



## **Safe Intramuscular and Subcutaneous Injections: A Need for Evidence-Based Practice**

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### **Abstract**

Medicines can be given to patients by different routes such as oral, topical, inhalation and parenteral. In the parenteral route of drug administration injections are among the most frequently used methods of drug delivery system and usually given for curative purposes and less than 5% cases for immunization. The correct vaccine administration is a very important component of a successful immunization. In India, 96% of all injections given by private practitioners include antibiotics, vitamins and analgesics and 66% of these injections are said to be unsafe. According to the WHO at least 16 billion injections are given every year in developing countries. The intramuscular (IM) and the subcutaneous (SC) injections are often referred as “basic skills”. The unsafe injection practices can give rise to the transmission of many blood borne diseases and complications such as abscess at the injection site, nerve injury and infections (Hepatitis B and C, and HIV etc). The reuse of syringes is another problem in some countries and it is also common in India. The injection practices are not always rational and research-based practices. So there is need to promote the research based injection practices for the safety of patients and the health care providers. The present article focuses on the issues related to the intramuscular and the subcutaneous routes of drug administration. This is particularly important for health care providers involved in the drug prescribing.

**Keywords:** Injections, complications, skills, practices

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### **Introduction**

Injections are among the most commonly used procedures in the hospitals. The injections are meant for the parenteral route of drug administration (e.g. intravenous, intramuscular, subcutaneous and intra-dermal etc.). The procedures used for giving injections are usually non-research based. The study carried by INCLN (International Clinical Epidemiology Network) in India reported that 66% injections given are unsafe and the reuse of syringes is very common practice [1]. The WHO defines a

safe injection as “A safe injection does no harm to the recipient, does not expose the healthcare worker to any risk, and does not result in waste that is dangerous for the community”. Unsafe injection practices not only lead to injection related complications but can also result in financial loss [2]. The data have shown that in many cases the use of injections is unnecessary [3]. The WHO in 1998 has stated that “An injection should only be given if it is necessary and each injection that is given must be safe”. The unnecessary use of injections should be avoided to prevent injection-associated infections and complications. The INCLN reported in 2004 that approximately 6 billion injections are given in India alone every year [1]. It is estimated that more than 12 billion injections are given by IM technique annually throughout the world [4]. A survey revealed that 96% of all injections given by private doctors are of antibiotics, analgesics and vitamins [5]. Rational use of injection is needed to be emphasized because nearly 70% of injections being given are actually unnecessary [1, 6, 7].

A study done in Puducherry, more than 90% IM injections given to infants are neither necessary

nor administered at the correct site and 91% of such injections are used for minor illness such as upper respiratory tract infection etc. [8]. So before administration of any injection the clinician must make the decision whether the injection is required or not. There is now need to recognize and reduce medication errors. Many complications that can be related to injections such as abscess at the injection site, nerve injury and infections [9, 10, 11]. The injection practices usually do not always reflect research-based or evidence based practice, so there is need to safe injection practice [13]. There is a paucity of research on IM injection [12]. So there are many important considerations required for giving IM injection right from hand washing of health care worker till the management of complications if occur.

### Identification of anatomical sites for IM injections

The site selection for intramuscular injection is very important. The site selection for intramuscular route depends on the age of patient, volume of drug and the type of drug to be administered. The muscle mass must be suitable to support the amount of drug and sometime also the type of drug also decide the muscle selection (e.g: vaccines). The wrong site selection may cause injury to nerves or blood vessels. The important sites used for intramuscular injection are:

**Anterolateral aspect of thigh:** The preferred site for intramuscular injections in pediatric age group is anterolateral aspect of thigh (antero-lateral aspect of thigh, middle third portion between greater trochanter and lateral femoral condyle) [1]. The target muscle is Vastus Lateralis. In children the rectus femoris muscle is not preferred.

**Mid-deltoid:** This is preferred for low volume injection usually less than 2ml in volume. The site selected is upper outer aspect of the arm. However this site is close to radial and brachial artery and is not preferred for small children. Although the muscle mass is not adequate in children but sometime it can be used for children above 2-3 years [1]. The site selected should be 3-5 cm below the bony landmark of acromian process or midway between acromian process and deltoid insertion [14, 15].

The mid-deltoid is the only site where the Hepatitis-B vaccine can be injected in adult. The deltoid muscle is also commonly used for Tetanus toxoid. The Hepatitis-B vaccine is preferred in the antero-lateral aspect of thigh in neonates and infants as they have smaller mass of deltoid muscle. There may be

suboptimal response in the gluteal region because the gluteal fat can retard the absorption of vaccine and may lead to low level of the antibody titers [16]. So it should not be administered in the gluteal region. In dorsogluteal area, the targeted muscle is gluteus maximus. Unfortunately, complications are also associated with this site because there is a possibility of damaging the sciatic nerve or the superior gluteal artery. The injections into the gluteal area have been associated with decreased immunogenicity of certain vaccines like Hepatitis B and Rabies vaccines. In obese patients, sometimes the IM injections into the dorsogluteal area may mean actually into adipose tissue [15]. There is other an important issue for practicing doctors or clinician that is how to identify sites [17].

**Size of the needle:** The size and bore of the needle are important considerations for intramuscular injections. Needle length must be sufficient to penetrate the subcutaneous layer of fat. Needle of at least 25 mm (23 Gauge) or also sometime 38 mm (21Gauge) are used for adults. However this decision may also depend on subcutaneous fat and age of patients [18]. The age of the patient is very important factor in deciding the needle size and bore. The following are the recommendations of Indian Academy of Paediatrics [1]

Most infants & children: 23G x 25mm (1 inch) needle

**Preterm/small babies (<2m):** 26/27G x 16mm (2/3 inch)

**Very obese children:** 23G x 38mm (1½ inch)

**Needle Bore:** The 26/27 and 23 G needles are appropriate for most vaccines [1]. A 1-inch, 23-Gauge needle is sufficient to penetrate the anterolateral thigh in infants younger than one year. A 5/8-inch, 25-gauge needle may be used to deliver vaccine in the deltoid region of toddlers and children up to, and including, 10 years of age [19].

### Subcutaneous injections

Subcutaneous route is frequently employed for certain drugs (e.g; Insulin). Abdomen, thigh and lateral aspect of the upper arm are commonly used sites for subcutaneous routes of drug administration. The greatest merit of this route is the self administration of drug is possible. For subcutaneous injections the skin fold is raised between the finger and thumb [20]. This can decrease the chances deep penetration and intramuscular drug administration instead of subcutaneous. It is also recommended that non-dominant hand should be used to raise the fold of skin.

**How to prepare skin for injection:** D Vlahov et al 1992 found that cleaning the skin prior to injection can reduce the frequency of infectious related to intravenous drug [21]. However, the routine use of disinfection is not recommended for routine immunization [16]. Whether to disinfect or not to disinfect a patient's skin before subcutaneous or intramuscular injection is a much debated area of research. Chemicals in impregnated wipes may interfere with the certain vaccines (E.g: Measles). The other debate is related to swab or not to swab the skin before giving injection.

### Swab or not swab

The issues of skin preparation before giving injections are still not clearly answered. . Many healthcare settings are addressing this issue of skin cleansing although evidence base is lacking or unclear. In many studies it was shown that skin cleansing is not necessary [22] and alcohol, soap and water or other chemical agents are not required for preparation of the skin before injection unless gross contamination is there. A study was conducted by DannTC in 1969 [23] where more than 5,000 injections were given without having done skin preparation to patients. This study included patients of 4 to 66 year of age but no infection was identified (local or systemic infection). So it was suggested that routine skin preparation was not necessary and the use of alcohol swab can be the cause of irritation to patients. In other studies the importance of cleaning the skin of the patient prior to injection was realized [24] and the swab skin preparation with alcohol has reduced the bacterial count [25]. Wipes that are impregnated with medicated chemical may interfere with the vaccines, particularly live vaccines [26]. To reduce the number of pathogens the swabbing the injection site with a saturated 70% alcohol should be at least for 30 seconds and it should be followed by allowing dry for 30 seconds [27]. So the antiseptics used in practice cannot act in the time that is generally used. Allowing the site to dry prevents stinging. Medico-legal implications need to be considered by health care providers. Therefore, it has been suggested that nurses or health care providers should follow the guidelines issued by health authority.

### To aspirate or not

Aspiration, or drawing back on a syringe to check for blood prior administering an IM injection has been the past practice for decades. These practices however are not supported by evidence-based studies. There is lack of data regarding syringe

aspiration whether it should be done or not [28, 29]. It was suggested that the sites used for IM injection are usually not located around the large blood vessels [30]. So it is said that there is no need to aspirate. IM injection used for immunization carry less risk to the patient than other medicines such as antibiotics[31, 26]. Rapid IM injection without using aspiration technology may result in less pain. The other question raised was the time needed for the aspiration to be effective. The time taken by nurses to perform aspiration is usually 1-2 seconds [32]. However the time to perform aspiration should be sustained for at least 5-10 second. But the recommended time (5-10 seconds) may cause more pain to patients because of longer contact time between the needle and the tissue. While performing aspiration the bleeding can occur from injection site and may not be an indicator of incorrect technique. The aspiration is not usually recommended for vaccination or immunization.

### Conclusion

The guidelines are emerging based on research based data. The injection practice must be evidence based to minimize the complication related to the use of injections. Use of injection must be rational and injections should be given only when clear indications are there. This area needs further research for making guidelines that can maximize the therapeutic effect of the drugs and can minimize or eliminate complications associated with the intramuscular and subcutaneous injection.

### References

1. A Parthasarathy, T.U. Sukumaran, S.S. Kamath, Anil Mishra. IAP Guide Book on Safe Injection Practices, Third Edition: 2012; The Indian Academy of Pediatrics.
2. WHO. Unsafe injection practice and transmission of blood borne pathogens. WHO, Geneva. WHO bulletin 1999; 77:787-799.
3. Lala MK, Lala KR. Review of injection practice. *Indian J Practical Pediatr* 2001; 3:72-75
4. Nicoll LH, Hesby A, Intramuscular injection: an integrative research review and guideline for evidence-based practice. *Appl Nurs Res.* 2002; 15(3):149-62.
5. Greenhalgh T. Drug prescription and self medication in Indian: An exploratory survey. *Soc Sci Med* 1987; 25:307-318
6. Simonsen L, Kane A, Lloyd J, Zaffran M, Kane M. Unsafe injections in the developing world and transmission of blood borne pathogens: A

- review. Bulletin of the WHO 1999; 77(10):789-800.
7. Sohn VW, Nutzen und risiken der intramuskularen injektion. Fortschritte der Medizin, 1996; 114(17):217-220
8. Gunasekaran D, Adhisivam B, Arulkumaran A and Shanthi AK. Intramuscular Injection Practices Among Infants Indian Pediatrics, 2007; 44: 842-844.
9. Hunter J. Intramuscular injection techniques. Art & Science. 2008; 22(24):35–40.
10. Beecroft PC, Redick SA. Possible complications of intramuscular injections on the pediatric unit. Pediatric Nursing 1989; 15(4):333-336, 376.
11. Cockshott WP, Thompson GT, Howlett LJ, Seeley ET. Intramuscular or intralipomatous injections? The New England Journal of Medicine, 1982; 307(6):356-358.
12. Cocoman A, Murray J. Intramuscular injections: A review of best practice for mental health nurses. Journal of Psychiatric and Mental Nursing. 2008; 15:424–434
13. WHO. Safety of injections in immunization programmes: WHO recommended policy, WHO, Geneva 1998.
14. Bergeson PS, Singer SA, Kaplan AM. IM injections in children. Pediatrics 1982; 70:944-948.
15. Beyea SC, Nicholl LH. Administration of medications via the intramuscular route: an integrative review of the literature and research-based protocol for the procedure. Applied Nursing Research. 1995; 5:23-33.
16. Kamlesh R, Lala Mrudula K. Lala Intramuscular Injection: Review ABD Guidelines Indian Pediatrics 2003; 40:835-845.
17. Engstrom JL, Giglio NN, Takacs SM, Ellis MC, Cherwenka DI. Procedures used to prepare and administer intramuscular injections: A study of infertility nurses. Journal of Obstetric, Gynecologic, and Neonatal Nursing, 2000; 29(2):159-168.
18. Department of Health. Impact assessment of commissioning for quality and innovation payment framework. 2008; Version 3.7.
19. Centers for Disease Control and Prevention. General Recommendations on Immunization: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1994; 43(RR-1):1-38.
20. Zaybak A, and Khorshid L A. Study on the effect of the duration of subcutaneous heparin injection on bruising and pain. Journal of Clinical Nursing, 2002; 17:378-385.
21. D Vlahov, M Sullivan, J Astemborski, and K E Nelson. Bacterial infection and skin cleaning prior to injection among intravenous drug users Public Health Rep. 1992; 107(5): 595–598
22. McCarthy JA, Covarrubis B, Sink P. Is the traditional alcohol wipe necessary before an insulin injection? Diabetes Care 1993; 16(1); 402
23. Dann TC. Routine skin preparation before injection: an unnecessary procedure. Lancet 1969; 2: 96-97.
24. Workman B. Safe injection techniques. Nursing Standard 1999; 13(39): 47-53
25. Koivisto JA, Felig P. Is skin preparation necessary before insulin injection? Lancet 1978; 1: 1072-1073.
26. Clements CJ. Aspiration before injection. SIGN January 2003; post 000153 (3): 1-2. Available from: sign@acithn.ug.edu.au. Accessed January 2003.
27. Mallett J, Bailey C. The Royal Marsden NHS Trust Manual of Clinical Procedures (5th ed.) Blackwell Science: London 1996.
28. Crawford, Ceclia, Johnson, Joyce. To Aspirate or Not to Aspirate: That is the Questions: An Integrative Review of Evidence. STTI International Nursing Research Congress. Vancouver, July 2009
29. Ipp M, Sam J, Parkin PC. Needle aspiration and intramuscular vaccination. Archives of Pediatric Medicine. 2006; 160(4):451.
30. Taddio A, Appleton M, Bortolussi R, Chambers C, Dubey V, Halperin S, et al. Reducing the pain of childhood vaccination: an evidence-based clinical practice guideline. Canadian Medical Association Journal. 2010; 182(18):E843-E855.
31. Nicoll LH. IM injection: updated information. Safe Injection Global Network (SIGN) September 2002; post 00138(1):1-2.
32. Kathleen Marie Davidson, Liam Rourke Teaching best-evidence: Deltoid intramuscular injection technique Journal of Nursing Education and Practice, 2013; 3(7):120.