Isolated Radial Nerve Palsy Secondary to Influenza Vaccination: A Case Report with Imaging Correlation

This report presents the first case of an injection injury to the radial nerve caused by inappropriately placed intramuscular Influenza vaccination, documented with advanced imaging.

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We present a case of an injection injury to the radial nerve caused by inappropriately placed intramuscular injection. This patient’s symptoms and corresponding images suggest the nerve palsy developed secondary to an inflammatory reaction induced by the injectate into the nerve sheath. This case report provides some understanding of the mechanism involved in injection injury to the radial nerve.

BACKGROUND

The Centers for Disease Control and Prevention (CDC) recommends vaccination against the Influenza virus for all health-care personnel. Vaccinations have been shown to protect health-care workers from viral infection and its comorbidities, while also decreasing mortality rates amongst hospital patients by reducing the rates of nosocomial infection. Many institutions now mandate that all hospital personnel be vaccinated. Complications are rare and often symptomatically negligible, making this a relatively uncontroversial health policy.

In adults older than 19 years of age, the recommended site for intramuscular injection is the deltoid muscle. Due to its abundant vascularity, this injection site optimizes the immunogenicity of the vaccine while also minimizing the adverse reactions at the injection site. Generally, the vaccination is well tolerated, and there are few side effects. The most common side effects include injection site soreness, redness, or swelling. Rarely, severe allergic reactions or autoimmune manifestations have been observed.

There are several reports of peripheral nerve injuries following intramuscular vaccine injection. The most recent of these come from countries with developing health care systems in which the staff were most likely improperly trained. We present an unusual case of a patient who suffered a radial nerve motor palsy secondary to inappropriate placement of the Influenza vaccination.

CASE REPORT

The patient is a 26-year-old male physician who presented to an outpatient hand surgery clinic with a chief complaint of left wrist drop. The patient indicated that he had received an Influenza vaccination into his left arm approximately one day prior to presentation. While the patient did not experience any paresthesias or other symptoms at the time...
of injection, 16 hours later the patient began to develop progressively worsening weakness over his distal left upper extremity. After 20 hours, the patient had total weakness in the affected muscles. The patient had no past medical history and the review of systems was unremarkable. Physical examination revealed a small puncture wound in the posterolateral portion of his mid-arm, approximately 2.5 cm distal to the clinically identifiable deltoid tuberosity. His motor exam demonstrated 4/5 strength in his triceps, 2/5 strength in his brachioradialis and 0/5 strength in wrist extension, finger extension and thumb extension. No sensory abnormalities were noted. The remainder of the neurovascular exam was within normal limits.

Magnetic resonance (MR) imaging of the left upper arm on the day after the injection, revealed edema along the course of the radial nerve without focal collection. The nerve itself was not grossly enlarged or damaged. (Figure 1) Ultrasound (US) examination of the patient’s arm on the day after the injection demonstrated swelling of the radial nerve in the distal third of the arm starting approximately 3 cm distal to the injection site. At the center of the swollen segment, an adhesive band was identified as compressing the nerve, likely an incidental finding since the band was not near the site of injection and the nerve was found to be swollen proximally and distally to the band. (Figure 2) Given the results of the MR and the US, the impression was that the nerve palsy was secondary to a demyelinating process related to inflammation around the nerve and not to axonal damage. A splint and a steroid taper were prescribed. Surgery in the form of a neurolysis was offered, but the patient elected nonoperative management.

One month following the injury, the patient underwent nerve conduction studies and electromyography (EMG) study to assess his peripheral nerve function. This study demonstrated a severe left radial neuropathy with total motor axonal loss with sparing of the radial sensory nerve. A follow-up US obtained at the same time revealed progression of the swelling of the radial nerve in both size and craniocaudal extent, with involvement of the posterior interosseous nerve and signs of supinator atrophy. This swelling and atrophy were absent on the US evaluation on the day after the injury. (Figure 3)
At approximately six months after the initial injury, the patient reported progressive improvement in his motor symptoms beginning with the brachioradialis and progressing inferriorly to his thumb extensor over time. At one year post injury, physical exam revealed 5/5 strength in his triceps, 5/5 strength in his brachioradialis, and 4/5 strength in wrist extension, finger extension and thumb extension. He reported minimal functional limitations and was able to resume work in full.

DISCUSSION
Significant peripheral nerve injuries may occur following improper administration of injected medications.5-8 A wide range of injury patterns and recovery has been reported.6 Whether an injection injury to a peripheral nerve is caused by direct injury to the nerve or secondary to chemical insult is unclear. Experimental studies have shown direct toxicity to peripheral nerves with intraneural injection.9 The imaging in this case suggests that his nerve injury was caused by injection of the vaccination into the nerve sheath and not the nerve itself. Specifically, the MR demonstrated edema along the course of the radial nerve without distinct injury to the nerve. Early US showed nerve response distal to the injection site. We hypothesize that the injectate dissected down the tissue planes along the radial nerve causing a chemical neuritis, leading to axonal ischemia and axon loss. The progressive development of symptoms over time supports the notion that the palsy developed secondary to an inflammatory process. Alternatively, it is also possible that the total axonal loss was due to ischemia from a chemical neuritis induced by the injectate.

We believe that the reason for the palsy was inappropriate location of the injection. The appropriate technique for deltoid intramuscular injection is as follows.10

- The entire upper extremity should be exposed in order to identify the landmarks. The center of an upside triangle is the target site. The acromion forms the base of the triangle, while the point of the triangle is located below the middle of the base at the level of the axilla.
- For adults, a 20- or 22-gauge needle that is 1 to 1.5 inches in length should be used.
- It should be injected at a 90 degree angle into the thickest portion of the deltoid muscle.
- A dose of no greater than 1cc should be administered. It is unclear whether early surgical intervention to debride the nerve sheath or observation is the preferred course of treatment. At the last office visit, one year after injury, the patient demonstrated near normal return of strength. The treatment strategy for nerve palsy remains controversial. Most radial nerve palsies are associated with humeral shaft fractures. In these injuries, the palsy is often secondary to a neuropraxia and the nerve often will undergo a complete recovery.11 In this case, as the inflammatory response waned, the nerve regenerated in the predicted proximal to distal fashion.

CONCLUSION
We present the first case of an injection injury to the radial nerve caused by inappropriately placed intramuscular Influenza vaccination with advanced imaging. The etiology of injury—direct trauma to the nerve versus indirect injury via an inflammatory process—remains unclear. Routine vaccination against the Influenza virus is warranted for healthcare personnel. With training in the appropriate administration of an intramuscular injection and a basic understanding of anatomy, iatrogenic injury to nearby peripheral nerves can be avoided. With the large number of vaccinations given annually, inadvertent injury may be inevitable.

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