

Shoulder injury related to vaccine administration and other injection site events

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Shoulder injury related to vaccine administration (SIRVA) is a preventable occurrence caused by the injection of a vaccine into the shoulder capsule rather than the deltoid muscle. As a result, inflammation of the shoulder structures causes patients to experience pain, a decreased range of motion, and a decreased quality of life. Physicians can mitigate SIRVA and other injection site events by refreshing their knowledge of and adopting proper landmarking and injection technique. Awareness is crucial to identifying patients who are displaying signs of this injury so they can access treatment in a timely manner.

What is SIRVA?

Shoulder injury related to vaccine administration is an under-reported, preventable series of events caused by incorrect technique or landmarking for intramuscular deltoid injections.^{1,2} Specifically, SIRVA occurs when an intramuscular deltoid injection is administered into the shoulder joint.^{1,2} This results in an inflammatory process that causes damage to the musculoskeletal structures including the bursae, tendons, and ligaments.² The main symptoms include persistent shoulder pain and a limited range of motion.² The keys to distinguishing SIRVA are that the symptoms typically begin within 48 hours of vaccine administration and that they do not improve with over-the-counter analgesic medications.² Patients will often visit their physicians months later because they are not able to carry out daily tasks that were possible before the vaccination.² These patients are often diagnosed with inflammatory injuries such as bursitis, rotator cuff tears, and adhesive capsulitis.^{1,2} During physical examination and on ultrasound scan, SIRVA will not appear to be any different from routine shoulder injuries. The only difference is that the shoulder symptoms will have started within days of a vaccination. Thus, *shoulder injury related to vaccine administration* is a term that describes improper landmarking of vaccinations that results in shoulder injuries such as adhesive capsulitis or bursitis. Treatment for SIRVA is the same as treatment for routine inflammatory injuries.^{1,2}

While the prevalence of SIRVA in Canada is unknown, as it is under-reported,¹ the global increase in case reports demonstrates that SIRVA is a developing topic. There is little information on the types of vaccines most likely to cause SIRVA, although case reports have been published on many different types of intramuscular vaccines. Primary care providers are well positioned to prevent injury through proper injection technique

and by recognizing, diagnosing, and offering treatment to patients with SIRVA. We developed an infographic (**Figure 1**), also available at **CFPlus**,* to guide all health professionals in proper injection administration and the prevention of SIRVA. To develop the infographic and accompanying article, we performed a literature search using terms related to SIRVA (*shoulder injury related to vaccine administration, incorrect vaccine administration, bursitis, and frozen shoulder*), its causes (*improper landmarking and incorrect deltoid injection*), and other injection site events (*radial nerve injury, axillary nerve injury, nodules, and cellulitis*) in the PubMed, EMBASE, and Google Scholar databases.

Other injection site events

Case reports that mention SIRVA also describe other shoulder injuries that can occur when landmarking is not performed correctly. Injections that occur below the deltoid muscle can hit the radial nerve and injections that are too far to the side of the deltoid muscle can hit the axillary nerve.^{3,4} If a nerve is hit, the patient will feel an immediate burning pain, which can result in paralysis or neuropathy that does not always resolve.^{3,4}

Landmarking to prevent SIRVA and other injection site events

Proper landmarking includes determining the injection zone of the deltoid muscle, including the upper and lower borders of a safe injection area.⁴ This technique has been developed and recommended by content experts in order to avoid injury to the surrounding structures of the deltoid muscle. The upper border is found by measuring 2 to 3 finger widths from the acromion to ensure injection below the shoulder capsule.⁴ Two fingers are recommended for those with thicker fingers, and 3 fingers for those with slender fingers.⁴ The lower border is marked by the armpit to ensure the injection is not inserted below the deltoid.⁴ The thumb and forefinger are used to make a V to outline the deltoid muscle and keep the injection zone visible before using the needle to inject at a 90° angle.⁴

If inserted outside the injection zone, the needle should be pulled out, a fresh needle tip should be applied, and landmarking should occur again before injection is re-attempted. If you suspect you injected into the shoulder capsule, the patient should be informed

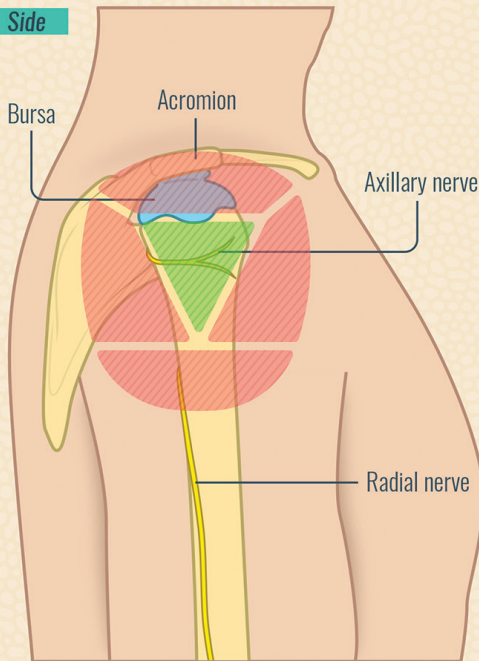
*The infographic (**Figure 1**) is available at www.cfp.ca. Go to the full text of the article online and click on the **CFPlus** tab.

Figure 1

SIRVA

Shoulder Injury Related to Vaccine Administration

Side



What to watch for when landmarking:

Too High*

*Most reported cause of injury

- Risk of injecting into shoulder joint or bursa
- Can cause inflammation leading to bursitis, frozen shoulder syndrome, and other complications
- Watch for prolonged shoulder pain, weakness, and decreased range of motion
- Symptoms begin within hours to days
- Without treatment, symptoms last months and may never resolve

Too Far to Side

- Can inject into axillary nerve

Too Low

- Can inject into radial nerve

- Can cause paralysis and/or neuropathy
- Watch for burning, shooting pain during injection
- Symptoms start immediately

What happens when:

Needle Too Short

Can inject into subcutaneous tissue

- More painful for patient
- Risk of skin reaction
- Vaccine may be less effective

Needle Too Long

Can hit bone or nerve

- If you hit bone, pull needle **back slightly** and inject
- If you hit nerve, pull needle out and try again

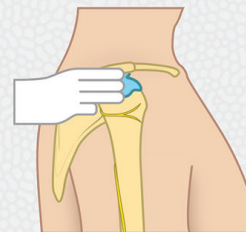
Tips to Avoid SIRVA

Landmark, don't "eyeball"

Always sit to inject a seated patient

Expose the shoulder completely

When a shirt can't be removed, roll the sleeve up, don't pull the shirt's neck over the shoulder



Remember!

2-3 fingers down from the acromion

¹Atanasoff S, Ryan T, Lightfoot R, Johann-Liang R. Vaccine 2010;28(51):8049-52. doi: 10.1016/j.vaccine.2010.10.005. Epub 2010 Oct 16.

²Barnes MG, Ledford C, Hogan K. J Am Board Fam Med 2012; 25(6):919-22. doi: 10.3122/jabfm.2012.06.110334.

³Cook IF. Hum Vaccin 2011; 7(8):845-8. doi: 10.4161/hv.7.8.16271. Epub 2011 Aug 1.

⁴Cook IF. Hum Vaccin Immunother 2015; 11(5):1184-91. doi: 10.1080/21645515.2015.1017694.

⁵Cross GB, Moghaddas J, Buttery J, Ayoub S, Korman TM. Aust Fam Physician 2016; 45(5):303-6.

⁶Davidson LT, Carter GT, Kilmer DD, Han JJ. Am J Phys Med Rehabil 2007; 86(6):507-11.

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about SIRVA and its symptoms.² The patient should monitor for increasing pain and a decreased range of motion that develops during the next 48 hours and does not subside.^{1,2} If a patient reports symptoms of SIRVA, imaging should occur to determine the level and type of damage.² A trial of nonsteroidal anti-inflammatory drugs should be started and, if ineffective, corticosteroid injections into the shoulder with physiotherapy might prove helpful to recovery.²

Importance of needle length

Needle length should be chosen based on the body habitus and weight of the patient.⁵ A needle that is too long can penetrate the deltoid muscle, hitting the bone.⁴ Although patients will not feel their bones being hit, the vaccine might not fully absorb into the muscle, leading to a reduced immune response.⁴ Furthermore, if the needle is too short the vaccine might be administered subcutaneously, which might result in decreased immune response and the development of nodules or cellulitis.⁴ The efficacy of vaccines administered outside the proper injection site is not guaranteed or quantified. In particular, a 16-mm (5/8-inch) needle should be chosen for patients weighing less than 60 kg (130 lb) and a 25-mm (1-inch) needle is appropriate for patients weighing 60 to 70 kg (130 to 152 lb).⁵ Women weighing 70 to 90 kg (152 to 200 lb) or men weighing 70 to 118 kg (152 to 260 lb) should receive injections with either a 25-mm (1-inch) or 38-mm (1.5-inch) needle.⁵ A 38-mm (1.5-inch) needle is necessary for women weighing more than 90 kg (200 lb) and men weighing more than 118 kg (260 lb).⁵

All health care professionals who provide injections should make individualized needle length selection part of their injection administration routine.

Conclusion

The key to preventing SIRVA and other vaccine injuries is to always use landmarking. The next time you give a vaccine to a patient, pay attention to your technique. Even the most experienced health care professionals can develop bad habits and need to polish their skills periodically. 

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Competing interests

None declared

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