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# THE EFFECTS OF ULTRASOUND-GUIDED PERIPHERAL IV INSERTION ON PAIN AND PATIENT EXPERIENCE

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# THE EFFECTS OF ULTRASOUND-GUIDED PERIPHERAL IV INSERTION ON PAIN AND PATIENT EXPERIENCE

by

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ABSTRACT

THE EFFECTS OF ULTRASOUND-GUIDED
PERIPHERAL IV INSERTION ON PAIN
AND PATIENT EXPERIENCE

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This study was conducted to investigate the use of ultrasound-guided peripheral intravenous (IV) insertion to minimize the pain patients experience with insertion. During this quantitative study, 201 adults were randomly assigned to have their peripheral IVs placed by ultrasound-guided insertion and insertion by the bedside nurse. After the procedure, nurses assessed the pain the subject felt during the procedure using a verbal pain scale, and asked how the patient compared the procedure to the last peripheral IV that they experienced. There were significantly lower pain scores with the use of ultrasound-guided insertion ($p=0.021$) and the number of attempts it took to successfully insert a peripheral IV ($p=0.038$) were significantly fewer with ultrasound-guided insertion. Additionally, there was a statistically significant correlation between insertion method and the experience of having an IV placed compared to previous IV insertions ($X^2=0.648$, $p=0.008$). Clinicians

can improve the experience that patients have with the placement of peripheral IVs through ultrasound-guided peripheral IV insertion and limiting the number of attempts required.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Background

Nurses and other healthcare workers commonly use peripheral intravenous (IV) catheters in hospital settings to obtain vascular access for administering substances such as medications, fluids, and blood (Gabriel *et al.*, 2005). Although obtaining vascular access through peripheral IVs is important for the patients' health, there are physiologic and psychologic complications associated with them. One of the main complications that researchers are looking at is the pain felt on peripheral IV insertion. Studies have been conducted on the use of lidocaine, distraction, vibration, and external cold to minimize the pain patients felt during the procedure (Canbulat, Ayhan, & Inal, 2015; Vosoghi, Chehrzad, Aboltalebi, & Atrkar Roshan, 2010; Brown, 2003). However, few studies were found that have looked at the effects of ultrasound-guided placement of peripheral IVs on pain during insertion. The purpose of this study is to examine the effects of ultrasound-guided placement of peripheral IVs on pain during insertion in medical surgical patients.

## 1.2 Literature Review

Peripheral IV access is frequently obtained by the nurse in the hospital, and patients may associate this procedure with great disfavor due to the painful insertion of the needle as well as the discomfort related to the IV being maintained while in the hospital. During insertion, patients experience a great deal of stress and anxiety because of the pain and trauma they have experienced from previous peripheral IV insertions (McGowan, 2014).

Patients may become traumatized by the experience of distress during the procedure. To help reduce the trauma and distress that patients experience, studies have been conducted to find methods of limiting the pain patients experience during peripheral IV insertion (McGowan, 2014).

Previous studies have examined interventions to minimize pain on peripheral IV insertion in the pediatric population. One approach that has been studied is the use of distraction (Vosoghi, Chehrzad, Aboltalebi, & Atrkar Roshan, 2010). Distraction has been found to be an effective technique in reducing the pain felt by children between 3 to 6 years old (Vosoghi, Chehrzad, Aboltalebi, & Atrkar Roshan, 2010). Other nonpharmacological interventions that have been studied to minimize the pain on IV insertion are the use of external cold and vibration on the skin (Canbulant, Ayhan, and Inal, 2015). Canbulant, Ayhan, and Inal (2015) found significant pain reduction using these two methods compared to the control group. Some pharmacologic interventions that have been studied are the use of intradermal lidocaine, topical lidocaine, and bacteriostatic normal saline (Brown, 2003; Fein & Gorelick, 2006). Lidocaine administered intradermally and topically have been found to reduce the pain of the procedure (Brown, 2003; Fein & Gorelick, 2006). However, a study found that, although the use of lidocaine is more effective than the use of bacteriostatic normal saline, bacteriostatic normal saline was the most cost-effective method (Ganter-Ritz, Speroni, Atherton, 2012).

The location and visualization of a vein can be a difficult task when preparing to place the peripheral IV. For example, a large patient may have veins that are deep in the tissue and hard to find, or a frail older patient may have veins that roll away when the nurse tries to insert the peripheral IV. Another reason for a difficult peripheral IV insertion is that

the valves in the veins may prevent the needle from threading into the vein.

As a means to overcome these challenges, a method of peripheral IV insertion that has been investigated is the use of ultrasound-guided insertion (Bahl, Pandurangadu, Tucker, & Bagan, 2016). A study about emergency room nurses inserting peripheral IVs found that the success rate of peripheral IV insertion increased by 20% using ultrasound-guided IV insertion compared to the traditional technique of palpation (Bahl, Pandurangadu, Tucker, & Bagan, 2016). Furthermore, they found that the time it took to insert the IV also decreased (Bahl, Pandurangadu, Tucker, & Bagan, 2016). A study conducted by Ault, Tanabe, and Rosen (2015), found that a majority of nurses were capable of completing training in using ultrasound-guided peripheral IV insertion technique. The current literature shows that the use of this technique is an effective way to improve patient care. For this study, we expect that by decreasing the number of peripheral IV insertion attempts and the time to insert them, may diminish the pain experienced.

Currently in nursing research there is a lack of evidence regarding the effects of ultrasound-guided peripheral IV insertion. Many bedside nurses like to start the IV the traditional way, which is feeling for the vein and then sticking blindly, hoping the vein is good enough to use for an IV. There is a limited number of studies that look into interventions to minimize the pain on peripheral IV insertion on adults. A large proportion of the research focuses on limiting the pain for pediatric patients, but not for limiting pain during adult IV insertions (Canbulat, Ayhan, & Inal, 2015; Vosoghi, Chehrzad, Aboltalebi, & Atrkar Roshan, 2010; Fein & Gorelick, 2006; Fanurik, Kohn, & Schmitz, 2000). Many times nurses will use an ice bag, or a warm towel to reduce discomforts on adult patients, but that is vastly different from what the pediatric patients have received suggested by the

research. Sometimes, the vein that is stuck for an IV placement interferes with the bony structures of the wrist, and patients complain that it is painful for days when they move that part of the arm. The pain from the movement can prevent or impede the use of a walker or cane, which interferes with the overall mobility of the patient who may be needing to ambulate for recovery. There is a lack of research in the relationship between the number of attempts taken to insert the peripheral IV, the pain associated with the insertion of the IV, and the ongoing pain from the location of the IV. Therefore, the purpose of this study was to investigate the use of ultrasound-guided peripheral IV insertion to decrease the amount of pain adult patients experience compared to peripheral IV insertion by the bedside nurse with palpation only, or with a vein finder.

# CHAPTER 2

# METHODS

## 2.1 Study Design and Setting

This was a quantitative quasi-experimental study that was conducted on five acute care units, at a hospital in North Texas, to determine the effect of ultrasound-guided peripheral IV insertion on pain. The study was approved by the hospital's institutional review board.

## 2.2 Recruitment

Recruitment was done in a face-to-face clinical encounter. The potential subjects were identified when a physician wrote orders to start an IV. When the IV was being started, the patients were informed about the study. Additionally, the researchers obtained written consent of the participant to be a part of the study. See the Institutional Review Board approval in Appendix A. Participants were asked if the researchers could observe the IV sites daily with ultrasound and collect data about the IV site. The subjects did not receive compensation for participating in the study.

## 2.3 Inclusion and Exclusion Criteria

Subjects were between 18 and 89 years of age. Additionally, the inclusion criteria were: 1) they must understand English; 2) be conscious and oriented; 3) agree to have an IV started; and 4) agree to have a member of the research team observe the IV site daily through the use of an ultrasound. Subjects were excluded if they were: 1) unconscious or did not understand the situation; 2) refused ultrasound observations of the IV site; 3) had a

condition that renders veins unsuitable for peripheral IV usage; 4) had a known pre-existing thrombus (blood clot) in both arms or any other evidence of bilateral arm thrombi; or 5) had a peripheral IV placed in both arms in the past 30 days since admission.

## 2.4 Power Analysis

A power analysis was conducted and assumed a multivariable linear regression, alpha= 0.05, desired power 0.80, two insertion methods, and an estimated effect size of f= 0.20. The analysis determined that a sample size of 175 was necessary to reject the null hypothesis. A sample of 175 subjects were divided into two equal groups. An additional 26 subjects were recruited to exclude incomplete data from the analysis.

## 2.5 Procedures

Randomization was achieved through the use of the patients' room assignments. Since the patients are randomly assigned to their rooms, this was used to assign subjects into different groups. The subjects in odd-numbered rooms had the IV inserted using the ultrasound-guided technique, and patients in even numbered rooms had an IV inserted using a vein finder, or by traditional placement. This allowed for proper randomization of the subjects. Two registered nurses from the vascular access team performed the ultrasound-guided peripheral IV insertions, and the others were done by the bedside nurse. The two groups were: 1) ultrasound-guided; 2) placed by the bedside nurse with palpation only or with a vein finder. The research members recorded their observations of the peripheral IV sites, and the nurses recorded the attributes related to the number of attempts required to obtain successful venous access. Data collected included the date of IV placement, vascular access nurse or bedside nurse, whether the study IV placement is the subject's first, catheter gauge, subject's perception of the pain during insertion, subject's

overall experience compared to a previous peripheral IV insertion, and method of insertion.

## 2.6 Data Analysis

With this data, a multivariable linear regression was used to determine the association between groups. Additionally, a chi square test was conducted to analyze the subjects' overall experience compared to a previous peripheral IV insertion. See the data collection sheet in Appendix B. A critical F of 3.049 was required to reject the null hypothesis for the study's sample size. The data was manually cleaned for impossible entries and recoded manually. It was then imported to the IBM-SPSS statistical package for analysis.

# CHAPTER 3

# RESULTS

## 3.1 Placement

Two hundred one patients were studied for this project. One hundred six patients (52.7%) had their peripheral IVs placed by the vascular access team using an ultrasound machine, and 95 patients (47.3%) had the peripheral IVs placed by the bedside nurse.

There were two hundred patients total that had IVs started. It took one nurse to start the peripheral IV in 177 patients (88.5%), two nurses for 20 patients (10%), three nurses for 2 patients (1%), and four nurses for 1 patient (0.05%). In most patients (71.6%), it took one attempt to start a peripheral IV, two attempts in 37 patients (18.4%), three attempts in 11 patients (5.5%), four attempts in 5 patients (2.5%), five attempts in 1 patient (0.5%), six attempts in 1 patient (0.5%), and eight attempts in 2 patients (1.0%). The average number of attempts it took a bedside nurse to start the IV was $1.71 \pm 1.227$. The mean number of attempts for the ultrasound-guided and traditional placement of peripheral IV are displayed in Table 1.1. The average number of times it took for an ultrasound-guided peripheral IV to be placed was significantly lower than when a peripheral IV was placed by a bedside nurse ($p=0.0001$). Most patients (97.0%) reported that they had a peripheral IV started in the past, but a few patients (3.0%) never had a peripheral IV ever started in the past.

Table 3.1: Characteristics of Placements

| | Ultrasound-guided | Traditional |
|---|---|---|
| Participants | 106 (52.7%) | 95 (47.3%) |
| Never had a Peripheral IV in the Past | 4 (3.8%) | 2 (2.1%) |
| Average Number of Attempts | 1.22±0.78 | 1.78±1.21 |

## 3.2 Location and Catheter

One hundred eleven patients (55.2%), out of all of the patients studied, had their peripheral IVs placed on the left arm, and 90 patients (44.8%) had their IVs placed on the right arm. The left arm was more preferred by the nurses compared to the right arm. Most patients are right handed; thus, an IV is placed on the opposite arm to prevent use of the dominant hand. The most common location for a peripheral IV was the forearm (64.7%). See Table 1.2 for the sites selected for peripheral IV insertion. See Figure 1.1 for the brand and gauge of the peripheral IV catheters used. The most commonly used catheter was the Introcan 20 gauge x 1.75 inch.

Table 3.2: Site of Peripheral IV

| | Forearm | Upper Arm | Wrist | Antecubital | Proximal Hand | Distal Hand | Finger |
|---|---|---|---|---|---|---|---|
| Peripheral IV Location | 130 (60.7%) | 24 (11.9%) | 21 (10.4%) | 17 (8.5%) | 5 (2.5%) | 2 (1%) | 2 (1%) |

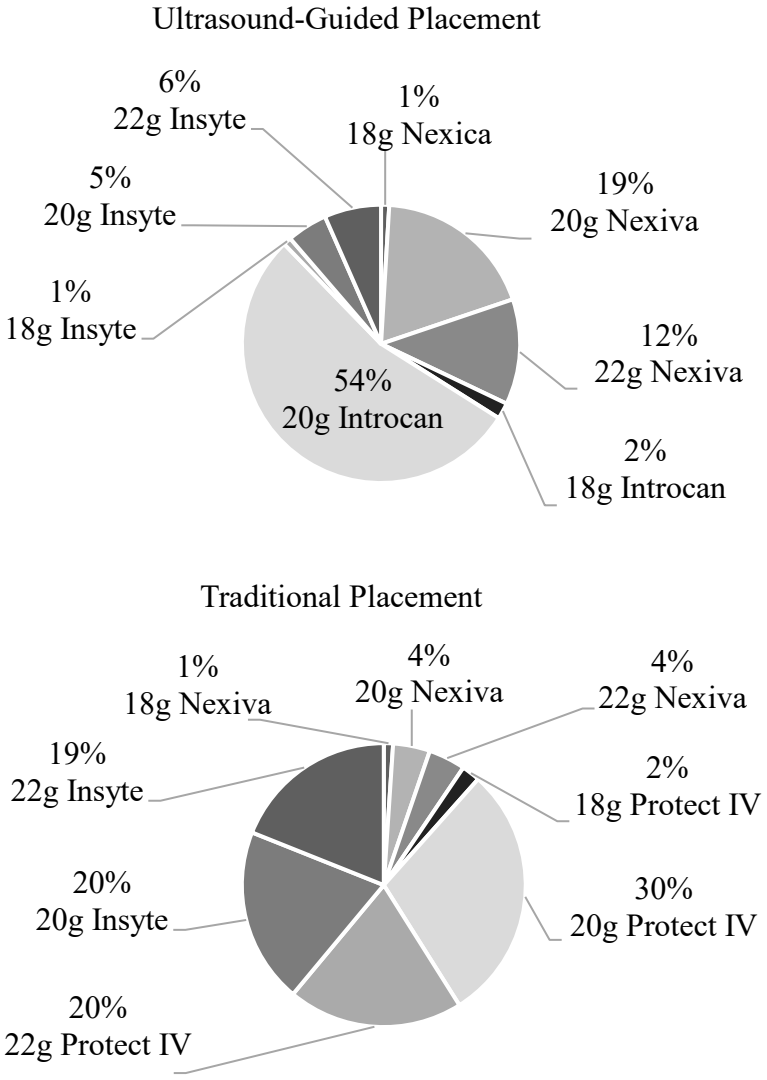



Figure 3.1: Peripheral IV Catheter Brand and Gauge

## 3.3 Experience

The overall mean pain level on peripheral IV insertion was 2.42 ± 2.453. See Table 1.3 for the mean pain scores for ultrasound-guided and traditional peripheral IV placement. One hundred twenty four patients (61.7%) reported that the peripheral IV that was started in the study was better than last time, 64 patients (31.8%) reported that the experience was the same as last time, and 13 patients (6.5%) reported that the experience was worse than last time. Out of the 124 patients that said the study peripheral IV was better than the

previous IV, 75 patients (60.5%) had their study peripheral IVs started using the ultrasound-guided method. Most of the patients (70.8%) that had their peripheral IVs placed using an ultrasound said that it was better than the last IV they had, and the remaining patients (29.2%) said that it was the same or worse than last time. Approximately half of the patients (51.5%) that had peripheral IVs started by the bedside nurse said that it was better than last time, and the remaining said that it was the same or worse (48.4%). Only three of the patients (23.1%) who had their peripheral IV placed using an ultrasound reported that the peripheral IV was worse than their last experience. The remaining (76.9%) were placed by the bedside nurse. The most common reason for removal of the IV was other (56.5%), which included discharge as a reason for removal. The most common symptom that led to the removal of the peripheral IV was infiltration (21.5%), followed by pain and inflammation at the site (2.5%). Five were removed because of accidental dislodgement (2.5%), and two were removed because four days had passed (1.0%). Thirty two patients' (16.0%) peripheral IV's were not removed during the study.

Table 3.3 Patient Experience with the Procedure

| | Ultrasound-guided | Traditional |
|---|---|---|
| Mean Pain Score | 1.95±1.94 | 3.04±2.93 |
| Better than the Previous IV | 75 (70.8%) | 49 (51.6%) |
| Same or Worse than the Previous IV | 31 (29.2%) | 46 (48.4%) |

## 3.4 Analysis

The multivariable linear regression showed that the number of attempts (p=0.038) and the use of ultrasound-guided insertion (p=0.021) had a statistically significant effect on the pain score (r=0.252). It was an expected result that the use of ultrasound guided

peripheral IV insertion and the lower number of attempts would decrease the pain on insertion. A biserial correlation revealed that there was a significant correlation between the pain score of insertion and the number of attempts (r= 0.206, p=0.003). The vein finder did not contribute to the variation in pain score. No relationship between the pain score and the placement of the peripheral IV in the hand was found (p=0.812). The study was not conducted to answer the question of whether placing the peripheral IV in the hand correlated with the pain score. A biserial correlation was performed to assess the relationship between the use of an 18 gauge catheter and the pain scale. A significant, but small, effect was found (r=0.149, p=0.035).

A chi-square test was performed on the correlation between the use of ultrasound-guided insertion and the comparison to the previous peripheral IV. The correlation was statistically significant and expected ($x^2$=0.648, p=0.008). A biserial correlation was performed between the number of peripheral IVs attempted and the comparison to the previous peripheral IV. The correlation was statistically significant and expected (r=-0.244, p=0.0001).

# CHAPTER 4

# DISCUSSION

## 4.1 Placement

The primary aim of this study was to identify if the use of ultrasound-guided peripheral IV insertion could minimize the pain experienced by patients during insertion. With better visualization of the patients' veins, we hoped that this would limit the number of insertion attempts and decrease the pain scores of the procedure.

We had expected that the number of ultrasound-guided and bedside nurse started peripheral IV insertions to be the same amount. However, the lower number of bedside nurse started peripheral IVs (47.2%), compared to the ultrasound-guided peripheral IV insertions (52.8%), may be because the bedside nurse was unable to start the IV. In some instances, the bedside nurse would attempt to start a peripheral IV on patients that were assigned to them for the day. Patients would have their IV started by the bedside nurse, but these were unsuccessful because the patient had few viable veins. This led to the bedside nurse calling the physician to obtain an order for an ultrasound-guided IV, peripherally inserted central catheter, or other central venous access catheter. The patient was then not a candidate for the study. Because of this, the IVs started by the bedside nurse may have been fewer than the other types of IV starts. The patients that were more difficult to start a peripheral IV on, without the use of an ultrasound, may have been excluded because ultrasound-guided peripheral IVs are known to have a higher success rate as reported by a previous study (Bahl, Pandurangadu, Tucker, & Bagan, 2016).

The use of a vein finder guided IV placement was also lower than expected. During the study, many nurses reported that they did not want to use the vein finder for peripheral IV insertions because they found it cumbersome and unavailing. No literature was found to explain this finding, but this may have led to the lower number of vein finder guided placements as well as the higher mean number of attempts to start a peripheral IV.

The number of attempts it took nurses to insert a peripheral IV using an ultrasound was expected to be lower than the attempts to insert an IV while using a vein finder or palpation only. This was found to be correct. The proper visualization of the vein when using ultrasound-guided placement was likely the cause of the lower number of attempts it took nurses to start a peripheral IV. Bahl, Pandurangadu, Tucker, and Bagan (2016) support this finding with their report that nurses were more successful starting peripheral IVs using an ultrasound compared to palpation only.

Overall, the number of nurses who attempted to start a peripheral IV were lower than expected. In all instances that the peripheral IV was inserted with an ultrasound, the procedure was conducted by a single nurse from the vascular access team. This most likely caused the low number of overall nurses who attempted to start an IV on the patient. As mentioned before, patients who were assigned to have their IV started by a bedside nurse with unsuccessful attempts were eliminated from the study. This also may have caused the lower than expected number of nurses attempting to start an IV on the patient. The same rational may explain the low number of peripheral IV insertion attempts by the nurses because the patients who were the most difficult to start a peripheral IV on, may have been excluded from the study.

The number of patients that had peripheral IVs started in the past was higher than expected. The high level of patients reporting that they have had a peripheral IV in the past may be because many of the patients that participated in the study were admitted through the emergency department and had peripheral IVs started in the field. No literature was found to support this finding, but we think that a high number of patients who were admitted to the hospital through the emergency department had peripheral IVs started prior to reaching the units.

## 4.2 Location and Catheter

We expected that the number of peripheral IVs started on the left arm would be higher than those started on the right arm. Nurses reported that they preferred inserting a peripheral IV in the left arm to allow right handed patients to have free movement on their dominant hand. The slightly higher rate of right arm peripheral IV insertions compared to the left may be explained by this. However, no literature was found to support this finding.

The most common location for the peripheral IV to be placed was the forearm, and this may be because there are less bony protuberances in that area compared to the hand and fingers. Additionally, bedside nurses reported that they had the most success in starting a peripheral IV in the forearm compared to other areas. The upper arm may have been used less because the vascular access team wanted to preserve the veins of the upper arm for peripherally inserted central catheters and midline catheters. Hadaway (2007) also found that placing IVs in the hand, and antecubital areas, may be more prone to complications, and nurses should avoid using these locations. All of these factors could have led to the high number of peripheral IVs being placed in the forearm rather than other areas.

Nurses preferred to use the Insyte IV catheter. Nurses available reported that they thought that it was the most pliable and short catheter out of the four; therefore, they may cause less irritation to the vein. However, the bedside nurses reported that they did not like the Insyte because the button to retract the catheter was inconvenient to use. Vascular access nurses reported that they did not prefer to use the Introcan catheter. The nurses thought that it was the stiffest and the longest catheter, and may cause more injury to the vein than the Insyte catheter. Nurses who used the Nexiva catheter reported that they used the catheter because it was convenient to have the extension tubing attached to the catheter before insertion. The ProtectIV may have been used more, but at the facility the ProtectIV was replaced by the Insyte catheter. Because of these factors, all of the brands of catheters were used by nurses in similar amounts.

Nurses believed that they should use the smallest gauge of catheter that they could to minimize the possible irritation to the vein, but they preferred not to use a 22 gauge catheter. This is because it is a very small catheter and patients could not receive IV contrast through the 22 gauge; therefore, nurses commonly used the 20 gauge catheter or larger, such as the 18 gauge catheter. However, no literature was found on what factors nurses look at when deciding the peripheral IV catheter that is used. From experience,, the larger the diameter of the needle and lumen the many more types of fluids, drugs, and blood can be given.  If the diameter of the needle and lumen is not large enough, the drug can be impeded, and blood can be hemolyzed, which does no good for the patient.

## 4.3 Experience

The mean pain score for all peripheral IVs started was lower than expected, and this may be due to the use of a vapocoolant spray used by nurses before peripheral IV

insertion. The vapocoolant spray has been found to lower the pain score during peripheral IV insertion (Mace, 2016). The number of patients who reported that their current peripheral IV was better than the previous IV was an expected finding. The high proportion of patients that reported their study peripheral IV was better than the previous IV may be because many patients had peripheral IVs started in the field. Field start IVs may be perceived as worse because of the stress the patient is experiencing.

A lower number of patients than expected experienced pain or inflammation of the peripheral IV site. Very few patients in the study had their IV removed because of pain or inflammation of the site. However, infiltration was a common problem that led to the removal of the peripheral IVs, and this may be due to the fact of administering vesicants and irritants through the IVs. These medications may cause more damage to the vessels and the surrounding tissues (Hadaway, 2007).

### 4.4 Pain Score

The primary hypothesis was that the use of ultrasound-guided peripheral IV insertion would help to decrease the pain the patient experienced was substantiated. The belief that with the use of an ultrasound machine during peripheral IV insertions would help to minimize the pain on insertion was substantiated. This may have been due to the fact that with the use of the ultrasound-guided peripheral IV insertions, nurses are able to better visualize the vein. The use of an ultrasound machine increasing the success rate and decreasing the time it takes to obtain successful venous access may have also contributed to decreasing the pain (Bahl, Pandurangadu, Tucker, & Bagan, 2016). Patients may also had a decreased anxiety level because they knew that the nurse had properly located the vein, rather than guessing, before attempting to insert the IV. The decreased anxiety levels,

related to the procedure, may have affected the pain score. Tang and Gibson (2005) found that an increase in anxiety levels was related to an increase in the pain that people perceived. Through all of these factors, the use of ultrasound-guided peripheral IV insertion may have been less painful for patients. This agrees with previous literature that found that the use of ultrasound-guided peripheral IV insertions decreased the amount of pain experienced by patients (Ismailoglu, Zaybak, Akarca, & Kiyan, 2015).

The number of attempts having an effect on the pain score was an expected finding. The greater number of times nurses had to insert a catheter into the patient, the greater the pain score they reported. Furthermore, with the greater number of attempts by the nurse to insert an IV, the patient may have experienced more stress. This could have led to an increased perception of pain by the patient. The 18 gauge catheter being related to an increase in the pain score may be because with an 18 gauge catheter, the diameter of the needle and lumen increase. Patients may experience more pain with a larger needle being used during peripheral IV insertion. However, the difference in pain levels is not clinically significant. Beck, Zbierajewski, Barber, Engoren, and Thomas (2011) also found a similar finding that 18 gauge catheters had no significant difference in pain scores during peripheral IV insertion.

We expected that the use of an ultrasound would improve the experience that the patient would have with the procedure. The use of ultrasound-guided peripheral IV insertion was found to be positively correlated with having a better experience using the peripheral IV. Because the ultrasound-guided peripheral IV insertion was always conducted by one nurse, the patient may have felt less anxious than multiple bedside nurses attempting to start an IV. Frequently, when bedside nurses were unable to successfully start

an IV, they would ask for help from colleagues, charge nurses, and nursing house supervisors. Furthermore, the use of an ultrasound could have eased the stress of the procedure because the patient knew that the nurse was able to properly visualize the vein before attempting to start an IV. The use of ultrasound-guided insertion has been shown to lower the amount of time it took to start a successful IV, and this may have led to patients having a better experience (Bahl, Pandurangadu, Tucker, & Bagan, 2016). No other literature was found that supported these finding, but it appears that these factors made the experience that patients had with ultrasound-guided insertion better than the previous IV they had.

We expected that the lower number of attempts to start a peripheral IV would lead to a better experience with the procedure. Patients reported a better experience with the current IV when the number of attempts to start a peripheral IV were lower. The lower the number of attempts nurses took to start an IV, the less pain the patient received. Additionally, the patient may have experienced less stress from the procedure with less attempts of IV insertion. No literature was found supporting these findings, but these may be the reasons why the patient experienced a better IV insertion with less attempts.

## 4.5 Future Implications

Ultrasound-guided insertions should be used more often to decrease the pain that patients feel and to improve patient experience. Especially for patients whose veins are difficult to visualize or palpate, the use of an ultrasound-guided peripheral IV insertion should be considered. Additionally, the bedside nurse should consider calling the physician to obtain an order for an ultrasound-guided peripheral IV before the patient experiences multiple attempts. Nurses should attempt to minimize the amounts of attempts it takes to

successfully insert a peripheral IV. Doing this can help to limit the pain that a patient feels as well as improve the experience of the procedure. Facilities should consider training more nurses in ultrasound-guided peripheral IV insertion. Furthermore, nurses should be educated on the benefits of using ultrasound-guided insertion, when to request an order for one, and the skills necessary to perform the procedure.

More studies should be done to look at the effects that ultrasound-guided peripheral IV placement may have on patient anxiety during the procedure. Additionally, more studies should be done to examine the effects of ultrasound-guided peripheral IV insertion on the pain for patients who have difficult IV access. More studies should also be conducted on the effects of vein finders on peripheral IV insertion. Through this, we can better understand the effects that these methods of insertion have on the patient's experience with the procedures.

## 4.6 Conclusions

The results show that with the use of ultrasound-guided peripheral IV insertion, the pain a patient feels can be minimized and the experience of starting an IV can be improved. Even though inserting a peripheral IV will still be painful and stressful for the patient, these problems could be minimized. Through educating bedside nurses on the benefits of using an ultrasound machine and forming guidelines to consider when to obtain an order for an ultrasound-guided peripheral IV, more patients will benefit from this method. Limiting the number of attempts nurses take to start a peripheral IV is an important factor to limit the pain and improve the patient's experience of this procedure. The number of nurses that are trained in placing ultrasound-guided peripheral IVs should be expanded to make this procedure more accessible to patients. Students in nursing schools may be better prepared

for working in the clinical area if they were trained to start peripheral IVs by palpation and with an ultrasound machine. Clinics may need to consider holding training sessions to educate more bedside nurses on ultrasound-guided peripheral IV insertion, as well as making ultrasound machines more available on the units. This study has provided clinicians with a means to help control pain on peripheral IV insertion through changing the methods of the placement. Research on IV placement should continue with a focus on reducing the effects of anxiety experienced by the patient. All of these implications can improve the patient experience.

# APPENDIX A

# INSTITUTIONAL REVIEW BOARD APPROVAL

| | |
|---|---|
| DATE: | June 6, 2017 |
| TO: | Helen Myers, BSN |
| FROM: | Texas Health Resources IRB |
| PROJECT TITLE: | [1024558-2] Effects of PICC Team Placement of Peripheral IVs |
| SUBMISSION TYPE: | Amendment/Modification |
| ACTION: | APPROVED |
| APPROVAL DATE: | June 6, 2017 |
| REVIEW TYPE: | Expedited Review |
| REVIEW CATEGORY: | Expedited review category 45 CFR 46.110 and/or 21 CFR 56.110 Category (b) (2) Minor changes in previously approved research during the period of one year or less for which approval is authorized. |
| ITEMS APPROVED: | *PIV Pilot Study Protocol June 2017_amended_clean copy.doc* |

Thank you for your submission of Amendment/Modification materials for this project. The Texas Health Resources IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

If your study involves waiving the HIPAA privacy authorization, please print out the approved study application and IRB approved HIPAA waiver and present it along with your approval letter when requesting access to protected health information (PHI).

The research may not continue beyond the end of the new approval period, as indicated by the expiration date above. In order for the research to continue beyond that date, the IRB must first conduct continuing review and designate a new approval period.

The IRB will send you a continuing review notice at least 30-60 days before the expiration date listed above. If not completely filled out, received, reviewed and approved by the IRB before the end of the expiration date above, enrollment of new

subjects in the research must cease until IRB approval can be obtained. Continued involvement in the research of previously enrolled subjects may not continue unless explicitly approved by the IRB to prevent harm to subjects.
Based on human research regulations and THR human subject research policies, the IRB emphasizes the following requirements in granting approval for this research project:

1. Any changes, modifications, or amendments to any facet of the research must be reviewed and approved by the IRB before they can be initiated.

2. All reportable adverse events and unanticipated problems involving risks to subjects or others must be reported to the IRB according to THR IRB policy requirements. This includes reporting to this Committee any death or serious reactions(s) resulting from this study. Please consult the THR IRB Policy and Procedure Manual for specific definitions and reporting time-frames and requirements.

3. It is required to submit annual and terminal progress reports to the IRB and to receive continuing review of your activity annually by the IRB.

Failure to submit the above reports may result in severe sanctions being placed on Texas Health Resources. All research-related records and documentation may be inspected by the IRB for the purposes of ensuring compliance with THR policies and procedures and federal regulations governing the protection of human subjects. The IRB has the right and authority to suspend or terminate its approval if THR and Federal requirements are not strictly adhered to by all study personnel.
All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.
**The JCAHO standards related to patients taking part in research require that they be informed about the benefits, risks, alternative treatments, research procedures and refusal to participate. This information is contained in each approved research consent form. All in-patients and outpatients that are actively taking part in clinical research must have a copy of their signed consent form on their open medical records.**

If you have any questions or concerns, please contact the IRB Office at IRB@TexasHealth.org. The IRB thanks you for your continued commitment to the protection of human subjects in THR research.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Texas Health Resource's records.

# APPENDIX B

# DATA COLLECTION SHEET

DATE: _____

ROOM#: _____

**Study ID#: _____**

**PIV PLACEMENT:**

Placed by: ____ PICC nurse ____ Staff nurse

Ultrasound used? ____Yes ____No Vein finder used? ____Yes ____No

# of attempts: _____ # of nurses that attempted: _____

Gauge:

____ 18ga Nexiva ____18ga x 1¼"ProtectIV ____18ga x 2½" Introcan

____ 20ga Nexiva ____20ga x 1¼"ProtectIV ____20ga x 1¾" Introcan

____22ga Nexiva ____22ga x 1¼"ProtectIV Other _____

Pt receiving vesicants / irritants? ___ Yes ___ No

**PT'S EXPERIENCE:**

1. Pain score at conclusion of IV placement (1-10) _____
2. Have you had an IV in the past? ____ Yes ____ No
3. Compared to your last IV experience, was this IV placement:
   ___Better than last time ____About the same as last time ____Worse than last time
4. Comments:

_____
_____
_____

**PIV REMOVAL:**

# days PIV lasted: _____ **CONFIRMATION OF DVT/SVT _____**

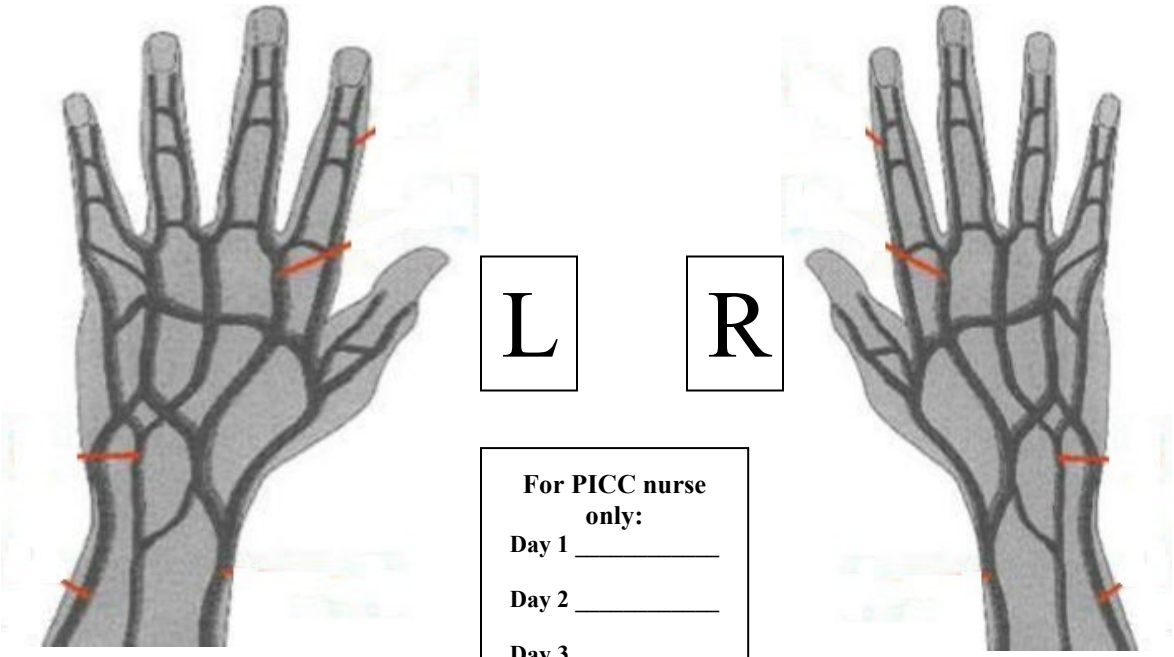
Reason for PIV removal: ___ Infiltration ___ Accidental Dislodgement ___ Pain at site ___ Other

Comments:

_____
_____

***Patient transferred to: _____ PIV Status: _____**

Please mark an X for unsuccessful attempts, and circle the area the IV was successfully placed:



L

R

**For PICC nurse only:**

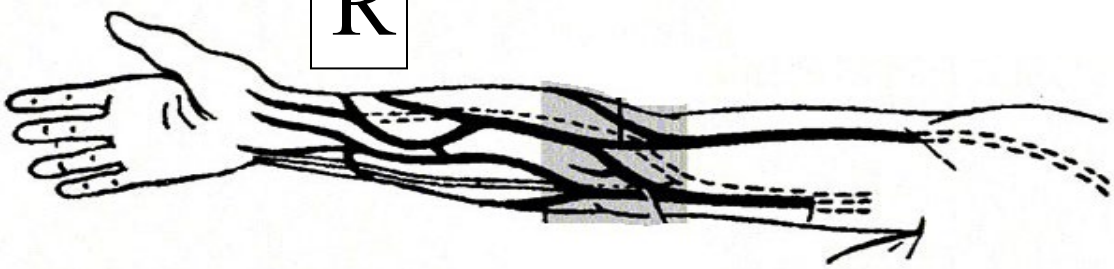
**Day 1** _____

**Day 2** _____

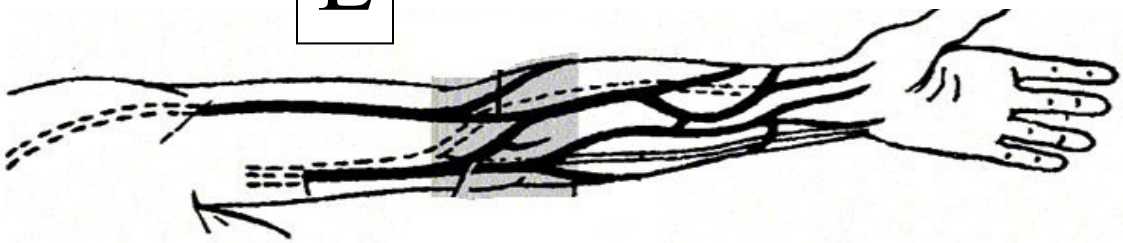
**Day 3** _____

**Day 4**

R



L



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## BIOGRAPHICAL INFORMATION

Genichiro Fujioka was admitted to the University of Texas at Arlington in 2014, and received the Honors Distinction Scholarship. He graduated in the spring of 2018 with an Honors Bachelor of Science in Nursing, *Summa Cum Laude*. During college, he developed an interest in critical care and pain management. He had a great experience in research, and he was captivated by the process. He has accepted a position at Parkland Hospital in the Critical Care and Trauma Nurse Internship. In the future, he hopes to obtain a doctoral degree in nursing, and continue conducting research on topics that will help to expand the body of knowledge in nursing and improve nursing practice.