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Comparison of Outcomes in Heart Bypass Patients Undergoing Insertion of an Internal Jugular Vein Central Line by Ultrasound Compared to Traditional Landmark Technique

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COMPARISON OF OUTCOMES IN HEART BYPASS PATIENTS UNDERGOING INSERTION OF AN INTERNAL JUGULAR VEIN CENTRAL LINE BY ULTRASOUND COMPARED TO TRADITIONAL LANDMARK TECHNIQUE

by

Sayha Ol Ma

Abstract of a Capstone Project
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Nursing Practice

December 2015

ABSTRACT

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Patients that undergo heart bypass surgery require central line placement from a healthcare provider. To place this device, one must use either ultrasound guided or landmark technique. Compared to landmark technique, using ultrasound guided technique may reduce complications. The goal of this project was to determine if ultrasound use of central line placement is a safer practice compared to using the traditional technique.

A retrospective chart review was performed to compare internal jugular central line placement by ultrasound with the traditional landmark placement to evaluate results related to patient outcomes. Data from fifty health records were analyzed using chi-square. The complications examined included cannulation failures, arterial punctures, pneumothoraxes, hematomas, and hemothoraxes. The differences in complications between the two techniques analyzed in this project did not reach the level of significance required to reject the null hypotheses.

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A Capstone Project
Submitted to the Graduate School
And the Department of Advanced Practice
at The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Nursing Practice

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Dean of the Graduate School

December 2015

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LIST OF ABBREVIATIONS

ASA	American Society of Anesthesiology
CDC	Centers for Disease Control and Prevention
CI	Confidence Interval
CLABSI	Catheter Related Blood Stream Infections
CVA	Central Venous Access
CVC	Central Venous Catheter
EMR	Electronic Medical Record
EPIC	Electronic Patient Integrated Care
HAI	Healthcare Acquired Infection
IRB	Institutional Review Board
ICU	Intensive Care Units
IJ	Internal Jugular
IJV	Internal Jugular Vein
IOM	Institute of Medicine
IV	Intravenous
RTUS	Real-time Two-dimensional Ultrasound
US	Ultrasound

CHAPTER I

INTRODUCTION

Central Venous Catheters (CVCs) are the most frequently used indwelling devices and have become essential tools for effective treatment of critically ill patients (Patil, Patil, Ramteerthkar, & Kulkarni, 2011). According to Gillies (2003), CVCs simplify venous access, prevent the distress associated with recurrent venipuncture, and allow the administration of complicated treatment systems, blood products, and intravenous (IV) nutritional support. They are one of the most common invasive lines used in ICUs. With using these lines, there are risks of infection in the blood stream of a patient. According to the Centers for Disease Control and Prevention (CDC, 2011), 80,000 catheter related blood stream infections (CLABSI) occur in intensive care units (ICUs) each year in hospitals. These infections result in increased hospital budgets, increased length of stay, and increased mortality (CDC, 2011). In addition, the Institute of Medicine (IOM) (2001) reported that reportable patient events in hospitals, also known as HAIs, surpassed the number of deaths caused by Acquired Immunodeficiency Disease Syndrome (AIDS), motor vehicle accidents, and breast cancer each year.

Needs Assessment

This population was chosen due to the availability of open-heart surgeries in this project/capstone's area and the required use of CVCs in patients that undergo this surgery. Healthcare providers, such as Nurse Anesthetists and a variety of other doctors, place CVCs for this procedure. Using ultrasound-guided placement of CVCs as compared to traditional landmark technique could potentially decrease costs for patients and hospitals by reducing complications.

The relationship of the Doctorate of Nursing Practice Essentials to the needs assessment is further discussed in the appendix section of this project/capstone.

The CDC (2011) reports that the following estimated United States costs put forward to only direct hospital costs for treatment of Healthcare Acquired Infections (HAIs) is $28 to $33 billion each year. The United States Department of Health and Human Services (USDHHS) (2010) estimated that temporary, adverse harm events, and HAIs linked with hospital care costs Medicare more than $300 million a month in 2008. Mostly, these costs were related to harm from the events, which increased the length of stay in the hospital (USDHHS, 2010).

The clinical problem of interest is noted in this PICO question: P (Patient problem or population) – heart bypass patient requiring insertion of an internal jugular vein device, I (Intervention) – Central line placement guided by ultrasound, C (Comparison) – central line placement using landmark insertion technique, O (Outcome) – Better or fewer attempts to central line placement resulting in fewer infections and complications. To further support this clinical problem, Miller et al. (2002), mentions that the mean number of Central Venous Access (CVA) or CVC attempts in the Ultrasound (US) group was 1.6 vs. 3.5 in the landmark group. Kline (2011) also notes that ultrasound guidance has been recently associated with a reduction in complication rates and an increase in success rates. Using this evidence to change practice may influence patient outcomes by drastically reducing infection and decreasing hospital stay.

Open-heart surgeries are performed daily in the United States, and the care of these patients require a way to provide multiple drug infusions and blood

products, thus, the insertion of an internal jugular central line is needed. Using ultrasound-guided technique shows healthcare providers the landmarks that are needed to safely perform this procedure. This is not to say that the traditional landmark technique is the wrong way of doing things. This is a way to better use technology to provide safer practice to avoid complications such as a pneumothorax or accidental insertion in wrong areas. This change in practice is a way to help provide safer care to patients and improve patient outcomes.

Patients that require central line placement from a healthcare provider using ultrasound guided insertion results in a reduction of placement attempts and prevents further infection in comparison to landmark technique. According to Miller et al. (2002), the mean number of CVA or CVC attempts in the US group was 1.6 vs. 3.5 in the landmark group. Kline (2011) also notes that ultrasound guidance has been recently associated with a reduction in complication rates and an increase in success rates with insertion. Based on this evidence, it is possible to drastically reduce patient complications such as infection thus, improving overall care and decreasing hospital stay. This capstone project examines the research question, in patients undergoing heart bypass surgery, does insertion of an internal jugular vein central line by ultrasound, compared to the traditional landmark technique, result in significant reduction in complications and costs?

Conceptual and Theoretical Framework

Pender's Health Promotion Model is a middle-range theory that represents a person's interaction with their personal and physical environments while he/she practices health as well as integrate concepts from the expectancy-value and social cognitive theory (Pender, Murdaugh, & Parsons, 2014). The three major foci of this model, according to Pender et al. (2014), are: individual characteristics and experiences, behavior-specific cognitions and affect, and behavioral outcome. Basically, in this theory, the provider functions to raise consciousness, promote self-efficacy, and control the environment. This allows for behavior change resulting in high-level health.

There are seven assumptions that are applicable to both behavioral and nursing viewpoints. One: People create living conditions by expressing their one-of-a-kind potential. Two: People have the ability to think about self-awareness. Three: People's values grow in a positive course and he/she attempts to balance between stability and change. Four: People control their own behaviors. Five: People interacting with the environment change overtime. Six: Health professionals establish personal environments that influences people throughout their duration of life. Lastly, seven: Arrangement of self-initiated personal and environmental interactions is essential for change of behaviors (Pender et al., 2014).

When applying the Pender's health promotion model to this capstone project, the providers inserting central lines must consider if using ultrasound guided technique is more beneficial to patients. In Pender's first category, a

provider has to rely on their experiences to determine if they are going to change which technique is being used; in this case, either landmark or ultrasound-guided. In the second category, Pender notes that to change, one must see benefits to action, barriers, self-efficacy, and activity-related affects (Pender et al., 2014). As noted with this theory, if providers see a benefit in patient care or in practice, they may consent to a change in anesthesia practice. Considering the cost barriers mentioned later, anesthesia providers might be reluctant to change practice unless a significant benefit to change is demonstrated.

CHAPTER II

REVIEW OF RELATED LITERATURE

Evidenced-Based Guidelines

American Society of Anesthesiologists (ASA, 2012) formed guidelines to deliver new and up to date recommendations on problems that have not been mentioned by previous guidelines. From surveys of experts and randomly chosen ASA associates, these recommendations were based on rigorous evaluation of current scientific literature and conclusions. The difference between this article and other articles is that it includes areas such as site selection of the insertion location, use of real-time ultrasound guidance when placing CVCs, and confirmation of catheters in veins. The use of bundled practices, CVC placement with assistance, and arterial damage management was also reported.

Gayle and Kaye (2012) recommend that for the daily practice of Anesthesiology, ultrasound use is an important tool. Ultrasound guided technique is used in the placement of peripheral nerve blocks, CVCs, arterial, and IVs. There has not been standardization of ultrasound guided technique use nor training for this procedure until recently. In the past few years, several organizations and societies, such as the ASA and CDC, have printed recommendations and guidelines pertaining to ultrasound-guided technique use. To improve successful Internal Jugular Vein (IJV) cannulation and reduce complications, the current literature supports the use ultrasound guided technique. This article also shows that with proper training, this evidence can lead to improve patient safety and achieve enhanced clinical outcomes.

Troianos et al. (2011), provides a complete practice guideline for the use of ultrasound-guided technique during CVC cannulation. The recommendations from level one evidence-based practice mention the use of US placement with IJ CVCs by properly trained health care providers to reduce complications with insertion of these catheters. Supported by literature, proper ultrasound guided technique training is essential to appreciate the anatomy, identify correct site and angle of the needle, and to understand its limitations. Skin marking with static US use before cannulation to identify vessel anatomy and thrombosis may not improve cannulation success or reduce complications, as does direct ultrasound guided needle confirmation technique.

Ultrasound Use

Balls et al. (2010), discusses ultrasound-guided technique CVC insertion to decrease complications and improve success rates. Several regulatory and professional organizations also recommend the use of this technique. Five different institutions were reviewed and a total of 1222 CVC attempts were noted. The reduction of numbered attempted punctures by US guided technique was found to be significant ($P < 0.02$).

Keenan (2002) asserts that to minimize complications, improve IJ CVC placement success, and patient safety, the use of ultrasound-guided compared to landmark technique is a must. Before making a protocol, the cost effectiveness of US use should be determined. After 18 trials were reviewed, there was a 0.12 reduction of failure rates, decreased number of attempts by 1.41, 0.24 differences in first attempts with US use; all with a confidence interval (CI) of

95%.

Kline (2011) notes that sonography and ultrasound address the association of invasive anesthetic procedures with concerns such as patient safety and comfort, cost-effectiveness, time completion, and success rates. More commonly, US guided-technique is used for nerve blocks, peripheral and central line placement, and catheterization of the arteries. Recently, this technique has been applicable in spinal and epidural placement. With US use, the current research demonstrates the concerns of patient safety and comfort, reliability, and cost as well as performance time reduction in a variety of common procedures. Overall, ultrasound can potentially have a positive impact on the practice of anesthesia.

Martin et al. (2004), concluded that the use of ultrasound guidance for CVC insertion by residents did not result in an improvement in procedure-related complications. During nighttime procedures, there was an increase in complication rates; 15% compared to 6% during the day. The potential cause of this could be unavailability of supervision or new resident exhaustion. From 1996-2001, 484 attempts of IJV CVC placements were done. An overall complication rate with ultrasound-guided was 11% compared to 9% using the traditional landmark technique.

Ultrasound Verses Landmark Use

Miller et al. (2002) noted the limitations of training and experience with emergency room physicians and their ability to use US in conjunction with CVA. This article concluded that the use of US may decrease the number of CVA

attempts and will decrease the amount of time required to place a CVC after the US machine has been already set up and turned on. Concluding from results, the landmark time was 462.7 seconds vs. 93.3 seconds in the US group. There was also an increase in number of CVA attempts for the landmark technique group compared to lower time and fewer attempts with the US group.

Bannon, Heller, and Rivera (2011) note the knowledge of anatomical landmarks determine successful venous cannulation. In addition, US technique is used to view orientation and location of vessels, but landmark identification is still an important component of safe CVA. Structure and landmark identification minimizes complications and optimizes success rates in CVC placement. With IJV CVC insertion, ultrasound guidance has been shown to improve cannulation and decrease punctures and complications.

Wu et al. (2013) conducted a meta-analysis to compare real-time two-dimensional ultrasound (RTUS) guidance technique with anatomical landmark technique for CVC placement to determine if either has any advantages. This meta-analysis provided evidence that compared to anatomical landmark use for CVC cannulation, RTUS guidance was related to decreased risks of cannulation failure, arterial puncture, hematoma, and hemothorax in adults.

Overall, there is evidence in the literature that ultrasound guided compared to landmark technique is associated with decrease in complications such as cannulation failures, pneumothoraxes, arterial punctures, hematomas, and hemothoraxes. Troianos et al. (2011) reiterates that proper training in the technique is important as well to decrease these complications. Based on the evidence considered in this review of literature, the use ultrasound guided technique may become the standard of practice for IJV CVC in the near future.

CHAPTER III

METHODOLOGY

The goal of this project was to determine if the use of ultrasound central line placement is a safer and cost-effective practice compared to using the traditional technique in the selected setting. In addition, the project examined evidence to see if implementation of ultrasound technique use of central line placement would be feasible for practice in the chosen setting.

The strength of evidence is strong from the literature reviewed. All concluded that ultrasound is a better technique that should be used to meet standards of care. Based on this evidence, data was collected from medical records through a retrospective chart review to compare outcomes in heart bypass patients undergoing insertion of an internal jugular vein central line by ultrasound and traditional landmark technique.

Data was collected from the records of patients who met the inclusion criteria. Analysis of the data compared groups based on the technique for central line placement and complications using GraphPad Prism.

Data Collection

Institutional review board (IRB) approval from the clinical site was attained prior to the data collection (Appendix B). Institutional review board (IRB) approval from the University of Southern Mississippi was obtained prior to data collection (Appendix C). A retrospective chart review of a convenience sample from electronic medical records was performed at the clinical site. The chart review

included 50 patient records within a thirty-three month timeframe from January 1, 2013 to September 30, 2015.

The patient electronic medical record, including the anesthesia record was reviewed to collect the data for each variable of interest. A simple form was created to collect data on the variables of interest and included the following legend: F – gender female, M – gender male; age - A; American Society of Anesthesiology (ASA) classification as I, II, III, or IV; U – for ultrasound guided technique; L – for landmark technique; P – for pneumothorax; CF – cannulation failure; AP – arterial puncture; HT – hematoma; HX - hemothorax Y- for yes; and N – for No.

Setting

The retrospective chart review occurred at a local 512-bed hospital in Hattiesburg, Mississippi. The hospital updated their charting system with the Electronic Patient Integrated Care (EPIC) in 2013.

Population

The data points were collected from records of fifty patients who met the following inclusion criteria: patients who are 40-80 years of age and experienced heart bypass with IJV line placement using either ultrasound or landmark technique. Patients with complications and without complications were included. Patients with ASA classification of less than five were included in the chart analysis. Exclusion criteria included any surgical patient receiving an IJV central line with ASA classification greater than or equal to five. Existing data collection from the EMR was collected and confidentiality of records were maintained.

To further explain ASA class, Sankar, Johnson, Beattie, Tait, and Wijeysundera (2014), note that this classification system was designed to measure preoperational health status. A higher number indicates that the patient has more risks and comorbidities. The ASA classification with description of each class is included in Table 2.

Barriers

Some barriers to implementation of this changing practice are costs associated with obtaining an ultrasound machine, time, lack of training, and possible provider resistance to learning how to practice using ultrasound. Despite these other barriers, cost is potentially the most significant factor in provider choice of the use of landmark or ultrasound guided technique. The cost to purchase an ultrasound machine ranges from 30,000 to over 100,000 dollars depending on what brand and what different options are included. According to Kinsella and Young (2009), using ultrasound is more costly due to codes that physicians use to bill federal government reimbursement. The beginning cost of central line placement was $390,780,000 to $651,300,000 dollars per year by the landmark technique as compared with $494,820,000 to $824,700,000 dollars per year by ultrasound-guided technique (Kinsella & Young, 2009). If a provider uses ultrasound-guided technique, it would costs $104,040,000 to $173,400,000 more per year.

Results will be shared with healthcare providers who perform this procedure at this specific facility after data analysis so that they can consider the results, benefits, and barriers in the context of any indicated change in practice.

Table 1

ASA Classifications

ASA Class	Description
Class I	A normal healthy patient
Class II	A patient with mild systemic disease
Class III	A patient with severe systemic disease
Class IV	A patient with severe systemic disease that is constant threat to life
Class V	A moribund patient who is not expected to survive without operation
Class VI	A declared brain-dead patient whose organs are removed for donation

Table 2 read Sankar et al., 2014, p. 2 table 1

CHAPTER IV

ANALYSIS OF DATA

Data from 50 charts, 25 documenting the use of landmark technique and 25 documenting the use of guided ultrasound technique were analyzed using the chi- squared test. Variables examined included ultrasound guided use, traditional landmark use, and complications, including pneumothorax, cannulation failure, arterial puncture, hematoma, or hemothorax. Multiple null hypotheses were tested at a significance level of 0.05.

The first null hypothesis assumes there is no change in the incidence of infection with use of ultrasound guided central venous catheter insertion compared to landmark technique. The second null hypothesis assumes there is no change in the incidence of pneumothorax with use of ultrasound guided central venous catheter insertion compared to landmark technique. The third null hypothesis assumes that there is no change in the incidence of cannulation failure with use of ultrasound guided central venous catheter insertion, compared to landmark technique. The fourth null hypothesis assumes there is no change in the incidence of arterial puncture with use of ultrasound guided central venous catheter insertion compared to landmark technique. The fifth null hypothesis assumes there is no change in the incidence of hematoma with use of ultrasound guided central venous catheter insertion compared to landmark technique. The sixth null hypothesis assumes there is no change in the incidence of hemothorax with use of ultrasound guided central venous catheter insertion compared to

landmark technique. The level of significance will be assessed at 95% or 0.05 significance.

The online software, GraphPad Prism was used for all statistical calculations. The first, second, fourth, fifth, and sixth null hypotheses were accepted because there was no difference in incidence of immediate infection at the insertion site, pneumothorax, arterial puncture, hematoma, or hemothorax with the use of ultrasound guided central venous catheter insertion compared to landmark technique. When all five hypotheses were analyzed using the chi-square tests, the results were undefined due to “0” being in the calculation of no recorded infections, no recorded pneumothorax, no recorded arterial puncture, no recorded hematoma, and no recorded hemothorax for either insertion technique. These data resulted in non-significant results.

Table 2

Incidence of Immediate Infection

	Ultrasound	Landmark	Grand Total
Yes	0	0	0
No	25	25	50
Grand Total	25	25	50

Computed chi-square *p* value = undefined; due to 0 being in calculation=not significant

Table 3

Incidence of Pneumothorax

	Ultrasound	Landmark	Grand Total
Yes	0	0	0
No	25	25	50
Grand Total	25	25	50

Computed chi-square *p* value = undefined; due to 0 being in calculation=not significant

Table 4

Incidence of Arterial Puncture

	Ultrasound	Landmark	Grand Total
Yes	0	0	0
No	25	25	50
Grand Total	25	25	50

Computed chi-square *p* value = undefined; due to 0 being in calculation=not significant

Table 5

Incidence of Hematoma

	Ultrasound	Landmark	Grand Total
Yes	0	0	0
No	25	25	50
Grand Total	25	25	50

Computed chi-square *p* value = undefined; due to 0 being in calculation=not significant

Table 6

Incidence of Hemothorax

	Ultrasound	Landmark	Grand Total
Yes	0	0	0
No	25	25	50
Grand Total	25	25	50

Computed chi-square *p* value = undefined; due to 0 being in calculation=not significant

The third null hypothesis, however, was slightly different. It was also accepted because there was not enough change in the incidence of cannulation failure with use of ultrasound guided central venous catheter insertion compared to landmark technique. There were five recorded cannulation failures using ultrasound technique compared to three cannulation failures recorded in the landmark technique attempts. There were 20 non-failed cannulation attempts using ultrasound compared to 22 non-failed cannulation attempts using landmark technique. When analyzed using the chi-square test the *p* value = 0.44. This result resulting is non-significant results because the *p* value was greater than 0.05.

Table 7

Cannulation Failure

	Ultrasound	Landmark	Grand Total
Yes	5	3	8
No	20	22	42
Grand Total	25	25	50

Computed chi-square *p* value = 0.44; greater than 0.05=not significant

Landmark to ultrasound technique was also compared using the chi-squared test. A selection of 50 charts showed that there was an equal amount of 25 landmark and 25 ultrasound techniques used. After using the chi-squared test the *p* value = 1. Since it was greater than 0.05, the results were non-significant and accepted the null hypothesis.

Table 8

Landmark Compared to Ultrasound Technique Use

	Ultrasound	Landmark	Grand Total
Yes	25	25	50
No	25	25	50
Grand Total	50	50	100

Computed chi-square *p* value = 1; greater than 0.05=not significant

CHAPTER V

SUMMARY

Significance and Implications

The goal of this project was to determine if ultrasound use of central line placement is a safer practice compared to using the traditional technique. Based on the statistical analysis of the data collected and the conflicting literature, there was not sufficient evidence to recommend conversion to the ultrasound technique for central line placement in practice in the setting where this project occurred. The results of this project did not support decreased complications or reduced cost.

Limitations

There were some limitations to this project. For example, there were no documented reasons for frequent attempts for cannulation of the IJV CVC. There were no documented finishing time frames to see how long it took for the provider to place a central line. At the facility used for the project, only anesthesiologists place the IJV CVC on open-heart surgery patients; therefore, the data collected in this project was limited to IJV CVC placed by anesthesiologist. There was also no area to find billing charges on ultrasound use compared to landmark in the patient chart; therefore, costs related to the use of these techniques were not available. Finally, the review revealed that various anesthesia providers use solely ultrasound technique and others solely use landmark technique for insertion of IJV CVCs.

Conclusion

Patients that undergo open-heart surgery continue to receive placement of central lines for purposes of multiple drug infusions and transfusion with blood products. The traditional landmark technique is still used daily as well as ultrasound-guided technique. The majority of research articles report a decrease in complications such as cannulation failures, arterial punctures, pneumothoraxes, hematomas, and hemothoraxes with the use of ultrasound guided placement compared to landmark technique of insertion IJV CVCs.

As reported in this retrospective chart analysis, an equal number of procedures for IJV CVCs using ultrasound technique and procedures for IJV CVCs using landmark technique were observed in the charts reviewed. The differences in complications between the two techniques analyzed in this project did not reach the level of significance required to reject the null hypotheses. The only complication of interest to this project to be recorded in any of the patient records was cannulation failure; but the differences again, were not significant. The ultrasound compared to landmark technique did not decrease cannulation failure or any other complications. The analysis of data gathered during this project does not provide evidence to support conversion to ultrasound technique use in IJV CVC placement in this local healthcare facility.

Since evidence of a benefit to a change in anesthesia practice was not supported by the results of this capstone project, providers who do not use ultrasound will probably not consider changing their current practices. While data related to barriers to practice change were not collected during the capstone

project, evidence of the existence of barriers has been documented in the literature. Considering the impact of perceived benefits and barriers to behavior change that are foundational to Pender's Health Promotion Model (Pender et al., 2014), a change in practice from traditional landmark to ultrasound guided IJV CVC is not predicted in this setting.

Recommendations

Recommendations for the future include the use of a larger sample size to see if there are significant differences in complications. The choice of another central line placement area, such as the subclavian rather than the IJV, may allow the examination of any differences in complications between techniques. In addition, the use of a different patient population can be considered. This facility does not allow nurse anesthesia providers to insert the IJV CVCs in open-heart patients. Possibly choosing another facility with less restrictions can be an option. The inclusion of a mechanism to collect data to analyze cost for different techniques within the organization would also generate useful information related to practice.

APPENDIX A

DOCTOR OF NURSING PRACTICE ESSENTIALS

Eight Essentials	Capstone Relationship
1. Scientific Underpinnings for Practice	Use of evidence-based practice to help show ultrasound-guided compared to landmark technique with central line insertion
2. Organizational and Systems Leadership for Quality Improvements and Systems Thinking	Use of ultrasound-guided central line insertion to improve patient outcomes and potentially changing practice
3. Clinical Scholarship and Analytical Methods for Evidence-Based Practice	Potentially spread the information from this capstone to improve healthcare outcomes
4. Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care	Use of newer technology such as ultrasound to improve patient care
5. Health Care Policy for Advocacy in Health Care	Educate policy makers in the hospital about ultrasound use to potentially improve patient outcomes
6. Interprofessional Collaboration for Improving Patient and Population Health Outcomes	Dissemination of capstone to physicians and nurse anesthetist to reduce complications thus improving patient outcomes
7. Clinical Prevention and Population Health for Improving the Nation's Health	Prevention of complications, insertion rates, and pneumothoraxes can aid in improvement of patient outcomes. This in turn, reduces cost for hospitals and patients.
8. Advance Nursing Practice	Use this research to advance healthcare professionals' clinical practice and knowledge base in ultrasound to overall improve patient outcomes

APPENDIX B

FORREST GENERAL IRB APPROVAL FORM

FORREST GENERAL HOSPITAL
Forrest Health®

DATE:	July 22, 2015
TO:	Sayha Ma
FROM:	Forrest General Hospital Institutional Review Board
STUDY TITLE:	[781632-1] Comparison of Outcomes in Heart Bypass Patients Undergoing Insertion of an Internal Jugular Vein Central line by Ultrasound Compared to Traditional Landmark Technique
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	July 22, 2015
REVIEW CATEGORY:	Exemption category # *B4*

Thank you for your submission of New Project materials for this research study. Forrest General Hospital Institutional Review Board has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will put a copy of this correspondence on file in our office.

If you have any questions, please contact Michele Stanley at 601-288-4324 or mstanley@forrestgeneral.com. Please include your study title and reference number in all correspondence with this office.

APPENDIX C

UNIVERSITY OF SOUTHERN MISSISSIPPI IRB APPROVAL

THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 15100102
PROJECT TITLE: Comparison of Outcomes of Heart Bypass Patients Undergoing Insertion of an Internal Jugular Vein Central Line by Ultrasound Compared to Traditional Landmark Technique
PROJECT TYPE: New Project
RESEARCHER(S): Sayha Ol Ma
COLLEGE/DIVISION: College of Nursing
DEPARTMENT: Advanced Practice (Nurse Anesthesia Program)
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 10/02/2015 to 10/01/2016
Lawrence A. Hosman, Ph.D.
Institutional Review Board

APPENDIX D

REVIEW OF RELATED LITERATURE

Authors date	Study type	Sample	Data collection	Key Findings
American Society of Anesthesiologist (ASA) (2012)	Evidence-based clinical practice guidelines	Anesthesia Providers	All literature (*e.g.*, randomized controlled trials, observational studies, case reports) relevant to each topic was considered.	57% did not effect time; 43% amplified time; 74% noted supplies, equipment, nor training would be desirable; 78% noted changes in practice-affected costs.
Balls et al. (2010).	Prospective observation study	Healthcare providers	Use of Central Line Emergency Access Registry database	From a total of 1222 CVC attempts, US use reduced the number of attempted punctures (P <0.02).

Bannon et al. (2011)	Review of literature	Healthcare providers	Systemic reviews of literature and references	Recognition of structures and landmarks lessens complications and improves successful procedure rates. US use in IJV CVC placement has been shown to optimize insertion and shrink punctures and complications.
Gayle & Kaye (2012)	Evidence-based clinical practice guidelines	Anesthesia Providers	Internet Evidenced-Based Resources/Article (No research data collection noted in article)	As supported by literature, US use for cannulation of the IJV improves success rates and lessens complications. Evidence also insists that the proper training is important to reach improved clinical outcomes and patient safety.

Keenan (2002)	Systematic review of literature	Healthcare providers	Medline 1966-2001, systemic reviews and use of references	Eighteen trials were reviewed: 0.12 decrease in failure rates, diminution of 1.41 in number of attempts, 0.24 difference in first tries with US use. A CI of 95% was assessed.
Kline (2011)	Evidence-based clinical practice guidelines	Anesthesia Providers	Internet Evidenced-Based Resources/Article (No research data collection noted in article)	Through research, ultrasound use addressed issues of patient safety and comfort, reliability, cost and condenses time performance on everyday procedures.
Martin et al. (2004)	Quantitative/ Prospective Study/Cohort	Surgery residents	Internet Evidenced-Based Resources/Article (No research data collection noted in article)	Complication rate with US use was 11% vs. 9% via traditional landmark technique. Nighttime procedures had a 15% vs. 6% complication rate during normal daytime hours.

Miller et al. (2002)	Quantitative/ Prospective Study/Cohort	Emergency Room Physicians	From 122 subjects, T-test, Mann-Whitney U test, Chi-square,	Limited training experience with Emergency physicians were able to use US to aide with CVA. US expertise may cutback the number of IJV CVA attempts and decrease cannulation time after the US equipment has been setup.
Troianos et al. (2011)	Evidence-based clinical practice guidelines	Anesthesia providers	Web search through PubMed and MEDLINE, peer-reviewed journals	Level-one scientific evidence mentions that properly trained clinicians should use US during IJV cannulation to improve success rates and reduce the incidence of associated complications.

Wu et al. (2013)	Quantitative/ Meta-analysis	Anesthesia Providers/ Other providers	Randomized studies were retrieved from PubMed, ISI Web of Knowledge, EMBASE, and OVID EBM	The use of landmark technique compared to US for CVC placement was linked with decreased risks of arterial puncture, cannulation failure, hematoma, and hemothorax in adults.

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