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Original Article

Are IM injections IM in obese and overweight females? A study in injection technique

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ABSTRACT

If given incorrectly, intramuscular injections may result in poor absorption of drug, reduced drug effectiveness, or irritation to surrounding tissues. In this study, IM injection techniques were observed and documented for needle length, injection site, needle insertion, and stretching or bunching of the skin during injection in a population of adult females. The patients' weights and BMIs were recorded to determine the amount of subcutaneous fat at the injection site. In 22 patients of varied weights, 90% of injections were given within current Advisory Committee on Immunization Practice (ACIP) guidelines in normal and underweight patients, and 17% were given within ACIP guidelines in overweight and obese patients. The study concluded that the needle length used is often too short in overweight and obese individuals.

1. Introduction

Intramuscular (IM) injection techniques based on patient weight and body mass index (BMI) may require reevaluation. In order to reach muscle tissue, several studies show that longer needles are necessary to deliver IM injections in overweight and obese individuals based on the amount of subcutaneous tissue over the muscle and needle length (Groswasser et al., 1997; Zaybak, Günes, Tamsel, Khorshid, & Eser, 2007). An observational study of injection techniques utilized by nurses and medical assistants and their choices of needle size related to the weight and BMI was done in two local clinics in southwestern Idaho. For the purposes of this study, recommendations from the Advisory Committee on Immunization Practices (ACIP) (Kroger, Sumaya, Pickering, & Atkinson, 2012) were used to determine efficacy of deltoid injections, while recommendations from Zaybak et al. (2007) were used to determine efficacy of dorsogluteal and ventroglueal injections.

1.1. Background

Administering injections is an activity inherent to nursing practice (Beyea & Nicoll, 1995). Though many medications and the majority of vaccines are delivered by IM injection, this injection technique is usually taught once during nursing education and may not be formally revisited thereafter (Malkin, 2008). In addition, many nursing fundamentals textbooks differ on IM injection procedures based on traditional and non-evidence based recommendations (Beyea & Nicoll, 1995; Carter-Templeton & McCoy, 2008). It is not clear whether clinician practice is reflective of recommendations for correct and current IM injection technique (Nicoll & Hesby, 2002).

2. Literature review

Muscle tissue is more vascular than subcutaneous tissue. Inadvertently giving an injection subcutaneously (SC) intended to be IM may result in improper absorption of drug, altering its effectiveness (Nicoll & Hesby, 2002). It is unclear how much variation from proper technique alters drug effectiveness, but any alteration of effectiveness could result in untoward effects. One drug observed in this study was Depo-Provera, a contraceptive delivered through the IM route. Improper absorption could cause decreased effectiveness. Improper administration can also cause irritation to surrounding tissues, induration, inflammation, or granuloma formation (Kroger et al., 2012). Several factors determine the efficacy of an intramuscular injection.

2.1. Needle length

Efficacy of IM injections is related to gender, injection site, and subcutaneous tissue thickness (Zaybak et al., 2007). In order to reach muscle tissue, it is important for practitioners to choose the right needle length, determine the amount of subcutaneous tissue present, the weight of the patient, muscle mass, and subcutaneous fat at the injection site before choosing a needle (Kroger et al., 2012; Malkin, 2008; Zaybak et al., 2007) (Table 1).

In both males and females, the deltoid muscle is preferred when giving most IM injections with 1 in. needles. A 1-in. needle is required to reach the deltoid muscle tissue in females whose BMI is less than 35. Females with a BMI greater than 35 require a 1-1/4 in. needle to

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Table 1
Needle length for intramuscular injection in deltoid muscle.

Required needle length for deltoid injection for weight and sex based on ACIP recommendations (2006)	
Weight and sex	Required needle length
Male and female < 130 lb (<60 kg)	1-in. needle
Male 130–260 lbs (60–118 kg) Female 130–200 lbs (60–90 kg)	1 in.–1 1/2 in. needle
Male >260 lbs (>118 kg)Female >200lbs (>90 kg)	1 1/2 in. needle

reach deltoid muscle (Cook, Williamson, & Pond, 2006). Zaybak et al. (2007) determined that dorsogluteal and ventrogluteal sites should not be used in women whose BMI is greater than 24.9. These authors further stated obese women have the highest risk of IM injection failure with both ventrogluteal and dorsogluteal sites because of subcutaneous tissue thickness. Interestingly, men of all BMIs may receive dorsogluteal injections without risk of failure because of increased muscle tissue vs. fat tissue (Zaybak et al., 2007).

2.2. Bunching-Versus-Stretching

Recommended pediatric injection techniques used in practice today include bunching (pinch-grasping) and stretching (flattening) the site prior to and during the injection. In children, bunching the skin while using a 16 mm needle will result in an SC injection, whereas if the skin is stretched, a 16 mm needle allows IM delivery of the medication (Groswasser et al., 1997; Nicoll & Hesby, 2002). Other factors influencing the injection with a 16 mm needle are obesity (which thickens SC tissue) and whether the needle is inserted fully or if a few millimeters are left outside the skin (Koster, Stellato, Kohn, & Rubin, 2009). Even though these recommendations exist for children and adolescents, there are few recommendations regarding bunching-versus-stretching for adult IM deltoid injections (Chan et al., 2006). The ACIP recommends that a 5/8-in. needle is adequate for IM injection into the deltoid muscle only if the skin is not bunched and the weight of the patient is less than 130 lbs (60 kg) (Kroger et al., 2012).

2.3. Research question

The purpose of this study is to determine if correct intramuscular injection techniques are used based on weight and BMI. In order to make this determination, the questions to be answered are: Is the administrator of the vaccine following current ACIP guidelines and/or Zaybak et al. (2007), guidelines in regards to weight and BMI when 1. choosing a needle, 2. choosing a site, 3. and deciding whether to bunch or stretch the skin.

The null hypothesis was that weight and BMI are not associated with receiving a correct IM injection.

3. Methods

3.1. Design

This is a descriptive study utilizing assessment research methods to evaluate injection processes. SPSS (version 19) was used to analyze both descriptive statistics and variables related to IM injection administration. Institutional review board approval was obtained through Boise State University.

3.2. Informed consent

Consents were obtained from each patient and medical office personnel stating that they voluntarily agreed to be observed during the injection. The patients also agreed to be weighed and their BMI measured for the study purposes (Attachment 1: Consent for healthcare personnel & Attachment 2: Participant consent).

3.3. Data collection

IM injections were observed being given to 22 adult female patients between the ages of 19 through 41 at a campus health services clinic and a community health clinic in southwest Idaho. No demographic data were collected on race or socioeconomic data. For patients receiving more than one IM injection in an office visit, only the first injection was recorded for this study. The researcher observed the medical office personnel (medical assistants and registered nurses) who measure the height and weight of each patient without shoes on equipment available in the office. The researcher collected the height and weight data, and the BMI was calculated by dividing weight in pounds by height in inches squared and multiplying by 703 (CDC Healthy Weight, 2013). Needle length and site of injection were recorded. Angle of injection was recorded as either 90° or not 90°. Insertion was recorded as fully inserted or not fully inserted. Aspiration was recorded if personnel were observed aspirating back on the plunger. Stretching or bunching of the skin during an injection was also recorded. The variables were compared to ACIP (Kroger et al., 2012) and Zaybak et al. (2007) recommendations for each weight category of patient (underweight, normal weight, overweight, and obese) and their BMI (Table 1).

The data collection was conducted in the patient room with the medical personnel and the patient. The observer witnessed the preparation of the injection, physician order, patient verification, instructions to the patient, injection process and documentation. The observer explained the purpose of the study to the patient and the process of witnessing the injection.

4. Statistical methods

For each injection, five items required for an injection (Fig. 1) were individually recorded as correct (1 point) or incorrect (0 points). There were no items left blank. The five items that determined a correct injection were needle size, site selected, 90° angle of insertion, stretching of the skin, and full insertion of the needle. The first two items were scored correct based on weight and BMI requirements, and the last two were scored correct if performed. If any of the 5 items were incorrect, the injection technique was scored as incorrect. Percentages were reported by body weight category for how often the injection was scored as correct. Fisher's exact test was used to test for an association between incorrect IM injection and the body weight category. All analysis used SPSS version 19.

5. Results

Of all injections observed in patients of all weights, only 50% were given correctly according to ACIP standards by weight (Kroger et al., 2012) and the BMI recommendations set by Zaybak et al. (2007). Of injections received by overweight and obese people in this study, 17% complied with ACIP guidelines, or conversely, for 83% of patients at least one injection criterion was incorrect, rendering the entire injection incorrect according to ACIP. Underweight and normal weight injections were incorrect 10% of the time. In terms of needle length, the needle length for all underweight and normal-weight patients was within guidelines, whereas needle length for over-weight and obese patients was incorrect for 75% of injections. A 90° insertion angle was documented in 83% of overweight or obese patients, and in 90% of underweight or normal weight patients. The skin was bunched in 33% of overweight and obese injections, and in 10% of normal or underweight weight injections. Full insertion was documented in 50% of overweight and obese injections, and in 80% of normal weight injections.