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Original Research

Ultrasonography in the Rural Suburban Pre-hospital Setting: What training is required for Paramedics to become proficient Ultrasonographers?

Christine Van Dillen, MD[1], Desmond Fitzpatrick, MD[1], Joel Rowe, MD[2], Christian Zuver, MD[1], Danielle Dicesare, MD[1], Jessica Wanthal, MD[1], Linh Nguyen, MD[1], Austin Reed, MD[2], Brian Nadler, EMT-P, BS, ESFO, Kourtni Nadler, RDMS, RVS

[1] Orlando Health, [2] emergency medicine, University of Florida

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Objective

The purpose of this pilot study was to assess ultrasound image-acquisition skills by paramedics in a rural suburban United States ground EMS agency.

Methods

This prospective, pilot study was conducted with Paramedics with at least 1 year of experience as the case group. The Paramedics were trained in emergency ultrasound through a 5-hour didactic teaching course as well as 5 weeks of hands-on training with live human models. First year emergency medicine residents who completed an ultrasound orientation served as the control group. Images were obtained and recorded using Sonosite M-Turbo ultrasound with a phased array P21 transducer on a single adult male. The images were reviewed by a blinded, Ultrasound Fellowship-trained physician who graded the images on a 5-point Likert scale, with 5 representing the best quality.

Results

19 residents and 19 paramedics were enrolled. The mean overall image quality obtained by the case group was graded higher (4.06 vs. 2.98, $p<0.05$). In addition, the case group obtained significantly superior image quality of the subxiphoid (3.95 vs. 2.89, $p<0.05$), right upper quadrant (4.79 vs. 2.95, $p<0.05$), left upper quadrant (3.84 vs. 2.58, $p<0.05$), and suprapubic regions (4.32 vs. 3.05, $p<0.05$) of the eFAST exam.

Conclusions

This study demonstrated that appropriately trained rural suburban paramedics can obtain ultrasound images comparable in quality to those acquired by emergency medicine residents in training. This capability could enhance prehospital patient assessments, enabling better communication with receiving physicians and optimizing resource utilization. Future research should investigate whether prehospital ultrasound images can inform transport and treatment decisions, such as determining whether a patient should be transported to a trauma center or a non-trauma facility, thereby ensuring the most effective use of limited resources.

INTRODUCTION

Point-of-care ultrasound (POCUS) is a critical tool in assessing severely ill patients. In the context of trauma, early detection via ultrasound can lead directly to timely interventions and significantly influence outcomes. For instance, a trauma patient with unstable vitals and an ultrasound indicating hemoperitoneum may require emergent surgical intervention. POCUS provides both diagnostic and therapeutic benefits without delaying patient management, especially in time-sensitive, prehospital scenarios. It answers critical questions, such as identifying the most appropriate destination for the patient and determining whether the trauma team needs activation.[1-7]

Emergency medical services (EMS) have evolved significantly since their inception in the 1970s. Due to the diverse geographic and demographic areas served, EMS protocols vary widely across the United States and globally. The most recent position statement from the National Association of Emergency Medical Physicians (NAEMSP) and the American College of Surgeons committee on Trauma (ACS-COT) emphasizes, “Injured patients who meet physiologic and/or anatomic criteria should be transported directly to trauma centers providing the highest-level care within the defined trauma system."[5] However, in rural areas, transporting patients to trauma centers can reduce the availability of EMS units for other emergencies, potentially delaying response times for all the other patients in these systems. These challenges highlight the need for EMS agencies to tailor protocols based on available resources and the populations they serve. Rural agencies often face additional barriers, such as limited training opportunities and fewer resources, which can hinder the adoption of new skills or equipment.

A 2015 systematic review identified effective programs for training paramedics in focused assessment with sonography for trauma (FAST) that required only 6-8 hours of instruction. These programs included didactic and hands-on components, along with competency evaluations.[4] The review also noted that participants' educational backgrounds influenced the training required for competency. Many of these studies involved agencies with physicians as part of their teams. Identifying the training requirements for rural suburban ground EMS crews to achieve competency in ultrasound use could enable more prehospital services to deliver enhanced patient care. This would improve triage decisions for transport to trauma centers and optimize resource utilization by avoiding unnecessary transports in future protocols.

This pilot project aimed to develop an effective, structured training program—including didactic and hands-on components—for rural suburban ground prehospital providers to use ultrasound effectively. It also sought to evaluate their ability to acquire adequate sonographic images. Specifically, participants were trained to perform the Extended Focused Assessment with Sonography for Trauma (eFAST), the standard ultrasound protocol used in trauma centers to assess the abdomen and thoracic cavity for internal injuries. Participants acquired eFAST images from healthy volunteers and compared their results to those obtained by emergency medicine interns using the same model. The emergency medicine interns who were within their first 1-2 months of emergency medicine training and had completed their initial emergency medicine orientation ultrasound training. In brief, the training consists of a day-long introduction to emergency medicine ultrasound. Before the course, residents are asked to review introductory videos covering core US concepts to serve as a primer. Using live models and simulators, much of the orientation is dedicated to hands-on training that introduces residents to techniques and essential exams (such as FAST, cardiac, and central line placement). The orientation concludes with a review of ultrasound cases that showcase significant pathology. The course will serve as a foundation for residents to build their ultrasound skills over the next three years of their emergency medicine training.

METHODS

Prehospital providers from two EMS systems were recruited for the study. This study was presented to the Orlando Health Institution Review Board and was approved. Those who provided written consent were enrolled in a structured training program that included online lectures and in-person didactic and hands-on training. Each participant was assigned a control number for identification. Training sessions were integrated into the agencies' regularly scheduled training times. Participants were required to view online lectures provided by Philips™ before attending in-person training sessions conducted by board-certified emergency physicians with fellowship training in ultrasonography and eFAST image acquisition. The training sessions occurred five times over two months. They included further didactic lectures and hands-on practice using Philips ultrasound devices with a phased array P21 transducer on standardized live models.

After completing the training program, participants underwent a proctored testing session. They performed a timed eFAST image sequence during the session on a standardized model. First year emergency medicine residents served as our control group. They had completed their intern orientation ultrasound course, which consisted of 4 hourse of online lecture follow by two days of hands on training which was done over 12 hours. Participants were identified only by their control numbers. A structured data form recorded the control number and the time required to complete the scans. Images and video clips obtained during the test were saved anonymously for subsequent review. A fellowship-trained emergency physician ultrasonographer, blinded to participant identity and scan times, graded the images. Each eFAST view was assessed using validated criteria for technique (TQ) and image quality (IQ) on a 5-point Likert scale (1 = Poor, 5 = Excellent) based on ACEP guidelines for FAST image evaluation. The data were compiled into an electronic database for statistical analysis.

RESULTS

A total of 19 residents and 19 paramedics participated in the study. The paramedics' overall mean image quality was significantly higher (4.06 vs. 2.98, $p < 0.05$) compared to residents. Paramedics also achieved superior image quality in the subxiphoid (3.95 vs. 2.89, $p < 0.05$), right upper quadrant (4.79 vs. 2.95, $p < 0.05$), left upper quadrant (3.84 vs. 2.58, $p < 0.05$), and suprapubic (4.32 vs. 3.05, $p < 0.05$) regions of the eFAST exam.

DISCUSSION

This prospective quality comparison study evaluated the training required for rural suburban paramedics to acquire ultrasound eFAST images non-inferior to those obtained by emergency medicine residents. As prehospital care continues to evolve, ultrasound is emerging as a practical tool for assessing patients in various scenarios.[6] For this study, participants focused on acquiring still images of internal anatomy—a foundational step in performing an eFAST exam. Similar to the introduction of prehospital ECGs, which initially followed an "obtain and transmit" model before field interpretation became widespread, modern connected devices could enable prehospital providers to capture images and transmit them to receiving hospitals for interpretation.[7] Early access to this information could help activate trauma resources sooner and guide decisions on patient destination.

LIMITATIONS

This study faced several limitations. Due to time constraints for firefighter paramedics at a smaller agency, enrollment was limited, reducing the study's robustness. Additionally, the study did not include patients with diverse presentations, such as those with abnormal anatomy or pain, nor did it simulate real-world prehospital environments, such as austere conditions or in-transit scenarios. Another limitation was the difference in baseline professional training for the case versus the control group. This may limit the generalizability of these findings. Further research in these areas could help identify the optimal timing for retraining to ensure sustained competency and confirm this applicability across EMS agencies in other settings.

CONCLUSION

This pilot study demonstrated that appropriately trained rural suburban paramedics can obtain ultrasound images comparable in quality to those acquired by first-year emergency medicine residents who have completed initial ultrasound training. This capability could enhance prehospital patient assessments, enabling better communication with receiving physicians and optimizing resource utilization. Future research should investigate whether prehospital ultrasound images can inform transport and treatment decisions, such as determining whether a patient should be transported to a trauma center or a non-trauma facility, thereby ensuring the most effective use of limited resources.

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