



A sure shot

Angela Cocoman and Carol Barron outline best practice for administering injections into the deltoid muscle

THE aim of this article is to highlight to practitioners of the possibility of injury due to poor landmarking of intramuscular injections into the deltoid muscle. Approximately 12 billion injections are administered worldwide annually,¹ the majority being vaccines that are licenced for administration into the anterolateral vastus lateralis muscle for babies/children^{2,3} or deltoid muscle for adolescents/adults.^{4,5}

Administering a vaccine by the recommended route is imperative; deviation might reduce vaccine efficacy, increase

the risk of local reactions or even cause permanent injury. Although vaccines are considered routine procedures, there is a risk of trauma and injury if they are performed incorrectly. The case report below is intended to raise awareness of the importance of accurate landmarking and the potential risks associated with deltoid injections. It reviews the anatomy of the deltoid muscle and suggests best practice to minimize trauma and potential injury to patients.

Case report

This is a report of a 12-year-old first-year

secondary school male (in the autumn of 2012), who received an intramuscular deltoid injection. The injection was the routine administration of the Tdap vaccine in his school, with parental consent. This vaccine is recommended for children between the ages of 13 and 18 and is a low dose tetanus, diphtheria and pertussis 'booster' vaccine, which was introduced to the Irish schools immunisation programme on a phased basis from September 2011. From September 2012 this vaccine is offered to all students in first year of second level schools and replaces the previous school-based vaccine, called Td, which was a booster vaccine topping up protection against tetanus (T) and diphtheria (d).

Figure 1 shows the 12-year-old boy's forearm three days after he received the booster Tdap/IPV vaccination. It is evident from the picture that the boy did not receive a true deltoid injection. Observe his right arm which is badly swollen just above the elbow. Accurate landmarking of an injection site is essential in preventing such errors occurring. Neurological consequences of this error can range from minor transient sensory disturbance (dull pain) to severe sensory disturbance and paralysis which can lead to poor recovery.⁶ The most common causes of injection nerve palsy is faulty technique during administration.

Reported injuries associated with intramuscular injection sites used for intramuscular injections include:

- Permanent damage to radial and axially nerves resulting in paralysis/ neuropathy
- Persistent nodules – granulomas, muscle contractures and/or palsy
- Peripheral nerve and bone injury
- Local irritation, pain local discomfort and redness at the site
- Infection, abscess, cellulitis and tissue necrosis
- Haematomas, bleeding, arterial punctures and, in rare cases, gangrene
- Muscle fibrosis.⁷⁻⁹

Anatomy and landmarking of the deltoid muscle

The deltoid muscle was named after the Greek letter Delta (Δ) due to the similar shape they share. This muscle is constructed with three main sets of muscle fibres: anterior, middle and posterior. These fibres are connected by a very thick tendon and are anchored into a v-shaped channel housed in the shaft of

the humerus bone in the arm.

Davidson et al⁶ describe the deltoid as a triangular muscle that originates from the lateral one third of the clavicle, the acromion and the scapular spine, and converges into the deltoid tuberosity near the middle of the humerus. The site should be selected, below the bony landmark of the acromion process or midway between the acromion process and deltoid insertion (see Figure 2).

To accurately landmark this site, practitioners need to fully expose the shoulder area, simply rolling up a sleeve of a shirt or jumper does not allow for an accurate view of the deltoid region for landmarking and may form a tourniquet and constrict blood supply. Once the shoulder region is fully exposed the practitioner must measure one to two finger-widths below the acromion process – a bony process on the scapula (shoulder blade). Then, find the bottom border of the injection site by drawing an imaginary line across the arm from the crease of the axilla in front, to the crease of the armpit in back.

The middle point of this triangle is the mid deltoid, where you will inject the medication. The injection should never be given at or below the level of the axilla⁹ as has happened in the case of the 12-year-old boy which was earlier reported.

Best practice on administration

Intramuscular injections are common procedures, yet unexpected complications and errors occur due to inaccurate landmarking. Professional errors and negligence affects nearly every sector of health care, for this reason ongoing professional development and evidence-based education is essential.

The deltoid site should be used only for the administration of small volume non-irritating medication such as vaccines, analgesics, antiemetics, antibiotics and antipsychotics.⁹ Various authors²⁻⁴ describe the administration of deltoid injections. While several vaccines may come pre-packed with syringes and needles attached, it is important to note that when injecting males and females weighing less than 60kg a 25 gauge 5/8, one inch (25mm) needle is sufficient to ensure intramuscular injection.

For females weighing 60-90kg and males weighing 60-118kg, a 25 gauge or 23 gauge 1-1½-inch (25-40mm) needle is needed. For females weighing more than 90 kg or males weighing more than 118kg,

a 23 gauge 1½-inch (40mm) needle is required.¹⁰

To avoid injecting into subcutaneous tissue in adolescent and adults, it is necessary to spread the skin of the selected vaccine site taut between the thumb and forefinger in order to isolate the muscle.¹¹ For children and/or emaciated elderly patients, it may be necessary to grasp the tissue and 'bunch up' the muscle.³

The needle should be inserted fully into the muscle at a 90° angle and the vaccine injected into the muscle tissue (at a rate of 1ml per 10 seconds). When the needle is withdrawn, light pressure should be applied to the injection site for several seconds with a dry cotton ball or gauze.

When administering multiple vaccinations, practitioners are advised to never mix vaccines in the same syringe unless approved by the vaccine manufacturer. When more than one vaccine needs to be administered the injection sites should be separated by one to two inches so that any local reactions can be differentiated.

When administering two vaccines into the same muscle one should not exceed suggested volume ranges for the deltoid muscle in any age group and the location of each injection should be documented in the patient's medical record.¹

The purpose of this brief report is to make practitioners aware of the potential for injury with vaccine administration into the deltoid muscle, due to poor landmarking. Sufficient anatomical knowledge and the user of evidence based techniques to accurately landmark the injection site, in combination with the selection of appropriate needles may help to minimise trauma and injury and thereby reduce patient discomfort, improve vaccination tolerability and acceptance, maximise patient safety and ensure injection efficacy.

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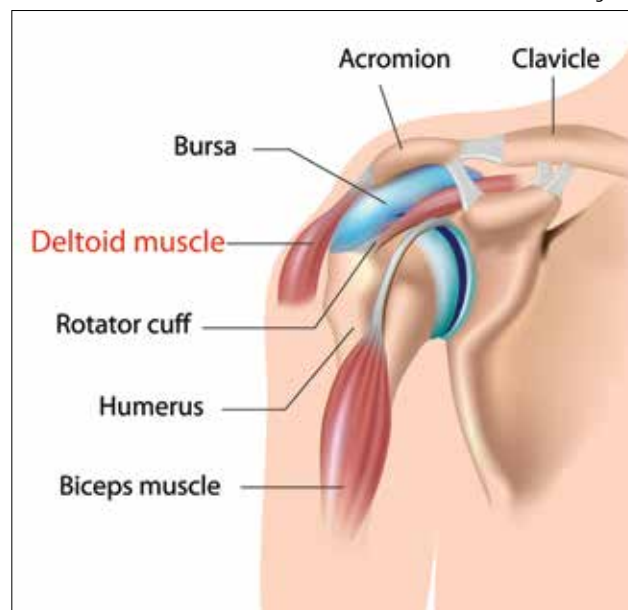
Acknowledgements

We wish to thank the parents of the 12-year-old boy docu-

Figure 1



Figure 2



mented in this case study who has made a full medical recovery and granted permission for this case to be reported. Their son's anonymity and confidentiality will be protected.

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