

CHALLENGES OF IMPLEMENTATION OF A FAST-TRACKED PRE-HOSPITAL POCUS ROUTINE

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CHALLENGES OF IMPLEMENTATION OF A FAST-TRACKED PRE-HOSPITAL POCUS ROUTINE (Abstract): The COVID-19 pandemic has changed the way of care for our patients and for our staff, many departments have compared the pandemic period to a 4 yearlong mass casualty situation managing scarce resources with insufficient manpower in a constantly shifting environment. A major bottleneck for healthcare systems were imagistic studies and the constant need for it, a foundation of modern medical practice. With the aim to improve care and facilitate better decision making we introduced a portable ultrasound device to the pre-hospital team, after providing Point of Care Ultrasound workshops to practicing physicians. **Materials and methods:** We performed a prospective observational study over 6 months, during the height of the COVID pandemic, using the extended Focused Assessment Sonography in Trauma (eFAST) protocol and the Shock Index (SI) to understand patient status; voluntary sampling was done by emergency physicians. The final outcomes were patient numbers, severity and type of cases and usage trends. **Results:** the study registered 34 patients: 41% traumas, 35% cardiac arrests, 18% shock, 6% acute respiratory distress. **Conclusions:** The overall increase and necessity of POCUS use during the pandemic or other mass casualty incidents does not equate to competency or familiarity of use despite workshops, instruments and willingness. Adapting and improving implementation of any new techniques requires a mature and professional team willing to collaborate, establish transparent feedback loops and implementation programs catered to the local needs. In this article we discuss the benefits and flaws we identified from a direct approach. **Keywords:** EMERGENCY, FAST-TRACKED PRE-HOSPITAL, POCUS, ROUTINE.

Imagistic input is a staple of modern medical investigation, diagnosis and treatment but with high convenience comes a high vulnerability in critical times such as mass casualty situations or pandemics. One

of the first evocative, and dramatic, experiences of modern casualty management was during the 1988 earthquake in Armenia that had over 150000 victims and over 25,000 deaths, imagistic triage was accomplished

with 30 ultrasound scanners and one computer tomography machine (1). Romania has a symbiotic relationship with radiology while providing patient care (2) but with an ever-increasing reliance on advanced imagistic techniques to evaluate patients with critical illness, fatigue was evident in the radiology team and a way to quickly assess but also triage the need for future imagistic investigations needed to be adopted. In late 2020 following one year of pandemic experience, we added a portable ultrasound device to the pre-hospital phase, the GE Handheld VSCAN Dual Probe (General Electric Company, New York, USA), to help physicians provide better patient care and help with decision-making under difficult conditions due to pandemic fatigue and limitations imposed by personal protective equipment (PPE).

MATERIALS AND METHODS

Study Aim: Study how a fast-tracked implementation of ultrasound workshops influences emergency physician use of Point of Care Ultrasound in pre-hospital. We provide emergency physician pre-hospital teams with specific training and an ultrasound machine to improve critical patient diagnosis and management before arrival at the hospital.

Study Setting. A prospective observational study with voluntary sampling submitted by emergency physicians that are performing pre-hospital shifts on the Mobile Intensive Care ambulance (MIC) during the COVID-19 pandemic. The study was done one year after the introduction of the ultrasound machine to the ambulance.

The submitting physicians had previously participated in at least one Point of Care Ultrasound Workshop that was done with support from the European Society of

Emergency Medicine (EuSEM). The workshops were structured over a two-day teaching period with multiple working stations focused on participant scanning experience and scan time. Workshop covered ultrasound basics, extended Focused Assessment Sonography in Trauma (eFAST), aorta lung and cardiac views.

The MIC ambulance is sent to cases in various environments following initial calls to 112 that meet the requirements for potential life-threatening situation, in support to lower ranked ambulances that require assistance or to facilitate intra-hospital transfer of critical patients. The environment can present different levels of accessibility difficulty, and at times can be at considerable distances from the closest hospital due to local geographical features and hospital placement making field decisions (stay and play approach) even more important.

The study took place in the county of Iasi, Romania, between January and June 2022, with ethics commission approval number 147/31.01.2022 from the “Grigore T. Popa” University of Medicine and Pharmacy Iasi and the “Sf. Spiridon” County Clinical Emergency Hospital from Iasi ethics commission board – The ethics approval was a part of a larger study.

Study Design

Participating physicians were instructed to complete a standard report form detailing patient demographics, cardiovascular parameters, causes for examination, ultrasound findings, diagnosis, elapsed time from arrival of crew till hospital transport and difficulties encountered. The encouraged scanning protocol was eFAST but pinpoint observations were also openly accepted.

Data Collection

The reporting physician gathered all the information required and submitted it

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anonymously.

Data Analysis

Shock Index was calculated after data submission to quantify hemodynamic status. The cases were divided in 4 groups: shock, acute respiratory distress, cardiac arrest and trauma depending on presenting motive, positive findings were noted, elapsed time from crew presentation till hospital arrival, and final diagnosis.

Descriptive data analysis was performed.

RESULTS

The starting point for the study was 2019, when POCUS was not performed in

our Emergency Department by emergency physicians, due to ease of access and close collaboration with the radiology department for diagnostic ultrasonography and advanced imaging (2).

The total number of participating physicians was 23 and the total number of cases submitted was 34. Emergency physicians preferred to use ultrasound with the following types of cases: 6 with shock, 2 with acute respiratory depression, 14 with trauma and 12 with cardiac arrests. The age varied between 18 and 81 years with an average of 57 and a ratio of female to male of 2.1:1. Shock Index was above 0.75 in 14 cases out of 22.

TABLE I
Categories of patients' groups

Category	Patients	Shock Index > 0.75	Causes/initial examination	US Findings
Overall	34	14		19 Positive findings
Shock	6	4	2 Undifferentiated, 2 Septic, 4 Cardiac,	4 Hypokinesia, 2 RV Strain
Trauma	14	8	12 Road Traffic Accidents, 2 Falls from Height	6 Free abdominal fluid, 2 Pneumothorax
Cardiac Arrest	12	N/A	8 Asystole, 2 PEA, 2 VT/VF	3 Mechanical activity, 2 RV strain
Acute Respiratory Distress	2	2	N/A	N/A

The **shock group** had a total of 6 patients out of which, 2 had an undifferentiated shock, 0 presented as septic, 4 had a cardiogenic shock and none presented with obstructive shock. A Shock Index of >0.75 was identified in 4 patients. Ultrasound findings reported were positive in 4 patients with hypokinesia and 2 with right ventricle (RV) strain.

The **group with acute respiratory distress** numbered 2 patients both with a SI >

0.75 but with no significant findings on ultrasound scans.

The **trauma group** numbered 14 patients, 12 were due to road traffic accidents and 2 fell from height (more than two meters). From the 14 patients with trauma, 8 patients had a SI >0.75 . eFAST scans were done and 6 patients were found positive for abdominal free fluid and 2 for pneumothorax.

The **cardiac arrest group** numbered 12 patients that had as initial rhythm as fol-

low, 8 with asystole, 2 with pulseless electrical activity and 2 with Ventricular Fibrillation or Ventricular Tachycardia. On ultrasound scan during CPR 3 patients were found to have mechanical activity 2 of which presented Right Ventricle strain.

The following difficulties while performing ultrasound in pre-hospital were reported by operators: 7 cases were difficult to exam/obtain images due to body status, 2 were very agitated, 1 due to extremely low ambient temperature and 1 due to patient lodged foreign body and the way he/she was immobilized in a patient from road traffic crash.

The following data was excluded from the data presented due to inconsistencies in submissions: The time elapsed at the scene and the time of arrival at the hospital. Accuracy of findings was not possible as follow-up was not completed due to multiple factors described in the discussion sub-heading.

DISCUSSION

The COVID pandemic challenged the way we practice medicine and the way we implement new techniques and habits into daily practice due to a constant struggle to reduce risk of infection for both patients and staff with several rushed decisions having to be made to cope with new patient influx and adjust to current working realities.

A lot of suspected COVID patients were investigated at the start of the pandemic by computer tomography (CT); drastically increasing the rate of non-contrasts scans (4). Although a shift from early CT assessment was done, usage remained high due to an increased risk of COVID patient population complications such as pulmonary embolism or co-infections. CT was also recommended to patients with an ini-

tial negative RT-PCR but a high suspicion of severe infection especially in environments with limited test in (5, 6, 7). Alongside the influx of COVID infections, non-COVID medical and surgical patients had diagnostic, management and treatment requirements that needed radiology input. Overall, this contributed to a tremendous stress on the radiology department and increased waiting times in some already standstill emergency departments.

The high workload was taking a toll the medical personnel and already in 2020 reports were coming out stating that 46% of radiologists were burned out compared to the average of 42% in all other specialties due to workload, complexity of cases, constant change of schedule and longer time between scans due to decontamination measures (8, 9).

As the pandemic progressed, technology started to step in and relieve pressure from repetitive tasks. Deep learning models were implemented to help analyze chest x-rays and chest CT obtaining a sensitivity of 92.3% and specificity of 85.1% for CT at the start of the pandemic progressing to a sensitivity of 97.6% and specificity of 78.6% with chest x-rays, but this was not available everywhere (10, 11, 12). Lung ultrasound such as the BLUE protocol (13) is seen as a viable way of imaging patients with accuracy rates comparable to CT or X-rays (14-17) but with obvious limitations in the form of required user experience.

The decision to initiate advanced imaging requests is directed by physicians, and with a high workload, decision fatigue was high. The choice to develop POCUS protocol use within our department was appropriate, especially since steps to develop a POCUS program was underway prior to the pandemic. The goal was to relieve pressure

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from the radiology department by optimizing patient evaluation and provide the means of getting the required simple, straightforward answers needed in most cases. The goal of POCUS has always been that of answering simple but important questions at the right time to provide clarity to the attending physician (18).

The workshops we provided are supported by experienced POCUS providers from the European Union Society of Emergency Medicine (EUSEM) and started two years prior to ultrasound introduction to the ambulance crew. They were geared to provide participants with the maximum scanning time and patient experience within the two days of the workshop, covering different topics and learning goals. Initial enthusiasm was high for the first workshop in the first half of 2019, before the pandemic, and during the second one, that took place in 2021 in the middle of the pandemic. The introduction of an ultrasound machine to the ambulance was also met with great enthusiasm and seen as a breath of fresh air in a very difficult environment due to epidemic restrictions, high patient load and personal protective equipment (PPE).

The study was started one year after the introduction of ultrasound to the pre-hospital, to have a better idea of trends and usage. The initial enthusiasm did not carry well to practice, at least when translated into submitted cases for the study. The meager 34 properly submitted cases did not meet surveyor expectations but the reasoning behind it provided valuable information on local learning requirements and characteristics.

The lack of cases submitted was partly explained by 1) the fact that POCUS was not considered to be of use in all encountered cases and 2) when faced with critical

cases that would have benefited from POCUS but required fast actions, most doctors preferred to fall back on ingrained behavior from Advanced Life Support or Advanced Trauma Life Support protocols without utilizing POCUS due to feelings of inadequacy from lack of experience with ultrasound.

Participants also declared that ultrasound was used a lot more than the submitted cases but due to long mission times, downtimes due to decontamination or back-to-back missions, information was omitted and not submitted to not pollute results.

The main request from most of the participants was more workshops or even implementation of POCUS curricula for residents, where even established physicians could participate. This led us to further implement an expansion of POCUS teaching into actual clinical practice to stress its usability in critical situations. These aspects have been studied and detailed in another study, performed and published by the authors (18). Without guidance and experience sharing the risk of inconsistent results or wrongful use is high and this in turn makes it dangerous for the operator to trust in the gained skills but also for them to practice in a wrong or inefficient manner.

Experience gathered during this period, can easily be applied to future mass casualty situation or other pandemics that may or may not come, solidifying the importance of adaptability and agility.

Documentation is a normal part of daily medical life, especially in pre-hospital where every step, procedure, medication and detail need to be noted to ensure safety of all parties. A severe disruption in effective documentation was noted during the heights of the pandemic, due to a multitude

of factors such as: personal protective equipment, sterilization protocols for ambulances and equipment, translating into long down-times and sometimes inability to maintain correct medical documentation. (19) An important limitation of our study was the lack of integration of data from the ultrasound machine to safe localized data storage and thus a heavier reliance on human scribing and submitting.

An implementation of the lessons learned in this study with the addition of easier to use and automate reporting mechanisms would provide a better understanding of POCUS usage and changes required to improve teaching and study protocols for future research.

CONCLUSIONS

Implementing correct and confident POCUS use in the daily practice of acute high paced departments cannot be achieved by providing ultrasound workshops. These will provide respite in resource strained environments but in the case of patients that require fast decisions, seldom will care

providers, with just workshops experience, use these skills effectively in their evaluation and care, falling back to ingrained behavior or risk misusing said skills. The lessons learned from adapting to difficult conditions such as those created by the pandemic are that we need to cultivate flexibility and adaptability, both of which are characteristics POCUS. Creating the prerequisites for a POCUS training curriculum would provide better current care and better resistance in the event of future mass casualty situations.

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