Prevent shoulder injuries during intramuscular COVID-19 vaccinations

As our nation begins a large-scale coronavirus disease 2019 (COVID-19) immunization campaign barely a year since the deadly virus emerged in the US, it is critically important for healthcare workers who administer the vaccine to understand proper intramuscular (IM) administration technique in order to avoid a preventable and disabling occurrence called shoulder injury related to vaccine administration (SIRVA). This is especially important right now, as healthcare workers who may not normally administer vaccines may be called upon to help administer the new COVID-19 vaccines.

Case Report

A patient recently reported to ISMP that she went to her local community pharmacy to receive the 2020-2021 FLUBLOK QUADRIVALENT influenza vaccine as well as SHINGRIX (zoster vaccine recombinant, adjuvanted). When one of the vaccines was administered in her right arm, the patient experiencing severe pain, more than previous immunizations she had received. She also described feeling as if the needle had passed straight through her muscle. Later that evening, the pain in her right shoulder, where Shingrix had been administered, intensified. It wasn’t until she applied ice to her shoulder that she was finally able to fall asleep. The severe pain had mostly resolved by the next morning.

It has been two months since the patient received these two vaccinations, and she states her right shoulder has not returned to normal. For example, she is not able to reach for things or move her shoulder in certain ways without experiencing pain and discomfort. So, what could this be? SIRVA could be one explanation.

SIRVA

SIRVA is a shoulder injury triggered by the incorrect injection of a vaccine into the shoulder capsule (joint) rather than the deltoid muscle. It is caused by using an incorrect IM injection technique or improper landmarking of the IM injection site (the deltoid muscle) that results in the unintended injection of the vaccine (and/or trauma from the needle) into and around the underlying bursa of the shoulder. This results in an inflammatory process that causes injury to the musculoskeletal structures of the shoulder (e.g., tendons, ligaments, bursae).1-3

Symptoms of SIRVA include persistent shoulder pain, weakness, and limited range of motion that typically develop within hours to a few days after receiving a vaccine; these symptoms do not improve with over-the-counter analgesics. The resulting chronic shoulder pain and the inability to carry out daily activities that were possible prior to vaccination could be one explanation.

Such a rapid sequence of injections is unlike many other medications administered via IV push. This is due to the drug’s very short half-life (less than 10 seconds) and the need to carry the drug to the heart as quickly as possible before rapid metabolism inactivates it. Manufacturer syringe and vial labels mention that the drug is intended for rapid IV use; however, some practitioners may be unaware of this fact. We recently received a report in which adenosine injection was administered too slowly during an advanced cardiac life support (ACLS) event, resulting in a failure to convert the patient to normal sinus rhythm.

Retrieval of adenosine from an automated dispensing cabinet (ADC) is often accomplished via override (e.g., during a code), so many safeguards built into orders may not appear on the medication administration record (MAR). Thus, an auxiliary label affixed to adenosine, reminding staff to administer the drug via rapid IV push, may be an important reminder. Prescribers can also remind staff to give adenosine by rapid IV push when giving verbal orders during an emergency. Staff, especially those stationed in the emergency department or other locations, need to be aware of this fact. We recently received a report in which adenosine injection was administered too slowly during an advanced cardiac life support (ACLS) event, resulting in a failure to convert the patient to normal sinus rhythm.

It has been two months since the patient received these two vaccinations, and she states her right shoulder has not returned to normal. For example, she is not able to reach for things or move her shoulder in certain ways without experiencing pain and discomfort. So, what could this be? SIRVA could be one explanation.

SIRVA is a shoulder injury triggered by the incorrect injection of a vaccine into the shoulder capsule (joint) rather than the deltoid muscle. It is caused by using an incorrect IM injection technique or improper landmarking of the IM injection site (the deltoid muscle) that results in the unintended injection of the vaccine (and/or trauma from the needle) into and around the underlying bursa of the shoulder. This results in an inflammatory process that causes injury to the musculoskeletal structures of the shoulder (e.g., tendons, ligaments, bursae).1-3

Symptoms of SIRVA include persistent shoulder pain, weakness, and limited range of motion that typically develop within hours to a few days after receiving a vaccine; these symptoms do not improve with over-the-counter analgesics. The resulting chronic shoulder pain and the inability to carry out daily activities that were possible prior to vaccination could be one explanation.

Figure 1. Intramuscular injection site for children and adults. Give vaccine in the central and thickest portion of the deltoid muscle—above the level of the arm pit and approximately 2 to 3 finger widths (about 2 inches) below the acromion process. To avoid causing an injury, do not inject too high (near the acromion process) or too low. Adapted from www.ismp.org/ext/572 with thanks to the Immunization Action Coalition.

Adenosine injection is often administered too slowly during an advanced cardiac life support (ACLS) event, resulting in a failure to convert the patient to normal sinus rhythm.

Retrieval of adenosine from an automated dispensing cabinet (ADC) is often accomplished via override (e.g., during a code), so many safeguards built into orders may not appear on the medication administration record (MAR). Thus, an auxiliary label affixed to adenosine, reminding staff to administer the drug via rapid IV push, may be an important reminder. Prescribers can also remind staff to give adenosine by rapid IV push when giving verbal orders during an emergency. Staff, especially those stationed in the emergency department or other locations, need to be aware of this fact. We recently received a report in which adenosine injection was administered too slowly during an advanced cardiac life support (ACLS) event, resulting in a failure to convert the patient to normal sinus rhythm.

Retrieval of adenosine from an automated dispensing cabinet (ADC) is often accomplished via override (e.g., during a code), so many safeguards built into orders may not appear on the medication administration record (MAR). Thus, an auxiliary label affixed to adenosine, reminding staff to administer the drug via rapid IV push, may be an important reminder. Prescribers can also remind staff to give adenosine by rapid IV push when giving verbal orders during an emergency. Staff, especially those stationed in the emergency department or other locations, need to be aware of this fact. We recently received a report in which adenosine injection was administered too slowly during an advanced cardiac life support (ACLS) event, resulting in a failure to convert the patient to normal sinus rhythm.
often lead patients to seek medical intervention. Patients are often diagnosed with inflammatory shoulder injuries (e.g., bursitis, rotator cuff tears, frozen shoulder syndrome, adhesive capsulitis) that do not appear to be any different than routine shoulder injuries, except that the shoulder symptoms started within days of an IM deltoid vaccination.1

How to Prevent SIRVA

The key to avoiding SIRVA is to recognize the anatomical landmarks for identifying the deltoid muscle and to use proper IM administration technique. Proper landmarking of the deltoid muscle requires determining the upper and lower borders of a safe injection zone (Figure 1, page 1). First, the patient’s shoulder should be exposed completely. When a shirt cannot be removed, the sleeve should be rolled up or the arm removed from the sleeve rather than pulling the shirt’s neck down over the shoulder. To ensure the injection is given below the shoulder capsule, measure 2 to 3 finger widths from the acromion (bony prominence above the deltoid) to identify the upper border of the injection zone. The lower border can be marked by the armpit to ensure the injection is not inserted below the deltoid muscle. ‘Eyeballing’ the injection site is not acceptable. The thumb and forefinger can be used to make a V to outline the deltoid muscle and injection zone. The lower border can be marked by the armpit to ensure the injection is not inserted below the deltoid muscle. 

Multiple resources related to proper vaccination techniques are provided by the Centers for Disease Control and Prevention (CDC) and the Immunization Action Coalition (IAC). These resources have been compiled in articles by Deborah Wexler, MD, which can be found at: www.ismp.org/ext/613 and www.ismp.org/ext/614. Many of these resources, including videos, checklists, and e-learning with continuing education credit, have been recently updated and are applicable to the COVID-19 vaccination campaign. Additionally, the University of Waterloo School of Pharmacy in Ontario, Canada, offers a helpful infographic on proper landmarking to prevent SIRVA, which can be accessed at: www.ismp.org/ext/611.

References

what’s in a Name?
The “-conazole” drug stem name

Medications with the suffix “-conazole” belong to a class of antifungal agents called miconazole derivatives orazole antifungals. Although they may be further divided into subcategories based upon chemical structure, these agents all work by inhibiting enzymes that synthesize sterols, thereby altering the permeability of the fungal cell which leads to lysis and death of the fungus. There are six systemic “-conazole” drugs: ketoconazole, fluconazole, itraconazole, voriconazole, posaconazole, and isavuconazonium sulfate; two locally acting oral products; and numerous topical preparations (Table 1, page 3). Theazole antifungals have a broad spectrum of activity and are often used to treat a variety of Candida infections. A specific agent is selected based upon its niche spectrum to effectively treat the fungal infections.

The overall side effect profile for this class includes gastrointestinal disturbance, hepatotoxicity, and rash. In general, patients should be monitored for elevations in liver function

> SAFETY wires continued from page 1 responding to codes, must be aware of and educate others about the requirement for rapid injection at a site as proximal to the patient’s torso as possible, and that the medication must be rapidly flushed and cleared from any tubing. Adenosine for cardioversion is available as a 3 mg per mL solution in 6 mg (2 mL) and 12 mg (4 mL) single dose vials, and in 6 mg (2 mL) prefilled syringes. These should not be confused with adenosine 60 mg/20 mL vials, which are used as a stress agent as an adjunct to thallium-201 myocardial perfusion scintigraphy in patients unable to exercise adequately.

Expiration date or beyond-use date? A medication expiration date and a beyond-use date are two different things. An expiration date is the date at which the manufacturer no longer guarantees the stability, full potency, and safety of the medication as prepared by the manufacturer. The expiration date is determined by the manufacturer through testing and may be influenced by the presence of antioxidants, preservatives, or how the medication is packaged.

A beyond-use date is the last day that a medication can be safely used after it has been altered or manipulated for patient use. Examples of alterations include combining the medication with a diluent or another drug, adding the medication to an infusion bag, or even repackaging the medication outside of its original manufacturer’s container. If the medication is altered or manipulated in any way, the expiration date is no longer valid, and a beyond-use date is assigned based on the current literature, manufacturer recommendations, physical and chemical stability, and the risk of contamination. The beyond-use date is typically much shorter than the expiration date. Storing the altered or manipulated medication in the refrigerator or freezer may extend the beyond-use date, but not all medications can be refrigerated or frozen.

Any medication altered or manipulated by a nurse on the clinical unit should be administered immediately because the medication is typically altered or manipulated for patient use.

> SAFETY wires continued from page 1—what’s in a Name?
### Table 1: List of "-conazole" medications available in the US

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name(s)</th>
<th>Dosage Forms</th>
<th>Common Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>butoconazole</td>
<td>GYNAZOLE-1</td>
<td>Vaginal cream</td>
<td>Vulvovaginal candidiasis</td>
</tr>
<tr>
<td>clotrimazole</td>
<td>ALEVAZOL, DESENEX, GYNE-LOTRIMIN, and numerous others</td>
<td>Cream, oral suspension, ointment, external solution</td>
<td>Oropharyngeal candidiasis, cutaneous candidiasis, tinea versicolor, vulvovaginal candidiasis, tinea corporis (ringworm), tinea cruris (jock itch), tinea pedis (athlete’s foot)</td>
</tr>
<tr>
<td>econazole</td>
<td>ECONASIL, ECOZA, ZOLPAK</td>
<td>Cream, foam</td>
<td>Ringworm, jock itch, athlete’s foot, cutaneous candidiasis, tinea versicolor</td>
</tr>
<tr>
<td>efinaconazole</td>
<td>JUBLIA</td>
<td>External solution</td>
<td>Onychomycosis (nail fungus)</td>
</tr>
<tr>
<td>fluconazole</td>
<td>DIFLUCAN</td>
<td>Capsule</td>
<td>Candidiasis infections, cryptococcal meningitis, ringworm, jock itch, athlete’s foot, tinea versicolor</td>
</tr>
<tr>
<td>isavuconazonium sulfate (prodrug of isavuconazole)</td>
<td>CRESEMB</td>
<td>Capsule, injection</td>
<td>Aspergillosis, mucormycosis</td>
</tr>
<tr>
<td>itraconazole</td>
<td>SPORANOX, SPORANOX PULSEPAX, TOLSURA</td>
<td>Capsule, oral solution</td>
<td>Aspergillosis, blastomycosis, esophageal and oropharyngeal candidiasis, histoplasmosis, onychomycosis</td>
</tr>
<tr>
<td>ketoconazole</td>
<td>EXTINA, KETODAN, NIZORAL A-D, XOLEGEL</td>
<td>Tablet, cream, foam, gel, shampoo</td>
<td>Systemic fungal infections, cutaneous candidiasis, dermatitis, seborrheic dermatitis, ringworm, jock itch, athlete’s foot, tinea versicolor</td>
</tr>
<tr>
<td>luliconazole</td>
<td>LUZU</td>
<td>Cream</td>
<td>Ringworm, jock itch, and athlete’s foot</td>
</tr>
<tr>
<td>miconazole</td>
<td>DERMAFUNGAL, LORIMIN AF, MICANOZOLE, PODACTIN DESENEX JOCK ITCH, and numerous others</td>
<td>Ointment, aerosol powder, external powder, external solution, aerosol, vaginal suppository, vaginal cream, cream</td>
<td>Ringworm, jock itch, athlete’s foot, vulvovaginal candidiasis, and a variety of skin and mucous membrane fungal infections</td>
</tr>
<tr>
<td>oxiconazole</td>
<td>OXISTAT</td>
<td>Cream, lotion</td>
<td>Ringworm, jock itch, athlete’s foot, tinea versicolor</td>
</tr>
<tr>
<td>posaconazole</td>
<td>NOXAFIL</td>
<td>Tablet, oral suspension, injection</td>
<td>Aspergillosis, esophageal candidiasis, oropharyngeal candidiasis, prophylaxis in patients with hematologic malignancy or hematopoietic cell transplant recipient</td>
</tr>
<tr>
<td>sertaconazole</td>
<td>ERTACZO</td>
<td>Cream</td>
<td>Athlete’s foot</td>
</tr>
<tr>
<td>sulconazole</td>
<td>EXELDERM</td>
<td>Cream, external solution</td>
<td>Ringworm, jock itch, athlete’s foot, tinea versicolor</td>
</tr>
<tr>
<td>voriconazole</td>
<td>VFEND, VFEND IV</td>
<td>Tablet, oral suspension, injection</td>
<td>Aspergillosis; candidemia, including disseminated Candida infections; esophageal candidiasis; fusariosis and scedosporiosis (serious fungal infections); ocular endophthalmitis</td>
</tr>
</tbody>
</table>

**Paralyzing agent vial caps without warnings into 2022.** Due to an increase in demand to treat critically ill coronavirus disease 2019 (COVID-19) patients on ventilators, shortages of neuromuscular blocking agents began to appear in the middle of 2020. At the time, the US Food and Drug Administration (FDA) allowed temporary manufacturing of these drugs without the vial cap (seal) warning statement, “Paralyzing Agent,” as normally required by USP and FDA (Figure 1), since caps with the warning statement were not available to the manufacturers. The products affected include vecuronium bromide injection 10 and 20 mg vials from Fresenius Kabi, rocuronium bromide injection 50 mg vials from Athenex and Alvogen, and rocuronium bromide injection 100 mg vials from Alvogen.

While new vials once again have caps with warnings, vecuronium vials with the temporary caps might remain in distribution.

> SAFETY wires continued from page 2 (www.ismp.org/ext/617), any medication altered or manipulated by pharmacy staff prior to dispensing to a clinical unit should have a label on it with a beyond-use date. Please contact the pharmacy if an altered medication, such as an IV infusion, an oral suspension mixed with water, or a pharmacy-prepared syringe of medication is dispensed from the pharmacy without a beyond-use date or storage instructions, or if you are unsure if the medication has been altered. If you come across a medication with a past-due expiration date or beyond-use date, report it as a hazard and return it to the pharmacy for proper disposal.

---

**Figure 1.** Images of typical cap (left) and blank temporary cap (right) for vials of vecuronium bromide (top) and rocuronium bromide (bottom) injection.
tests and prolongation of the QT interval while on therapy. Of note, isavuconazonium sulfate is the only drug in this class which does not prolong the QT interval, and fluconazole is the only drug in this class that requires renal dose adjustment. Oral ketoconazole carries a Boxed Warning for hepatotoxicity. Also, patients taking voriconazole for ocular endophthalmitis must be monitored for visual disturbances.²

This class of medications has numerous drug interactions due to its mechanism of action of inhibiting enzymes also involved in drug metabolism. These drugs may increase the risk of bleeding in patients on anticoagulation therapy, including warfarin (COUMADIN), apixaban (ELIQUIS), and rivaroxaban (XARELTO). Patients concurrently taking some antiepileptic agents (i.e., phenytoin, carbamazepine) require close clinical monitoring for treatment efficacy because these drugs enhance the metabolism of azole antifungals. Itraconazole and ketoconazole require an acidic environment for absorption and should not be administered with proton pump inhibitors (e.g., omeprazole, pantoprazole) or histamine (H₂) receptor antagonists (e.g., famotidine). Azole antifungals should also be avoided during pregnancy.

The many topical preparations of the “-conazoles” are generally used to treat vaginal or epidermal candidiasis.² Several of these preparations can be obtained without a prescription. These drugs are listed in Table 1 (page 3) for reference.

References


Marvel’s newest Superheroes: NURSES

We cannot express enough gratitude to all of our frontline heroes, especially nurses, who have tirelessly, willingly, and relentlessly gone to work, day after day, trying to save lives during the coronavirus disease 2019 (COVID-19) pandemic. We are truly humbled.

But we are not alone! Allegheny Health Network (AHN), based in Pittsburgh, Pennsylvania, worked with Marvel Comics and the Doner advertising agency to produce “The Vitals: True Nurse Stories,” inspired by AHN nurses. The comic is available online (www.ismp.org/ext/623). About 200 copies were printed initially, but because of its popularity, another 50,000 copies will soon be printed! A video accompanying the comic’s release is also available (www.ismp.org/ext/624) and features the children of nurses getting their first look at the comic book. Get your tissues!

Marvel plans to create a series based on this premise, which is what they usually do with their comic books. It is anticipated that these comic books will be used in school programs to promote the nursing profession.

> SAFETY wires continued from page 3

of patients with COVID-19 experiencing delirium have been described. In a recent study of 54 patients with COVID-19 who were admitted to a medical ICU, 80% were noted to have delirium (1). Delirium is marked by changes in level of consciousness, mental status, and in some cases, hallucinations, behaviors, and perception. Delirium in ICU patients is independently associated with higher mortality and increased length of stay. Prevention of delirium in these patients is clearly important. A recent study (2) suggested that sedation practices in the ICU may be a significant contributor to delirium in COVID-19 patients. In this study, patients who received early sedation were significantly more likely to develop delirium over time than patients who received no sedation or sedation only as needed.

It is important for healthcare providers to understand that only imminent life-threatening adverse events are allowed to appear on vial caps or overseas. Therefore, nurses and others who handle or administer these drugs should be sure to pause to assure they understand the implications of the warning.

Staff awareness about the absence of the usual warning statement is critically important, as is safe handling and storage of the vials with their labels, not caps, facing up. Please communicate this information again to all relevant staff and implement the safety measures we previously recommended in our newsletter, such as asking pharmacy to affix auxiliary “Warning: Paralyzing Agent” labels to vial caps prior to storage in critical care units, the perioperative setting, or emergency departments.

To subscribe: www.ismp.org/node/138
ISMP Safe Medication Management Fellowships

ISMP is now accepting applications for three unique Fellowship programs commencing in 2021.

### ISMP Safe Medication Management Fellowship

**Location and Term:** This Fellowship commences July 2021. The Fellow will spend 12 months with ISMP, which is located in the suburbs of Philadelphia (Montgomery County), Pennsylvania. Relocation to the Philadelphia area will depend on the state of the COVID-19 pandemic.

**Description:** Now in its 29th year, this Fellowship offers a healthcare professional with at least 1 year of postgraduate experience in a healthcare setting an unparalleled opportunity to work collaboratively with the nation’s experts in medication safety to assess and develop interdisciplinary medication error-prevention strategies.

### FDA/ISM Safe Medication Management Fellowship

**Location and Term:** This Fellowship commences late summer/fall 2021. The Fellow will spend 6 months with ISMP, which is located in the suburbs of Philadelphia (Montgomery County), Pennsylvania, and 6 months with the US Food and Drug Administration (FDA), which is located in Silver Spring (near Washington, DC), Maryland. Relocation to these areas will depend on the state of the COVID-19 pandemic.

**Description:** This Fellowship, open to a healthcare professional with at least 1 year of postgraduate experience in a healthcare setting, is a joint effort between ISMP and FDA’s Center for Drug Evaluation and Research, Office of Surveillance and Epidemiology, Division of Medication Error Prevention and Analysis. The Fellowship allows the candidate to benefit from ISMP’s years of medication safety experience along with FDA’s valuable regulatory experience focused on medication error prevention.

### ISMP International Medication Safety Management Fellowship

**Location and Term:** This Fellowship commences July 2021. The Fellow will spend 12 months with ISMP, which is located in the suburbs of Philadelphia (Montgomery County), Pennsylvania. Relocation to the Philadelphia area will depend on the state of the COVID-19 pandemic.

**Description:** This Fellowship, open to a healthcare professional with at least 1 year of postgraduate experience in a healthcare setting, will help train a medication safety leader interested in seeking a long-term career at an international level. The Fellow will be involved in both US and international medication safety initiatives, helping to address medication safety issues on a national and global level.

Applicants for all three Fellowship programs must be legally eligible to work in the US and have excellent written and verbal communication skills. A competitive stipend is provided with all Fellowship programs.

**How to Apply**

For a complete description of candidate qualifications and the online application, visit: [www.ismp.org/profdevelopment/](http://www.ismp.org/profdevelopment/). For questions regarding the Fellowships or the application process, please contact ISMP at: [fellowship@ismp.org](mailto:fellowship@ismp.org) or 215-947-7797.

The application deadline for all three Fellowship programs is **March 31, 2021**.