

# An Inter-professional Approach to Training Emergency Nurses in Ultrasound Guided IV Placement

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## Purpose

The purpose of this pilot program is to evaluate the effect of Emergency Department (ED) physicians partnering with ED nurses through the use of ultrasound guided IV insertion on patients that present for care with difficult IV access.

## Introduction

A critical component for providing care to acutely ill and unstable patients within the ED is obtaining successful IV access. Any delay or failure to secure IV cannulation can impede treatment and diagnosis which may result in adverse patient outcomes. In most emergency departments the nurse is primarily responsible for obtaining IV access. A patient presenting with difficult IV access can be a challenge for even the most experienced nurse. When the nurse is unable to obtain IV access the emergency department physician is notified of the need to secure access.

Historically, unsuccessful IV placement would most likely result in a physician placement of central venous access. Central line placement frequently has been noted to result in increased time demands for the physicians performing the central venous access, as well as using additional resources for the procedure, and increased levels of frustration noted by the patient and nursing staff.

This pilot program is intended to introduce the use of physician and nurse ultrasound guided IV insertions as an alternative approach in patients that present with difficult IV access.

## Background

- Average IV cannulation was reported as 2.5-13 minutes with patients presenting as difficult IV access requiring 30 minutes and greater.
- Delays in establishing vascular access often impedes diagnostic testing, thereby preventing efficient treatment of the patient leading to both patient and nurse dissatisfaction (Chinnock, Thornton and Hendey, 2007).
- Ultrasound guidance for IV access was initially done by physicians to obtain central access. Recently this technique has been expanded for use to gain peripheral access.
- Many studies were done to understand the effectiveness with physician use of ultrasound guided IV to obtain peripheral IV access (White, Lopez, & Stone, 2010).
- Few studies have been done to evaluate the effectiveness of nurses using US in difficult IV access patients (Brannam, Blaivas, Lyon, & Falke, 2004).
- There were no studies to date that directly compares patient outcome measures for nurse delivered US guided IV placement versus standard of care.

## Setting

Figure 1. Beaumont Hospital – Royal Oak, Emergency Center



An eighty five bed emergency department located in a large (1,070 bed) public, tertiary care, teaching, research and referral medicine center in southeastern Michigan.

## Methodology

- A randomized, two group, experimental design was used. Patients aged 18 years and older with identified inclusion criteria were recruited.
- The study had two phases:
- Phase 1 consisted of an educational program training emergency nurses on the techniques necessary to obtain IV access in challenging patients. Nurses included in the study were randomized into two groups. The control group was asked to take a pre-test and post-test prior to obtaining education regarding ultrasound guided IV insertion.
- Phase 2 consisted of a randomized prospective cohort study in which 124 patients presenting to the ED were randomized to one of the two IV cannulation methods: ultrasound guided peripheral IV placement versus standard of care.

Figure 2. Dr. Bagan teaching the technique of ultrasound guided IV insertion



Figure 3. Training one of the nurses in the ultrasound guided group



## Analysis

Data was analyzed using chi-square statistics and student t-test (or Fisher exact test and non-parametric test for non-normal variables), to evaluate baseline differences between the two groups for discrete and continuous variables, respectively. Wilcoxon-Rank-sum tests were performed to compare the IV attempts and the time to catheter placement.

Table 1. Test Scores for Ultrasound Nurses

	Pre Test	Percentage	Post Test	Percentage
1.	10/20	50%	14/20	70%
2.	11/20	55%	15/20	75%
3.	11/20	55%	15/20	75%
4.	11/20	55%	16/20	80%
5.	11/20	55%	16/20	80%
6.	12/20	60%	16/20	80%
7.	12/20	60%	17/20	85%
8.	12/20	60%	17/20	85%
9.	12/20	60%	17/20	85%
10.	12/20	60%	18/20	90%
11.	14/20	70%	19/20	95%
12.	14/20	70%	19/20	95%
13.	14/20	70%		
14.	14/20	70%		
Average	12/20	61%	16.6/20	83%

## Results

- Nursing knowledge improved from 61% on average pretest to 83% on average posttest taken 6 months post training.
- Patient satisfaction for the completion of Ultrasound Guided IV placement was rated as 10/10 on a scale of 1-10 with 10 being the most satisfied. The standard of care IV insertion group patient satisfaction was 8/10.
- Time to IV placement for difficult IV access was found to be 15:48 minutes for the ultrasound group versus 20:41 minutes for the standard of care group.
- Successful IV placement using Ultrasound guided IV insertion was 76% versus 56% for the standard of care group (p value = 0.0179).

Figure 4. Algorithm for study

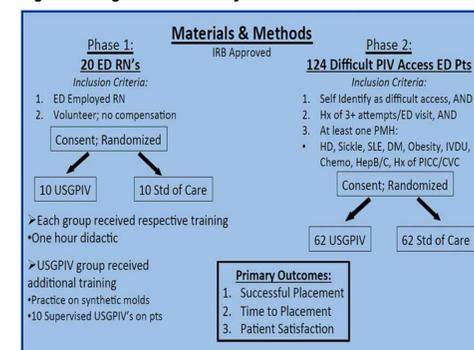


Figure 5. Outcomes of study

Successful Placement?	Yes	No	%	P-value
USGPIV	48	15	76	0.0179
Std of Care	33	26	56	

Patient Satisfaction	Median	p-value
USGPIV	10	0.035
Std of Care	8	

Time to Placement	Mean
USGPIV	15:48
Std of Care	20:41

Secondary Outcomes:
•Number of attempts
•Duration of PIV
•Reason for PIV Removal
•Nursing satisfaction

## Discussion

This pilot study showed a 76% success rate when utilizing ultrasound guidance to start IV's on difficult to access patients. An important advantage of the successful use of ultrasound by nursing staff is that nurses are usually the first to attempt line placement, and will be more likely to successfully complete their task if aided by ultrasound. This favorably impacts length of stay in the emergency department for the patient.

The percentage of difficult to access patients who go on to receive a central line probably varies among emergency departments.

A limitation of the study is that the researchers were unable to determine how many of the participants would have required a central line if ultrasound guidance was not used.

## Conclusion

Data suggests that training emergency nurses in ultrasound guided peripheral IV insertion may help to diminish the problem of difficult IV access in the ED setting.

Patient's satisfaction with ultrasound IV access was high. This supports the continued use of ultrasound guided IV insertion in the emergency department.

Developing a program to train nurses in the use of ultrasound guided IV technique has shown to improve IV cannulation times on difficult to access patients as well as increase patient satisfaction. The use of senior nursing staff as the core group selected was done to acknowledge their advanced skill set and added to the efficiency of departmental throughput and patient outcomes.

## References

- Blaivas, M. and Lyon, M. (2006). The effect of ultrasound guidance on the perceived difficulty of emergency nurse obtained peripheral IV access. *The Journal of Emergency Medicine*, 31(4): 407-410.
- Brannam, L., Blaivas, M., Lyon, M., and Falke, M. (2004). Emergency Nurses utilization of ultrasound guidance for placement of peripheral intravenous lines in difficult access patients. *Academy of Emergency Medicine*, 11(12): 1361-1363.
- Brauman, M., Braude, D. and Crandall, C. (2009). Ultrasound guidance vs. standard technique in difficult vascular access patients by ED technicians. *The American Journal of Emergency Medicine*, 27: 135-140.
- Chinnock, B., Thornton, S., and Hendey, G. (2007). Predictors of success in nurse performed ultrasound guided cannulation. *The Journal of Emergency Medicine*, 33(4): 401-405.
- Resolution GA11-014 – Ultrasound guided peripheral intravenous access (2011). Retrieved from [www.ena.org](http://www.ena.org).
- Clinical Practice Guideline: Difficult Intravenous Access (2011). Retrieved from [www.ena.org](http://www.ena.org).
- White, A., Lopez, F. and Stone, P. (2010). Developing and sustaining an ultrasound guided peripheral intravenous access program for emergency nurses. *Advanced Emergency Nursing Journal*, 32(2): 173-188.