

CASE REPORTS

Vaccination induced rotator cuff tear: A case report

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Abstract

Intramuscular vaccinations are a necessary tool in the prevention of communicable disease in the public health realm. While commonplace, these vaccinations have the potential for adverse side effects and complications. While local skin reactions are the major cause of morbidity associated with immunizations, other more significant problems can arise. These problems can be secondary to the vaccine itself and/or the technique of administration. We present a rare and previously undescribed case of a vaccination induced rotator cuff tear occurring as the direct result of an inadvertent administration of a Tdap vaccine into the insertion of the infraspinatus and teres minor tendons on the posterior aspect of the greater tuberosity.

Keywords

Rotator Cuff Tear, Vaccination, Complication

1 Introduction

While some believe that naturally acquired immunity is the best way to develop protection from common and uncommon communicable diseases, this strategy runs the risk of severe disease and complications. Vaccinations help develop immunity for infectious disease by stimulating the body's natural defenses to produce antibodies to a particular pathogen. They may be live attenuated, inactivated, toxoid or subunit vaccines. Each type develops immunity differently, but almost all vaccines require multiple vaccinations to achieve acceptable levels of antibody required to fight infection. Vaccines, like any other medication, pose the potential for side effects and complications. The majority of vaccinations are administered during infancy and early childhood, but many require boosters during the course of a patient's life to maintain effective antigenicity and protection.

Pertussis, also known as whooping cough, requires a booster which is combined with vaccines for tetanus and diphtheria; commonly referred to as DTap for children or Tdap for adults and adolescents. Although adults do not often suffer from pertussis, they are the most common source of infection for infants. For this reason, vaccinating pregnant women with Tdap is especially important. Adults 19-64 years of age need one booster for pertussis, and adults 65 years and older need an additional booster if they plan on coming into close contact with infants younger than 12 months of age^[1].

The Tdap vaccination is administered as an intramuscular injection and contains additives including aluminum phosphate, formaldehyde, glutaraldehyde, and 2-phenoxyethanol. Common side effects following vaccination include but are not

limited to vomiting, redness or swelling, fever, fatigue, and poor appetite [2-4]. Less common and more severe side effects include seizures, serious allergic reactions, and shock [5-6]. To date there have been no reported musculoskeletal complications related to the administration of the TDaP vaccine. We present a rare case of a bursal-sided partial thickness tear of the infraspinatus tendon caused by an inadvertent intratendinous pertussis vaccination.

2 Case presentation

A thin, 60-year-old right-hand dominant female with no significant past medical history presented to the office with a chief complaint of left shoulder pain and limited active range of shoulder motion, 6 weeks following a Diphtheria, Tetanus and Pertussis (TDaP) booster vaccination. The patient had received the intramuscular vaccination in her left posterior deltoid by her primary care physician. She reported no previous history of left shoulder pain or functional limitation. Several days following the vaccination, the patient reported the atraumatic onset of significant left shoulder pain and inability to forward elevate her left upper extremity past 100 degrees or externally rotate past 30 degrees without pain. Despite use of nonsteroidal anti-inflammatory medication and ice, her symptoms did not improve.

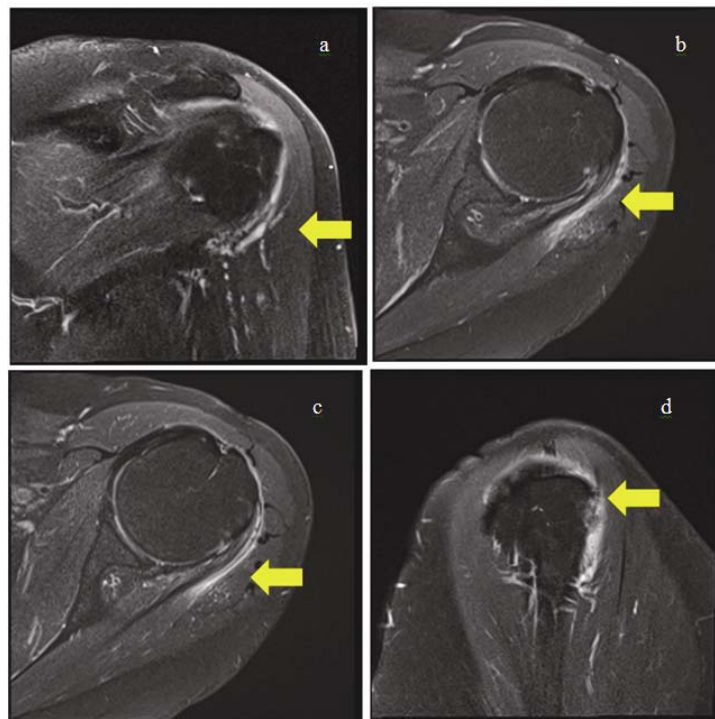


Figure 1. T2 weighted left shoulder MRI coronal image (a), axial images (b and c) and sagittal image (d) demonstrating the vaccination associated partial thickness tearing of the infraspinatus and teres minor tendons. The coronal image identifies the needle track (yellow arrow) directed to the posterior aspect of the greater tuberosity. The broad based partial thickness tear of the bursal surface of the infraspinatus and teres minor tendons are seen on the axial images and the sagittal image (yellow arrows) corresponding to a 40% rotator cuff injury

On physical examination, her left shoulder showed no evidence of atrophy or asymmetry compared to the contralateral side. She was nontender to palpation over her acromioclavicular or sternoclavicular joints. She was nontender over her bicipital groove. She was primarily tender to palpation over the posterolateral aspect of her humeral head in the region of the greater tuberosity. Her active range of motion was forward flexion to 170 degrees, abduction to 170 degrees, external rotation to 50 degrees and internal rotation to the T8 level, with pain present on forward elevation and external rotation. She had rotator cuff strength graded as 5/5 on manual testing, but had reproduction of her pain symptoms with resisted

infraspinatus testing. She had a moderately positive Hawkin's sign. She had an intact belly press and lift off exam indicative of intact subscapularis function. She was sensate to light touch in the left C5-T1 distribution and had 2+ radial pulses present. She had no cervical tenderness, had full, painless cervical ROM and a negative Spurlings test.

Imaging, including 3 plain radiographic views of her left shoulder, was obtained and demonstrated no evidence of pathology. An MRI of the left shoulder was then obtained (see Figure 1) which demonstrated a broad based bursal surface medium grade partial thickness tear of the infraspinatus tendon extending inferiorly to involve the superior portion of her teres minor tendon attachment with a distinct area of intrasubstance fluid filled delamination present. The tear measured 0.6 cm × 0.8 cm in dimension, comprising 40% of the tendon substance.

With the diagnosis of a vaccination induced partial thickness rotator cuff tear, the patient was started on a course of nonoperative management in the form of continued non-steroidal anti-inflammatory medication, a subacromial corticosteroid injection, and a physiotherapy regimen directed at rotator cuff stretching and strengthening.

The patient's activity related left shoulder pain persisted for a three month period at which time it resolved. She is currently back to her usual activities without pain or functional limitation.

3 Discussion

We believe this case is an example of an Arthus reaction following inadvertent Tdap injection into the substance of the infraspinatus and teres minor rotator cuff tendons. An Arthus reaction is a painful, local reaction that is characterized by reaction of previously residing antibodies (from a previous Tdap injection) to newly injected antigens [7]. In our case, this reaction occurred within the substance of the rotator cuff tendons due to over penetration of the vaccination needle through the deltoid to the depth of the greater tuberosity of the humerus.

Previously, when whole killed cells were used as part of the immunization, the pertussis vaccine was a common cause of severe post immunization reactions, the most serious being severe neurologic complications. This led to a decrease in the utilization of the vaccine and a subsequent rise in the disease worldwide. Since the mid 1990's an acellular pertussis vaccine has been used. The acellular vaccines used today are safer, provide good immunogenicity and a lower rate of local complications. A Cochrane database survey of 52 trials has demonstrated that the acellular variety of the pertussis vaccine is effective in preventing whooping cough while minimizing minor and severe complications associated with the vaccination [8].

Linkage of the current patient's rotator cuff tear to the various inactive ingredients in the vaccine is less likely than a local reaction to the immunization. Glutaraldehyde (GA) is known to enhance collagen crosslinking; this may lead to increased tensile strength of the collagen fibrils [9]. Formaldehyde has been shown to add to collagen's heat stability and ability to resist degradation by collagenase [10]. Thus these substances would be more likely to enhance the tendon than to damage it.

The vaccine location may have also played a role in this unique complication. Vaccine reactions are more common when administered in the arm compared to the leg and tend to occur in children after the 4th or 5th dose [3]. The most common symptoms following intramuscular vaccinations into the deltoid are erythema at the injection site and swelling in the extremity [2]. Ultrasound studies have demonstrated 111%-281% swelling of the subcutaneous soft tissues in the injected arm when compared to the contralateral arm. These findings demonstrate a significant inflammatory response following the injection of the Tdap vaccine [11].

The proper technique for injection of the Tdap vaccine depends upon the patient's age and size. In a female adult less than 130 pounds, a 0.5 ml intramuscular injection into the deltoid is recommended. A 23-25 gauge needle 5/8ths to 1 inch in length should be placed at 90 degrees to the shoulder with care taken to ensure that the vaccination contents are deposited

into the deltoid muscle belly^[12]. It is unclear from the patient history if these recommendations were followed. However, in this patient with a very small body habitus and small muscle mass, it seems very plausible that the vaccine was injected past the deltoid and into the substance of the rotator cuff tendons at their insertion onto the posterior aspect of the greater tuberosity of the humerus.

One limitation of the current case report is the possibility that this patient developed rotator cuff dysfunction spontaneously due to a prior event and that the injection was not responsible for the partial thickness, bursal-sided rotator cuff tear that lead to her symptomatic presentation. It is also possible that an Arthus reaction occurred at the site of pre-existing rotator cuff damage leading to dysfunction. However, given that the symptoms occurred chronologically with the injection, we find these unlikely. Furthermore, there is MRI evidence of the needle track and fluid present at the site of tear corroborating our hypothesis that her injury was an unintended complication of the vaccination.

In summary, we present the unusual complication of a vaccination-induced partial rotator cuff tear leading to a chronically painful shoulder. In very thin patients, administrators of vaccines should be very careful to stay intramuscular within the deltoid and avoid injecting the vaccine directly into the rotator cuff as this may lead to the consequences of an inflammatory reaction within the tendon leading to partial tearing.

References

- [1] Updated Recommendations for Use of Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccine (Tdap) in Pregnant Women and Persons Who Have or Anticipate Having Close Contact with an Infant Aged < 12 Months-Advisory Committee on Immunization Practices (ACIP), 2011.
- [2] Barbaud A, Deschildre A, Waton J, *et al.* Hypersensitivity and vaccines: an update. *European Journal of Dermatology: EJD.* 2013; 23(2): 135-41.
- [3] Jackson LA, Yu O, Nelson JC, *et al.* Injection site and risk of medically attended local reactions to acellular pertussis vaccine. *Pediatrics.* 2011; 127(3): e581-7. <http://dx.doi.org/10.1542/peds.2010-1886>
- [4] Principi N, Esposito S. Vaccines and febrile seizures. *Expert Review of Vaccines.* 2013; 12(8): 885-92. <http://dx.doi.org/10.1586/14760584.2013.814781>
- [5] Rowlands HE, Goldman AP, Harrington K, *et al.* Impact of rapid leukodepletion on the outcome of severe clinical pertussis in young infants. *Pediatrics.* 2010; 126(4): e816-27. <http://dx.doi.org/10.1542/peds.2009-2860>
- [6] Sokhey J. Adverse events following immunization: 1990. *Indian Pediatrics.* 1991; 28(6): 593-607.
- [7] Siegrist CA. Mechanisms Underlying Adverse Reactions to Vaccines. *Journal of Comparative Pathology.* 2007; 137: Supplement 1, S46-S50. <http://dx.doi.org/10.1016/j.jcpa.2007.04.012>
- [8] Zhang L, Prietsch SOM, Axelsson I, *et al.* Acellular vaccines for preventing whooping cough in children. *The Cochrane Database of Systematic Reviews.* 2014; 9: CD001478. <http://dx.doi.org/10.1002/14651858.CD001478.pub6>
- [9] Hansen P, Hassenkam T, Svensson RB, *et al.* Glutaraldehyde cross-linking of tendon-mechanical effects at the level of the tendon fascicle and fibril. *Connective Tissue Research.* 2009; 50(4): 211-22. <http://dx.doi.org/10.1080/03008200802610040>
- [10] Fathima NN, Madhan B, Rao JR, *et al.* Interaction of aldehydes with collagen: effect on thermal, enzymatic and conformational stability. *International Journal of Biological Macromolecules.* 2004; 34(4): 241-7. <http://dx.doi.org/10.1016/j.ijbiomac.2004.05.004>
- [11] Marshall HS, Gold MS, Gent R, *et al.* Ultrasound examination of extensive limb swelling reactions after diphtheria-tetanus-acellular pertussis or reduced-antigen content diphtheria-tetanus-acellular pertussis immunization in preschool-aged children. *Pediatrics.* 2006; 118(4): 1501-09. <http://dx.doi.org/10.1542/peds.2005-2890>
- [12] Diggle L. Effect of Needle Size on Immunogenicity and Reactogenicity of Vaccines in Infants: Randomised Controlled Trial. *BMJ: British Medical Journal. Immunization Action Coalition. Centers for Disease Control and Prevention.* 2014; 333.7568 (2006): 571-74.