What is the Likelihood of Blood Return Using Aspiration Technique with Intramuscular Vaccine Administration?

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Abstract

Administering intramuscular (IM) vaccinations is a basic nursing skill. Yet, there is debate among clinicians regarding the necessity of aspirating to assess for blood return prior to IM vaccine administration. The debate is further complicated by inconsistencies in procedural manuals and guidelines regarding the recommendation of whether or not to aspirate for potential blood return. Underlying these uncertainties is the question of how often blood return occurs with aspiration and the risk of inadvertently administering the vaccine intravenously.

The goal of the observational study was to identify how often blood return occurs with aspiration in adult patients.

Registered Nurses who regularly performed aspiration for potential blood return were observed by a study team member when they administered an IM vaccination. The team member recorded the presence of blood return as well as size of needle, injection site and type of solution injected.

A total of 318 IM injections with 10 second aspiration events were observed. Fifteen different RNs were observed. The majority of patients were female (57%) and the mean age was 64.6 years. The pneumonia vaccine was given to 57% of the patients and the influenza vaccine to 43%. The 23 gauge needle was used for the majority (98%) and the left arm deltoid was the most common injection site (66%). No blood return was identified with any of the IM aspirations.

This study provides insight to the chance of blood return with aspiration and scientifically points to the limited benefits of IM blood aspiration assessment prior to vaccination in the adult population. The results support the recommendations to eliminate the step of aspiration prior to IM vaccine administration in the deltoid of adults.

ABBREVIATIONS

IM: Intramuscular; RN: Registered Nurse

INTRODUCTION

Administering intramuscular (IM) vaccinations is a basic nursing skill. The process of administering an intramuscular injection includes delivering small volumes of a solution deep into designated muscle tissue. Aspiration is heralded as a safety mechanism to reduce the potential injection of unwanted solutions directly into a blood vessel. However, aspiration, which was once a standard of care, is now a questionable practice within the clinical setting [1].

The choice of injection site is relevant to avoid injuring adjacent structures such as nerves or major blood vessels while ensuring the muscle mass can absorb the medicative volume being administered. The Centers for Disease Control (CDC) primarily recommends the deltoid muscle as the site of choice for children age 3 and above as well as adults receiving IM vaccinations [2].

The deltoid is considered ideal for this population because it is a well-developed muscle that is surrounded by small vessels that are unlikely to enable the administration of an injectate, and consists of anatomical and marks that can be incorporated to reduce nerve injury [2,3]. The IM vaccine must reach the muscle tissue site for optimal immune response to occur. In order to reach the muscle mass, the use of longer needles is recommended [2]. Longer needles are associated with reduced pain, erythema and edema when compared to shorter needles because they facilitate the delivery of the vaccination deeper muscle mass [2]. The Immunization Action Coalition recommends basing the selection of needle length on the prescribed route, size of the individual and injection technique [4]. In fact evidence demonstrates that a 22-25 gauge needle is supported as the standard for IM injections administered to patients with a length of one-inch for recipients weighing 60 to 90kg and a length of one and one-half inches for those weighing more than 90kg [5].

With the decision of injection site location and needle size determination developed in the science, the exact relevance of

aspiration prior to injection is questionable. The practice in terms of the likelihood of protecting the patient from inadvertently injecting into a vessel given the vascular anatomy is interesting since the likelihood of blood return appears to be low [6]. The debate among clinicians regarding the necessity of aspirating to assess for blood return prior to IM vaccine administration is also relevant because of the potential of unnecessary pain particularly if the step is not absolutely required [7].

The discussion is further complicated by inconsistencies in procedural manuals and guidelines regarding the recommendation of whether or not to aspirate for potential blood return [8-12]. The host of varying recommendations without scientific support contributes to clinical uncertainties. Underlying these uncertainties is the need for a clear understanding of the likelihood of blood return with aspiration and therefore the real risk of inadvertently administering the vaccine intravenously.

Aim

The goal of the observational study was to estimate the proportion of blood return with aspiration in adult patients. The hypothesis is that the chance of aspiration of blood with IM vaccinations is minimal and thus the risk of intravenous administration is unconfirmed.

MATERIALS AND METHODS

A prospective observational research study was approved by the Institutional Review Board for Health Sciences Research (IRB-HSR). The sample size was chosen to give sufficient precision for estimating the risk of blood return with aspiration [13]. Assuming that blood return occurs in approximately 1% of aspirations, a sample of at least 300 IM injections allows for the estimation of the likelihood of blood return with aspiration that is no greater than 0.6 percentage points. With this sample size, using the confidence interval method of Agresti and Coull [14], the expected upper limit on a 95% confidence interval for the proportion is 2.5%.

Registered Nurses in (RNs) the Heart and Vascular clinics at an academic center who regularly performed aspiration as a standard of care and verbally consented to participate were observed during a four month time frame. The RNs notified a member of the study team when a scheduled IM vaccination was prepared for administration in an adult patient. A convenience sample was used. Patients under the age of 18 were excluded.

The study team member explained their presence to the patient, obtained verbal consent from the patient and observed the injection process without interruption. The study team member recorded the presence of blood return as well as the size of needle, site of injection and type of solution injected. No Health Insurance Portability and Accountability Act identifiers were recorded. An information sheet describing the study rationale and plan was provided to each patient.

Statistical methods: Descriptive statistics were tabulated for the sample. The method of Agresti and Coull [14] was used to calculate the upper limit of one-sided 95% confidence intervals for the risk of blood return with aspiration.

RESULTS AND DISCUSSION

During a ten month period of time, a total of 318 IM vaccine administration aspirations were observed. Fifteen different RNs were observed providing the aspiration assessment to adult patients. The majority of patients were female (57%) and the mean age was 64.6 years (range 18-100 years). The pneumonia vaccine was given to 181 (57%) patients and the influenza vaccine to 43%. The 23 gauge needle was used for the majority (98%) of the injections and the 25 gauge needle was used for 2% of the patients. The left arm deltoid was used as the injection site 66% of the time and the right arm deltoid 34% of the time.

Of the 318 aspirations, no blood return was observed. The upper limit of a 95% confidence interval for the risk of blood return is 1.0%.

The limitations of the study included the lack of data about arm circumference and needle length which may provide detail about the depth of the injection and resulting effect of the aspiration under varying conditions. Although clear data about differing arm sizes and needle lengths was not collected, the syringe needles typically used by the RNs are one-inch in length for both 23 and 25 gauge needles. Future studies on aspiration may consider varying needle lengths. Building upon the work of Poland [5] who used ultrasound to measure needle length in association with deltoid injection, identifying the degree of blood return with aspiration at various needle depths would shed additional light on the need for aspiration as a safety measure. Furthermore, analyzing varying durations of aspiration time may contribute to a greater understanding of potentially contributory factors. Additionally, there is a potential that blood return may have occurred at a greater rate among patients not enrolled in the study. The study used a convenience sample because the logistical difficulties of obtaining complete data from every IM vaccination with aspiration overrode the need to eliminate this potential limitation.

Despite the limitations, the findings are noteworthy due to the prospective nature, sample size and the consistency of standardized aspiration practices used at baseline by the RNs. The fact that no blood return was identified with any of the 318 observations is remarkable given the probability of slight variations in technique among the 15 RNs. These findings build upon the work of Waibel and his exploration of blood return with aspiration [6]. While more recent authors call the rationale for the longstanding tradition of aspiration with IM vaccination into question and ask for science to back the practice [1,3], these findings provide evidence that supports our anatomical vascular knowledge and point to the limited identification of blood return with aspiration [6]. Given these findings and pain-related results noted by Ipp [7], the scientific backing to omit the practice of aspiration for blood return with IM vaccine administration in the deltoid muscle of adults is building.

CONCLUSION

The hypothesis that the risk of aspiration of blood with IM vaccinations is minimal was supported. There were no observed aspirations with 318 IM injections, from which we can be 95% confident that the population rate does not exceed 1.0%. This
study provides additional insight on the low risk of blood return with aspiration and scientifically points to the limited benefits of aspiration with IM vaccine administration in the deltoid muscle within the adult population. The results support the recommendations to eliminate the step of aspiration prior to IM vaccine administration in the deltoid of adults.

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