that 5/8-in-, 7/8-in-, and 1-in-long needles led to over-penetration in 11%, 55%, and 61% of the pediatric population studied, respectively.[9] Similar conclusions were drawn by Bodor and Montalvo who performed ultrasonographic measurements on 2 of their adult patients presenting with shoulder stiffness after vaccination.[9] Therefore, it is recommended that the whole upper extremity be exposed for proper landmark identification, 20- or 22-gauge needles of 1- to 1.5-in length be used, and injection be made at 90° angle.[14] The complications that arise from over-penetration could be attributed to the interaction of the injected antigens with preexisting antigens in the synovial spaces. Normally, with an injection into the deltoid muscle, the immune response to the vaccine antigens resolves in several days as the antigens are cleared from the soft tissue. When these contents reach the synovial space, however, the interaction between the antigens and antibodies in the synovial tissue can be prolonged, leading to a protracted immune response.[9] It is important to note, however, that the mere inflammatory response to the antigenic contents of the vaccine itself, regardless of the administrative technique can in itself be a cause of the pain.[15] Furthermore, the location of the vaccine administration could be related as an injection too high in the deltoid can result in shoulder stiffness post-vaccination.[15]

Limitations

Because of the rarity of vaccination induced adhesive capsulitis, it would be difficult to obtain a large sample of patients with this condition. Case reports cannot suggest cause and effect, thus it is not certain that the vaccinations were the cause of the adhesive capsulitis. No further radiologic studies or arthroscopy was undertaken to evaluate the soft tissue or chondral components of the affected shoulders. Therefore, although we know the location of penetration, we do not know precisely the depth of the administration in our cases and therefore cannot conclude definitively that the adhesive capsulitis in these patients stemmed from improper injection.

Nevertheless, the literature suggests that it may have been the cause.[2,11–13] Given that the majority of primary and secondary causes of frozen shoulder are unknown,[11] there could be a yet undiscovered underlying cause leading to the presentation of our patients. However, to the best of our knowledge, vaccination was the cause of shoulder stiffness in our cases. Even though the pneumococcal and influenza vaccinations may have their side-effects, the advantages of vaccination in decreasing mortality and morbidity are not debatable.[14,16–20] Therefore, we aim not at discouraging vaccination but rather at raising awareness of the fact that inappropriate vaccine administration may be a cause of frozen shoulder.

Conclusion

Frozen shoulder can be caused by known and unknown factors. Recently, intramuscular injections of influenza/pneumococcal vaccines have been shown be a potential but rare cause of frozen shoulder, and can be managed in the same way that other causes of frozen shoulder are managed. Although vaccines are of tremendous importance in the prevention of serious illness, we emphasize the importance of administering them at the appropriate depth and location for each patient.

Funding Sources and Conflicts of Interest

No funding sources or conflicts of interest were reported for this study.

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