

# Evaluation of the Use of Upper Extremity 16, 18, and 20 Gauge Peripheral Intravenous Catheters to Obtain Intraoperative Blood Samples under General Anesthesia

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## Abstract

### Background:

Anesthesiologists are often required to send blood samples for lab testing while their patient is under general anesthesia. The objective of this study is to determine the proportion of PIV in different sizes of the upper extremity which can be used to obtain blood samples. Sizes of catheters included 16, 18, and 20 gauges. We hypothesize that existing PIV catheters in 16, 18, and 20 gauges can be used to obtain lab samples from patients under anesthesia, and that larger gauge PIV catheters will be more likely to result in a successful blood draw.

### Methods:

The study population included Memorial Hermann Hospital surgical patients who were scheduled to undergo surgery and anesthesia. 10 patient samples for each size PIV were obtained (16G, 18G, and 20G), yielding a total number of 30 enrolled patients. No patients were withdrawn from the study following enrollment.

### Results:

The proportion and its 95% exact CI of ability to obtain a blood sample for 16, 18, and 20 G PIV were 0.6 (0.26, 0.88), 0.8 (0.44, 0.97), and 0.54 (0.25, 0.81), respectfully.

### Conclusions:

Out of the sizes we tested, which included 16G 18G, and 20G PIVs, 18G PIVs have the highest likelihood of a successful blood draw. The authors conclude that when an 18G PIV is present in a patient, the anesthesiologist has the highest likelihood of obtaining a blood sample via aspiration while under general anesthesia.

## INTRODUCTION

Anesthesiologist are often required to send blood samples for lab testing while their patient is under general Anesthesia. Often, these blood samples are for values such as venous blood gases, complete blood counts, cardiac enzymes or electrolytes. Peripheral blood draws generally require phlebotomy with a needle unless there is a pre-existing central venous line. In patients that are challenging to perform peripheral intravenous (PIV) insertion or venopuncture on practitioners may attempt to use PIVs for phlebotomy, or draw blood upon insertion of a PIV. The practice of using an existing PIV for phlebotomy has long

been established, as Arants et al demonstrated study using 18 G saline lock PIVs showing that lab values for aPTT were accurate compared to new sticks when the volume initially discarded was 0.5mL<sup>2</sup>. The saline locks in this study were not used for crystalloid or medication administration, but only for the blood sample<sup>2</sup>. Knowing the likelihood that a PIV could be used for the blood sample could likely save time and prevent complications or costly interruptions to the patient's surgery. Furthermore, attempting to aspirate blood under the surgical drapes may serve to distract the anesthesiologist or surgeon patient care issues. In general, it is likely that minimizing the amount of time spent on lab

draws may be beneficial to patient care. Corbo et al demonstrated that blood aspirated from a saline lock PIV was acceptably accurate in terms of the resulting laboratory values in emergency room patients<sup>1</sup>. While this practice is anecdotally applied, to the authors' knowledge, there is no study determining which types of PIVs are more likely to result in success when negative pressure is applied in order to aspirate blood. In the operating room, venodilation from general or regional Anesthesia could alter the ability to aspirate blood samples. Additionally, patient co-operation and voluntary immobility for the aspiration is not necessary which may alter results. We designed this study to determine the likelihood of success when pre-existing PIV catheters are used for lab draws, in order to avoid new venopuncture of the patient. The objective of this study is to determine the proportion of PIV in different sizes of the upper extremity which can be used to obtain blood samples. Sizes of catheters included 16, 18, and 20 gauge. We hypothesize that existing PIV catheters in 16, 18, and 20 gauges can be used to obtain lab samples from patients under Anesthesia, and that larger gauge PIV catheters will be more likely to result in a successful blood draw.

## METHODS

This study was initiated following approval by the Institutional Review Board at UT Houston Health Science Center. Written informed consent was obtained from all patients prior to enrollment in this study.

The study population included Memorial Hermann Hospital surgical patients who were scheduled to undergo surgery and Anesthesia. Patients included were English speaking adults between 18-65 years of age, with valid surgical and Anesthesia consents. Patients that were excluded were pregnant patients, prisoners, and patients who were unable to sign their own surgical and Anesthesia consent forms.

Ten (10) patient samples for each size PIV were obtained (16G, 18G, and 20G), yielding a total number of thirty (30) enrolled patients. No patients were withdrawn from the study following enrollment. The procedure for obtaining the blood sample was as follows:

- A Tourniquet was applied two (2) minutes prior to drawing sample. If a patient had intravenous fluids (IVF) running through that PIV, the infusion was disconnected prior to applying the tourniquet.
- The saline lock was cleaned with a chloroprep solution.
- The sample of blood drawn back will be 2 mL to discard,

and then a 10 mL sample of venous blood will be drawn, using two (2) 5 mL syringes (to take advantage of the increased ease of aspirating with smaller syringes).

- The volume of blood obtained will be recorded
- Location and size of the PIV will be recorded.

A 2mL volume was chosen in order to eliminate any chance of dilution from IVF, because many of the PIVs sampled were being used as the primary IV access to the patient.

## Statistics

All analyses were performed using SAS 9.3 (Cary, NC). For the primary endpoint, the ability to take a blood sample, the estimated proportion and its 95% Clopper-Pearson confidence interval (CI) by exact method (Clopper and Pearson, 1934) were calculated for each size PIV. A binomial test (Howell, 2007) was utilized to compare the estimated proportion with the acceptable one, 0.9 and the p-value was obtained for each size PIV. For secondary endpoint, the blood amount obtained in mL, mean and standard deviation (SD) were summarized. To adjust for multiple comparisons, we control the family wise error rate at 0.017 using Bonferroni correction (Dunn, 1961).

## RESULTS

The primary endpoint in our study was determining the ability to obtain a 10 mL blood sample from an existing peripheral IV. Successfully drawing 9mL or greater was considered as an ability to take a blood sample. The lowest acceptable proportion was set at 0.9.

We calculated the proportion of ability to take a blood sample with exact 95% confidence interval for each size PIV (table 1). The mean and SD of the blood volume obtained is shown (table 2).

The proportion and its 95% exact CI of ability to obtain a blood sample for 16, 18, and 20 G PIV were 0.6 (0.26, 0.88), 0.8 (0.44, 0.97), and 0.54 (0.25, 0.81), respectively. The mean  $\pm$ SD of volume of blood obtainable was the secondary endpoint of the study and resulted in 6.3 $\pm$ 4.8, 8 $\pm$ 4.2, and 5.7 $\pm$ 4.9mL for 16G, 18G, and 20 G catheters, respectively.

Our hypothesis was that existing peripheral IV catheters could be used to draw blood. The 18G PIV had the highest likelihood of a successful blood draw (0.8). The 16G had the next highest value (0.6), and the 20 G had the lowest likelihood of a successful blood draw (0.54). If a patient had an 18 G, then attempting to take a lab sample via that

catheter has a good chance to be successful. However, sizes 16 and 20 G had a lower probability, so the decision to attempt to take a sample via an existing catheter or simply do a new stick becomes more difficult. However, knowing that a 20G catheter has the lowest probability of aspiration success should suggest the placement of an 18G or 16G PIV catheter if the anesthesiologist anticipates the need to aspirate blood during the case through the PIV.

The determination that 16G PIV catheters did not have a similar, or higher, success rate when compared to 18G PIVs may be the result of several factors. Anatomically, a larger catheter may result in greater perturbations in the venous anatomy, resulting in alterations of aspiration flow through the catheter. Furthermore, it may be possible that the larger catheter was more prone to blood entering the catheter due to the quasi-turbulent flow at the catheter entrance while the PIV was not being used in as dictated by the study protocol in preparation for the aspiration procedure. This relatively brief period of stasis may have resulted partial clotting of the PIV and as such, limitation of flow. A larger study with a similar design would be needed to validate this finding.

Limitations of our study include the inability to differential success rates by other factors such as age, BMI, vascular past medical history, and length of hospitalization. Our study was not adequately powered to obtain this degree of information. Furthermore, our study did not attempt to determine the accuracy of labs draw via a PIV catheter compared to a traditional phlebotomy technique, such as venopuncture or using an arterial line or central venous line. Further studies would be needed in order to determine the reliability of these samples. Finally, given the vasodilatory effects of volatile anesthetics, these findings are not generalizable to the pre or postoperative environments.

## CONCLUSIONS

Our hypothesis was that existing peripheral IV catheters could be used to draw blood with larger PIVs being more likely to be successful in drawing a 10mL alloquote of blood. Out of the sizes we tested, which included 16G 18G,

and 20G PIVs, 18G PIVs have the highest likelihood of a successful blood draw. The authors conclude that when an 18G PIV is present in a patient, the anesthesiologist has the highest likelihood of obtaining a blood sample via aspiration while under general Anesthesia. A future study to determine the likelihood of blood draws via existing catheters should take in to account more variables such as age of the catheter and location of the catheter.

## TABLES

**Table 1**

PIV size	Proportion of ability to take a blood sample (95% exact confidence interval)	P-value
16	0.60 (0.26, 0.88)	0.026
18	0.80 (0.44, 0.97)	0.528
20	0.54 (0.25, 0.81)	0.002

\*p-values are obtained by binomial test

**Table 2**

Volume of blood obtained

PIV size	Mean of obtained blood amount (mL) $\pm$ SD
16	6.3 $\pm$ 4.8
18	8.0 $\pm$ 4.2
20	5.7 $\pm$ 4.9

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