CASE REPORT

Septic Shoulder Joint After Pneumococcal Vaccination Requiring Surgical Debridement

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Introduction

Inflammatory complications after routine vaccination, including pain, local erythema, and bursitis, have been reported. Several cases of bursitis after vaccination, most commonly with the pneumococcal and influenza vaccines, have been reported in the literature [1–8]. Many of these cases have been attributed to poor technique of the administrator or an inflammatory reaction when the vaccine is deposited in the subdeltoid space [1, 3, 7]. Many of these reactions are self-limiting and demonstrate good relief with subacromial corticosteroid injection [1–4, 7]. We report a case of a patient who rapidly developed a septic shoulder joint after pneumococcal vaccination in her right deltoid. This required prompt surgical shoulder arthrotomy, irrigation, and debridement.

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Case Report

The patient was a 90-year-old woman (4 ft, 10 in.; 47 kg; body mass index, 21.9 kg/m²) with a history of hypertension and asthma who presented with increasing right shoulder pain after receiving the pneumococcal polysaccharide vaccine (PPSV23) 1 week prior. The patient had received the injection by a nurse in her primary care physician's office. The patient had received the pneumococcal conjugate vaccine (PCV13) 5 years earlier with no complications. Within 24 h of receiving the PPSV23, she had increasing right shoulder pain and could not move her arm. This is a key point in the history: pain and restricted shoulder range of motion arising within hours of vaccination suggest inadvertent subacromial or intraarticular shoulder injection. Her family noted decreased appetite, decreased ambulation, and generalized weakness. This was a major change, as the patient had been walking, cooking, and cleaning independently, according to her children.

On admission, the patient appeared weak but was able to answer questions. Her oral temperature was 38.9°C and vital signs were stable. Her clinical examination was significant for severe right shoulder pain with passive forward elevation. The patient was unable to elevate her arm herself. Skin was intact, and moderate tenderness to palpation was noted over the anterior and lateral shoulder. There was no cellulitis. Neurologic status (including the axillary, radial, median, ulnar, anterior interosseous, posterior interosseous, and musculocutaneous nerve functions) was intact. Brachial and radial pulses were 2+. Her white blood cell (WBC) count was 11.5 with 85% neutrophils. Erythrocyte sedimentation rate (ESR) was 130 (normal, 0–25) and C-reactive protein (CRP) was 22 (normal, 0–0.5), both significantly elevated. Plain radiographs of the right shoulder were unremarkable.

Ultrasound examination of the right shoulder demonstrated a hypoechoic fluid collection anterior to the proximal humerus, measuring 2.2 × 0.6 × 1.8 cm, with peripheral vascularity, suggestive of abscess, hematoma, or encapsulated complex joint fluid. Magnetic resonance imaging (MRI) of the right shoulder demonstrated a large shoulder joint

Fig. 1. Pre-operative T2-weighted MRI sequences of the right shoulder joint. **a** Sagittal oblique cut demonstrating a large fluid collection anterior to the humeral head and neck (black arrow). **b** Coronal oblique cut demonstrating fluid within the glenohumeral joint and laterally beneath the lateral deltoid (black arrow).

effusion with a large component anterior to the right shoulder joint (Fig. 1a, b). These imaging studies, combined with the abnormal serology and clinical history and physical examination, supported a diagnosis of shoulder joint sepsis that would require surgical irrigation and debridement.

The patient underwent surgery in the beach chair position and under general anesthesia. The patient was given vancomycin 1 g. A deltopectoral approach was used to access the shoulder joint; mild induration at the injection site (anterior deltoid, Fig. 2a) was noted. A large loculated fluid collection was noted beneath the underlying clavipectoral fascia (Fig. 2b). The fascia was incised lateral to the conjoint tendon and copious purulent material was

evacuated from this area (Fig. 2c) and from the lateral subdeltoid region (Fig. 2d) and sent for microbiological analysis. The subscapularis was noted to be severely attenuated. The shoulder capsule was then incised to evacuate purulent fluid and fibrinous tissue from the joint. After thorough irrigation and debridement of the shoulder joint (Fig. 2e), the capsule was repaired and the wound closed in layers over a drain.

Pathologic analysis confirmed that the evacuated specimen was composed of purulent and fibrinous material. Bacterial cultures returned positive for methicillin-resistant *Staphylococcus aureus* (MRSA). The patient was given culture-specific antibiotics (vancomycin) for 6 weeks via a peripherally inserted central catheter (PICC) line. Over the next week, the patient's appetite and ambulatory function improved, and she was discharged to a rehabilitation facility on post-operative day 15. At 3 months post-operatively, the patient had discontinued all antibiotics for 6 weeks. She was in good spirits, had a good appetite, and was walking with a cane. She had no pain with active shoulder elevation or external rotation. Her serology at this time was normal (CRP, 0.4; ESR, 14).

Discussion

Several cases of shoulder dysfunction have been reported after routine vaccination in the deltoid. While most complaints involve short-lasting pain, mild erythema, and bursitis, more serious complications such as adhesive capsulitis, bone erosion, and osteonecrosis have been described [1–10]. These are primarily inflammatory complications, not

Fig. 2. **a** Pre-operative photograph demonstrating an area of induration corresponding to the vaccination site (black arrow). **b** Intra-operative photograph showing exposure of the shoulder beneath the deltopectoral interval, demonstrating a large loculated fluid collection deep to the clavipectoral fascia (white arrow). The black arrow denotes the coracoid process. The deltoid is being retracted laterally (left) and the pectoralis major is being retracted medially (right). **c** Incision of the clavipectoral fascia demonstrates the presence of purulent loculated material (white arrow). **d** Purulent loculated material was also seen in the lateral subdeltoid space (black arrow) beneath the retractor (left), which is retracting the deltoid muscle laterally. **e** The glenohumeral joint: the glenohumeral capsule and subscapularis musculature are retracted medially after arthrotomy and irrigation, exposing the lesser tuberosity of the humerus (white arrow) and the humeral head (black arrow).

infectious, and thus have been successfully managed with corticosteroid injection [1–3, 7].

Two case reports have described arthroscopic synovectomy for synovitis in the shoulder joint after pneumococcal and influenza vaccination, respectively; in both cases, there was no evidence of infection [5, 6]. The mechanism of shoulder injury was likely the injection of antigenic material into synovial tissues, resulting in an immune-mediated inflammatory reaction [1–3, 5, 8]. Sepsis of the shoulder joint is the most serious complication of routine shoulder vaccination because of the severity of the associated pain and shoulder dysfunction, as well as the risks of destruction of the shoulder joint and widespread sepsis [11–14].

Atanasoff and colleagues have reported on the largest series to date, of 13 patients who developed shoulder pain and dysfunction after vaccination [1]. Eight patients received the influenza vaccine, and four patients received a tetanus-containing vaccine. One received the human papillomavirus vaccine. Eleven patients (85%) had previously received the same vaccination without complications. All patients complained of shoulder pain, 93% within 24 h of vaccination. Six patients (46%) felt that the vaccine had been injected too high in the deltoid. MRI findings demonstrated fluid collections in the deep deltoid or overlying the rotator cuff tendons, bursitis, tendonitis, and rotator cuff tears. Treatment included corticosteroid injection in eight patients (62%) and surgical debridement in four patients (31%). No information was presented on the findings at surgery or any evidence of infection [1].

Based on prior ultrasound studies, the subdeltoid bursa extends 3 to 6 cm distal to the acromion and is approximately 0.8 to 1.6 cm deep to the skin surface [3]. Thus, injection into the upper third of the deltoid muscle can result in antigenic material being deposited into the subdeltoid bursa, causing an inflammatory and immune response. This inflammation can extend into the contiguous subacromial bursa, leading to shoulder capsule involvement [1, 3].

Shoulder joint infection may be avoided by proper injection technique. Seventy percent alcohol should be used to disinfect the skin prior to injection, which may have helped prevent MRSA contamination in this patient [12]. The proximal third of the deltoid should be avoided because of potential for subacromial bursal involvement. Anterior injection risks penetrating the glenohumeral joint [1, 7]. Based on the location of the induration in our patient, injection was likely too superior and anterior [13]. Thinner patients, such as our patient, have a higher risk of inadvertent bursal or joint penetration. To avoid this complication, it has been recommended that in adults weighing less than 60 kg, a 5/8-in (16-mm) needle should be used [15–17]. If there is significant shoulder pain and limited range of motion 24 h after injection, strong consideration should be given to immediate evaluation and possible debridement to identify and treat a septic joint before it can progress to joint destruction or systemic sepsis.

Compliance with Ethical Standards

Conflict of Interest: Michael J. DeRogatis, MS, Lalitha Parameswaran, MD, Patrick Lee, PA-C, Theodore G. Mayer, MD, and Paul S. Issack, MD, PhD, declare that they have no conflicts of interest.

Human/Animal Rights: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2013.

Informed Consent: Informed consent was obtained from the patient for being included in this case study.

Required Author Forms Disclosure forms provided by the authors are available with the online version of this article.

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