

Successfully Eliminating Chest Radiograph (CXR) with Dual Vector Technology for Tip Placement

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Abstract

The Vascular Access Team at Presence Saint Joseph Medical Center (PSJMC) has demonstrated a success rate of 96% for PICC placement without tip navigation.

The primary investigator's goal was to eliminate the need for CXRs in an effort to reduce radiation exposure to patients that require a PICC. The investigator will consider eliminating CXR for central venous catheters placed in the IJ & subclavian veins.

The Vascular Positioning System® (VPS®) is a FDA-cleared device for the elimination of a CXR for PICCs & CVCs.¹ (in the presence of a Blue Bullseye)

This technology utilizes ECG, Doppler and an algorithm to confirm tip placement in the lower one third of the Superior Vena Cava at the Cavo-Atrial Junction.

Objectives

The purpose of this study was to evaluate the accuracy of tip placement using ECG and Doppler dual vector and algorithm technology in the patients at PSJMC.

The VPS technology was used for tip placement with success being defined as tip placement in the lower one third of the Superior Vena Cava at the Cavo-Atrial Junction. VPS tip placement was confirmed by traditional CXRs interpreted by independent radiologists.

The goal of using the VPS was to improve patients care by reducing radiation exposure and reducing delays in treatment.



Methods

This study was approved by PSJMC IRB. Clinical data was collected from a sample of 31 subjects in a non-randomized prospective study.

The subjects were selected from the PICC patient population at PSJMC. Subjects enrolled met all standard inclusion and exclusion criteria for a PICC.

This study included the use of CXRs to confirm accurate tip placement. The radiologists utilized were not employed by PSJMC and their interpretation of the CXRs was blinded to the study to reduce bias. Agreement between catheter tip placement as indicated by the Blue Bullseye (BBE) and the corresponding CXR were analyzed.

Discussion

The need to reduce radiation exposure has been discussed in the vascular access field and has long been recognized as a potential hazard to patients³. Therefore, any reduction in radiation exposure can be seen as an improvement in patient care.

Dual vector and algorithm technology reduces subjective interpretation by medical professionals, creating accuracy and confidence in tip placement.

The VPS also eliminated malpositions for patients in this study. One subject, Doppler flow was lost and the algorithm indicated the PICC was in the IJ. The investigator scanned the IJ with ultrasound to reveal the PICC. The PICC was retracted and slowly advanced as indicated by the algorithm and Doppler until a BBE was achieved, eliminating the need for an exchange for the IJ placement. This reduced treatment delays and decreased costs associated with malpositions.

Results

The study enrolled 31 subjects. The goal was to replicate the Georgetown University study². With a 99% confidence level. 25 of the subjects were in normal sinus rhythm. For those 25, 25 achieved a BBE which correlated 100% with the CXRs.

An unexpected outcome was found with five patients diagnosed with A-Fib. Three of the Five subjects achieved a BBE, suggesting that the dual vector and an algorithm technology may be useful in patient populations that do not have a normal sinus rhythm. This is an area of further study that should be explored.

Presence Health Study Results

No. of Patients in Normal Sinus Rhythm	No. of Patients with A-Fib (absent P-wave)	No. of Patients With BBE correlation with CXR
25 Patients		25 Patients 100% correlation
	5 Patients	3 Patients 60% correlation

Limitations

The sample size utilized was small, and, therefore, may not be generalizable to a other patient populations and could lead to lower external validity of the study. The study was non-randomized; therefore, it is subject to selection bias, which could have confounded comparisons between our historical PICC population (830 in 2011) and the subjects enrolled in the study (31 in 2013). This could limit the effect of the intervention. It could also increase the variability of the observed effect.

Smaller sample sizes, such as in this study, make it more difficult to distinguish between "real" and random variations, and they can affect the reliability and precision of results; therefore, they must be interpreted with caution.

The assumption is that the sample size and methods utilized for this study would provide meaningful information that could benefit our PICC patients.

Conclusion

Having the ability to utilize ECG, Doppler and algorithm technology removes the need to interpret an ECG rhythm in isolation. The dual vector and algorithm technology allows CXRs to be eliminated in patients with normal sinus rhythm and those with A-Fib, unlike the single vector of ECG.

This study demonstrated the VPS can be used accurately, reliably and repeatedly, without increasing procedure time and with only minimal training. After completion of this study, an ROI (return on investment) evaluation was completed and a capital request was approved by our corporate headquarters.

Presence Saint Joseph Medical Center (PSJMC) has successfully eliminated CXRs for our patients who receive PICCs. This investigator is strongly considering use of the VPS technology for CVC placements.

Acknowledgments/References

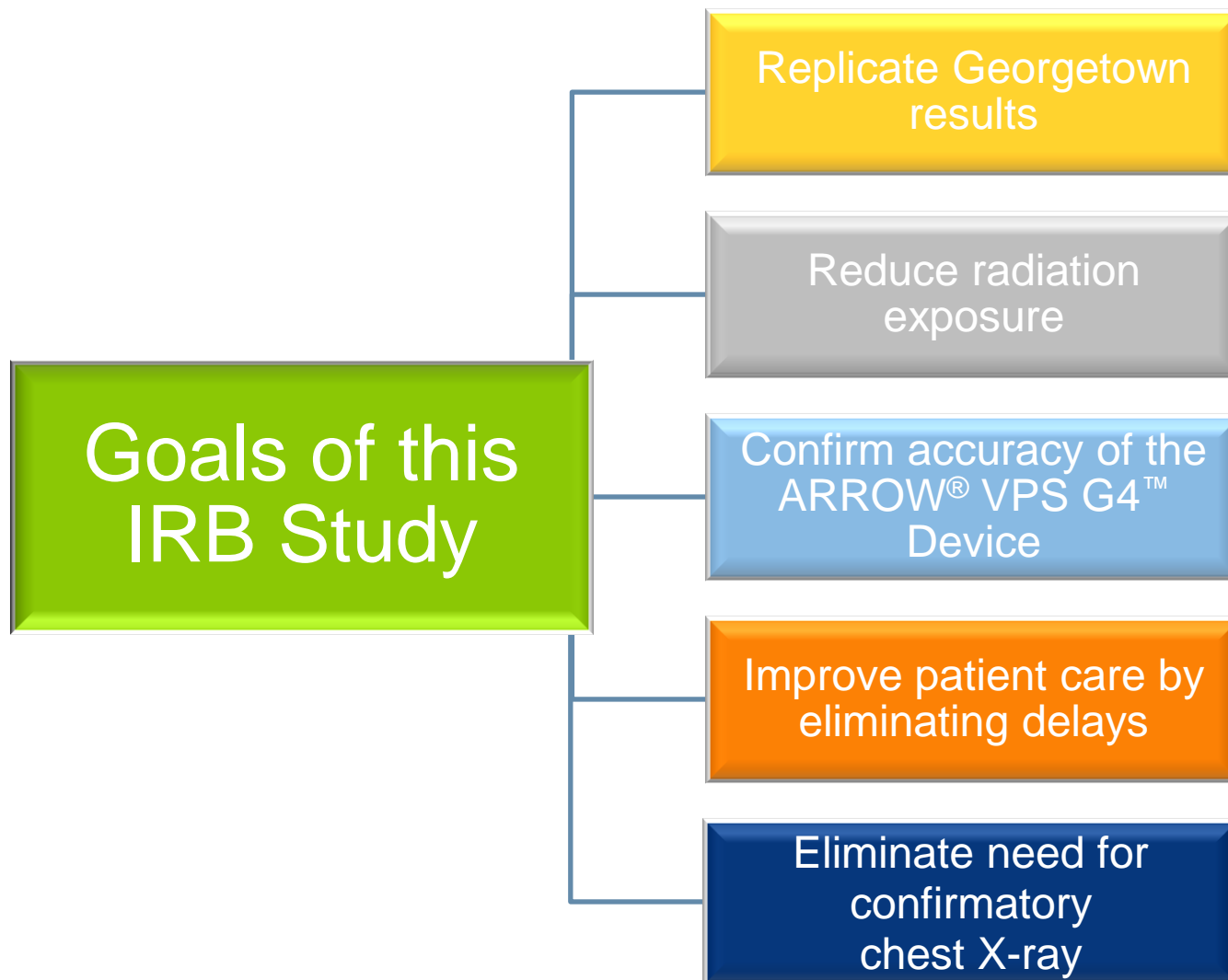
This study could not have been done without the on going leadership support at PSJMC. Special thanks to Jackie Medland, RN, PhD, Lynn Watson, RN, MSN, CMSRN and Susan Greer-Day, MA, LPC.

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Outcomes of this Study

25/25
in-patients in
NSR
achieved a
steady Blue
Bullseye,
correlated at
100% to be
at lower 1/3
SVC-CAJ

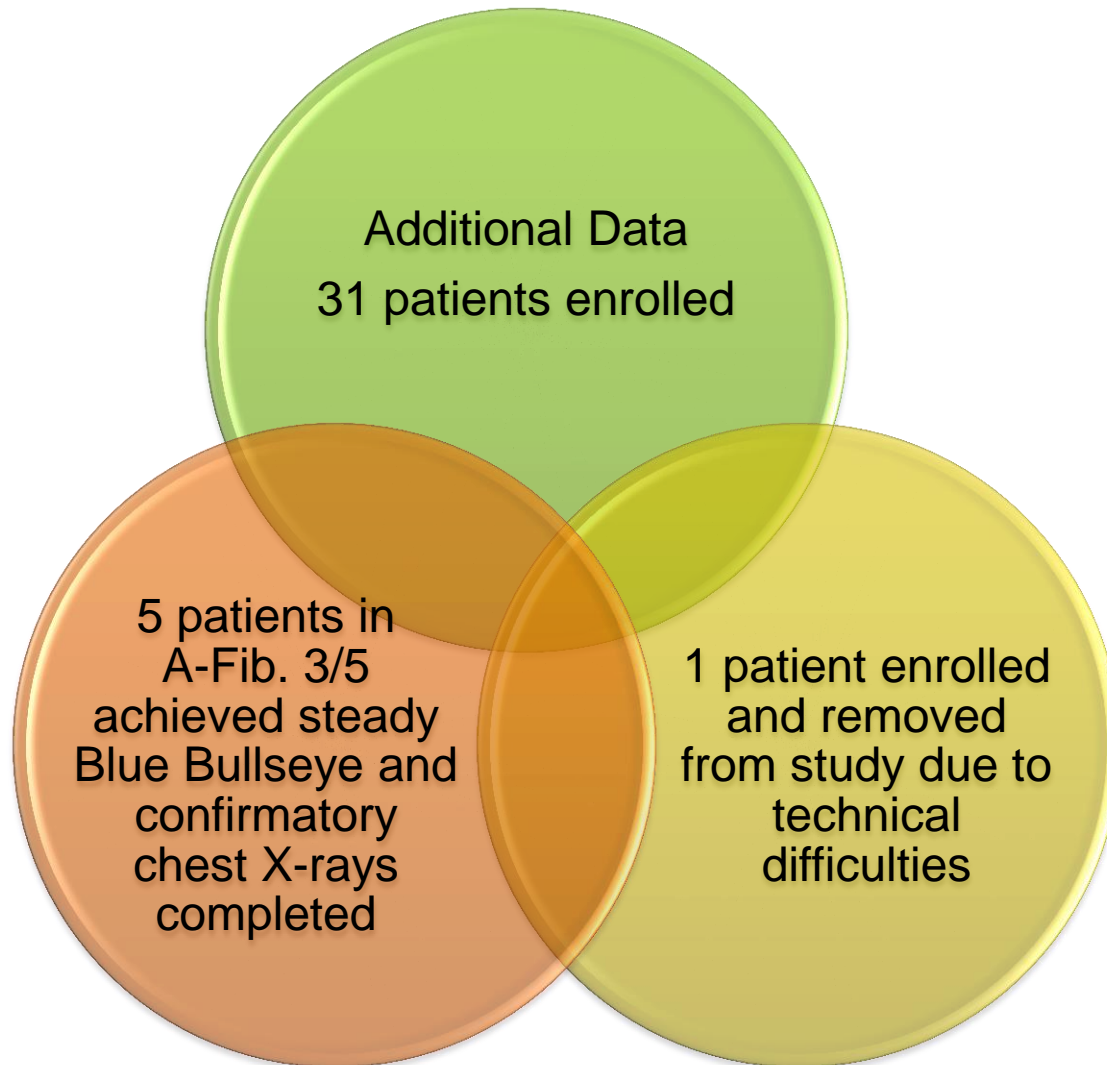
Georgetown
study =
>98.4%
accuracy
Presence
St. Joseph
= 100%
accuracy

Reduction in
radiation
exposure
achieved

Delays in
treatment
reduced
when using
ARROW®
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chest X-ray
eliminated
with steady
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