

Position Statement on Injection Technique

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Royal College of Paediatrics
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The administration of a vaccine should ensure the attainment of maximum immunity, with the least possible harm. This will depend on the type of vaccine, the recipient, correct storage of the vaccine and the administration technique. Severe local reactions to injections do occur, albeit rarely. Subcutaneous atrophy¹, abscesses², hyperpigmentation³, subcutaneous nodules⁴, muscle contracture and fibrosis⁵, and nerve palsies have all been described. It is important to reduce, as far as possible, the risks of these occurring. Unfortunately there is a very poor evidence base from which to make recommendations on injection technique. What follows is based on the information that is available.

Site of Injection

It is recommended that all the injectable routine childhood vaccines (except BCG), should be administered by the deep subcutaneous or intramuscular routes^{6,7}. There are three possible sites – the deltoid, the anterolateral thigh, and the buttock. Writing in 1920, Grey Turner⁸ argued strongly for using the outer side of the thigh for intramuscular injections, pointing out the theoretical dangers of use of the buttock. Although there is an extensive literature on local damage to the sciatic nerve following injections into the buttock⁹⁻¹¹, one of the earliest reviews of peripheral nerve palsies following injections relates to peripheral nerve palsies not necessarily at the site of injection¹². Many of these affected the upper limb. However most reports are of sciatic nerve injury. It is not clear whether this occurs with current vaccines. Thompson¹³ has argued very strongly that this does not occur with modern medications, especially vaccines. Piggot¹⁴, on the other hand has first hand experience of sciatic nerve damage in infants after intramuscular injections, though none were vaccines. In 1994, MacDonald and Marcuse^{15,16} requested case reports of any cases of sciatic nerve injury occurring as a result of injections of vaccines into the buttocks of an infant. 18 months later they wrote that they had only received one report of ‘a two year-old boy with sciatic and peroneal nerve injury temporally associated with hepatitis B vaccine administered in the thigh or buttock (the site was uncertain)’¹⁷.

Muscle fibrosis and contracture has been reported after injection in the buttock¹⁸, thigh¹⁹ and triceps²⁰. Unfortunately, it is not possible to estimate the incidence of this adverse effect as, in none of the papers is an indication given of the total population receiving injections. Much less is it possible to calculate this specifically for vaccination, but it would appear to be rare.

Another factor to be considered is whether the vaccine is equally effective when given at different sites. The antibody response to rabies²¹ and hepatitis B²² vaccines has been shown to be lower when the injection is given in the buttock rather than the deltoid. It is likely that this is due to the injection being subcutaneous in the buttock and intramuscular in the deltoid. Fessard and colleagues²³ have shown that hepatitis B vaccine given intramuscularly in the deltoid produces higher levels of antibody than when given subcutaneously in the suprascapular region. Shaw and colleagues²² showed that when giving hepatitis B vaccine in the buttock, a longer needle (2” as opposed to 1”) produced a better response, thus supporting this hypothesis.

There is little research which compares more minor local reactions, such as tenderness, redness and swelling, and systemic reactions when vaccines are given at different sites. Baraff and colleagues²⁴ compared the incidence of adverse reactions in infants after DTP immunisation given in the buttock, anterior midthigh and upper lateral thigh. They found that while swelling, pain and fever were less common following immunisation in the buttock than in the midanterior thigh, drowsiness and persistent crying were more common. Ipp *et al.*²⁵ examined the incidence of systemic effects, such as fever, drowsiness, crying and anorexia, and local reactions after vaccination in the deltoid or thigh. The children were all about 18 months old. Parents were more likely to rate reactions as moderate or severe when the injections were given in the thigh.

Because of this, most official bodies^{6,7,26} recommend that the buttocks should be avoided for intramuscular injections and only used if a large volume immunisation, i.e. immunoglobulin, is to be given. In

this case the upper outer quadrant of the buttock should be used and the needle directed anteriorly. Bergeson and colleagues²⁷ have described the exact technique which should be followed.

Needle Size and Length

There are few data on this. As noted above, there is some evidence to suggest that intramuscular injections may be more effective than subcutaneous injections for some vaccines. Groswasser *et al*²⁸ showed that if an injection is given perpendicular to the skin of the thigh, using a 5/8" needle, the vaccine should enter the muscle. If, on the other hand, tissues are bunched up before injection, this size needle would deliver the vaccine into the subcutaneous tissues and a 1" needle would be more appropriate if this technique is to be used. Diggle²⁹ has correctly pointed out that the weight of most of these infants fell between the 10th and 50th centiles, so the results may not be applicable to the whole population. Ipp *et al*²⁵ found that there was very little difference in local or systemic reactions between a group of children receiving DTP vaccine in the thigh using a 1" needle compared with another group where a 5/8" needle was used. The only differences reaching statistical significance were in the frequencies of redness and swelling which were commoner in those where the shorter needle was used (40.6% v. 13.4% and 32.8% v. 13.4% respectively). Diggle³⁰ examined the incidence of local reactions following DTP-Hib immunisation at 4 months of age. She found that redness and swelling were less common when a 1" 23 gauge needle was used as compared with the incidence after the use of a 5/8" 25 gauge needle. There was no significant difference in tenderness, which is arguably the most important local adverse effect for the infant or mother. There would seem to be insufficient evidence to advise any recommendation to change current practice.

Skin Cleansing

Bacterial or sterile abscesses have been said to occur at a frequency of 6 to 10 per million injections of DTP³¹. Between July 1963 and January 1990, there were 49 reports to the Committee on Safety of Medicines (CSM) of injection site abscesses following DT and DTP vaccines. It is difficult to translate this figure into a precise frequency, but a reasonable estimate is of the order of 1 abscess per one or two million injections. This is undoubtedly an underestimate.

Sterile abscesses

The aetiology of sterile abscesses at injection sites is poorly understood and there is little evidence that injection technique has any part to play. Sako³² stated that in their study, the deeper the injection, the less likely was abscess formation.

Infected abscesses

The organisms usually responsible for causing infected abscesses at injection sites are *Staphylococcus aureus* and haemolytic *Streptococcus pyogenes*, though mycobacteria have occasionally been implicated³³. *Staphylococcus aureus* is found on the skin of the forehead of 39% of children and 15% of adults³⁴. It is common in children's nostrils (65%), but less so than in adults (43%)³⁵. It is not commonly found at other sites. These organisms are pathogenic (disease producing), but the need for attempting to remove them from the skin before injections has been debated. Dann³⁶ has suggested that 'routine skin preparation before injection is quite unnecessary' and Koivisto and Felig³⁷ concluded from their research in diabetic patients 'that routine skin preparation with alcohol before insulin injection markedly reduces skin bacterial- counts but may not be necessary to prevent infection at the injection sites'. On the other hand, Selwyn and Ellis³⁸ thought that 'though the nihilistic approach of Dann (1969) seems unwise, relatively brief disinfection of the operation site will usually suffice'. Others have contributed to the debate with not always helpful comments, e.g. 'There is no good reason that healthy skin needs chemical disinfection for routine injections given outside hospital, though the use of 70% ethyl alcohol or isopropyl alcohol is desirable in most cases.'³⁹

Choudhuri and colleagues⁴⁰ showed that alcohol pads were not as effective as iodine pads and produced only a 61% sterilization rate with a significant number of staphylococci remaining viable. How-

ever their assessment of sterilisation was based on swabbing the skin before and after preparation. Selwyn and Ellis³⁸ have shown that this an insensitive method of picking up skin organisms and so is likely to grossly overestimate the rate of skin sterilisation. The contemporaneous guidelines from the Department of Health⁶ state ‘If the skin is to be cleaned, alcohol and other disinfecting agents must be allowed to evaporate before injection of the vaccine since they can inactivate live vaccine preparations.’

More and more people have abandoned skin preparation, other than making sure it is grossly clean, prior to immunisation and there has been no sudden upsurge in abscess formation.

RECOMMENDATIONS

For immunisations the anterolateral thigh or deltoid should be used for all intramuscular or deep subcutaneous injections. The anterolateral thigh is probably best used in infants and the deltoid in older children. **The buttock is not recommended.** A needle length of 5/8” is the minimum for all intramuscular or deep subcutaneous injections. There is insufficient evidence to recommend whether a larger (1”) needle should be used in infants and young children, but it would seem sensible to do so in children of 5 years or older. **In younger children, a decision has to be made on an individual basis depending on the size of the child.** Formal skin disinfection is not necessary before administering immunisations.

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