Point-of Care-Ultrasound by Military Clinicians: A Review of the

Alexis Blessing^{1,2},Shelia Savell¹, Darren Baldwin¹, Joseph Maddry^{1,3} ¹United States Air Force En route Care Research Center/59th MDW/ST, ²Oak Ridge Institute of Science and Education, ³Department of Emergency Media

Background

- Ultrasound (US) has long been used for trauma assessment in the initial evaluation of patients with suspected blunt trauma.
- US technology has the potential to improve diagnostic accuracy and enhance patient care in the prehospital austere setting.
- Emergency ultrasound is not meant to replace a thorough history and exam, but to quickly answer specific questions and support decision making.
- US devices have evolved over time and continue to get smaller, lighter, more portable, and more durable.

Objective

The purpose of this project was to report data related to the use of point-of-care US (POCUS) by military clinicians and to describe specific ultrasound devices.

Methods

- Databases searched: PubMed, Cochrane, Scopus, Web of Science, Defense Technical Info. Center
- Keywords: military, ultrasound
- Inclusion Criteria: Use of ultrasound by military clinicians with report of sensitivity/specificity, accuracy of exam and/or clinical decision impact

Table 1. Military Studies											
Study #	Device	Sample	Training	Results							
1	SonoSite M- Turbo	28 Army medics	1-hour didactic & 1-hour hands-on training, used chicken model (chicken thigh in surgical glove), each medic was presented with 20 randomized models.	Sensitivity 73%Specificity 78%							
2	Not specified	32 Army Combat medics	15-minute lecture on transtracheal US techniques, followed by hands-on practice	Sensitivity 66.7%Specificity 76.4%							
3	Not specified	12 Army National Guard combat medics	5-minute lecture and brief hands-on training.	 44 of 48 exams accurately documented presences of cardiac activity. 							
4	SonoSite M- Turbo	20 18Ds	3-minute orientation & training.	Sensitivity 100%Specificity 90%							
5	Not specified	29 18Ds	16.7 hours training on average using SOLCUS outline. Included FAST exam, pneumothorax detection & musculoskeletal exam.	 4 fracture cases presented – 100% were correctly diagnosed and confirmed by x-ray. 							
6	SonoSite Vet*	22 physician assistants, SOFs and conventional force medics, veterinary technicians, and food service inspectors	10-minute slide show training & orientation to US machine.	Sensitivity 95.5%Specificity 100%							
7	FuKuda Denshi USA Device	34 Conventional US Army medics naïve to US	 90-minute classroom didactic & 150- minute hands-on scanning instruction (n=19) 90-minute video from SonoSim & 150- minutes hands-on scanning instruction (n=15) 	 There was no statically significant difference between knowledge, technical performance, or diagnostic accuracy between medic groups. 							
8	SonoSite M- Turbo	2 military medicine residents in a French Army teaching hospital	90-minute theoretical and practical (10 US in healthy students, 50 US in patients with symptoms, observed by trainer) US training focused on the gall bladder, kidney & upper urinary tract & the deep venous network of the lower extremities.	 48 patients had ultrasounds, 18 gall- bladder, 16 renal, 14 lower extremity. POCUS improved diagnostic accuracy in 73% of cases, was misleading in 2% and did not contribute to 25%. 							
9	SonoSite 4-6 MHz	3 consultant radiologists, deployed to the Role 3 MTF, Camp Bastion Jan May 2014.	N/A – Retrospective review	 Sensitivity 75% Specificity 99.3% Overall accuracy 94.7% ID of intraperitoneal free fluid - PPV 96.2% & NPV 94.4% 							
10	SonoSite M- Turbo	Consultant radiologist at a Role 2 MTF - Op TRENTON 3	N/A – prospective questionnaire study aimed to assess usefulness of diagnostic US in Role 2 setting.	 US increased diagnostic confidence in 68% cases and led to a change in patient management for 29% cases. 3% had no clinical impact. 							
11	GE Vscan	15 trainee doctors during French pre- deployment simulation training	 MEDICHOS (medical courses in hostile environments) internship 2-hour training on the use of the Vscan & US devices were provided, trainees to use their discretion. 	 eFAST or POCUS exams performed on 26% simulated patients. 51% of US cases had a significant impact of therapeutic and evacuation priorities Changed 67% of therapeutic decisions and 72% of evacuation priorities 							

Assessment of Sonography for Trauma; PPV = positive positive value; NPV = negative positive value.

- limit the ability to assess utility of specific devices.
- Patient outcome data was not well described.

This study was conducted under a protocol reviewed and approved by the U.S. Air Force 59th Medical Wing Institutional Review Board. The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Air Force, Department of the Army, Department of Defense, or US Government



Result

Limitations

> A portion of military studies did not specify the US device used and

Conclusions drawn form studies are limited due to small samples.







Model	Features							
CE Hooltheore	 Handhold dovice with dual has 							

Litera	ature	(*	SUT NEDICAL MIRAC							
cine, San Antonio Military Medical Center												
S												
A GE He	althcare	B SonoSite iViz	C. Phi	illins Lumify	D Butterfly iO	F Clarius C3						
V-Scar	Extend		12 C. Phillips Lumity D.			Convex						
Table 2. Porta	ble Handheld	Devices										
Model GE Healthcare Vscan Extend	 Handheld devi store images t 60-minute con online apps av educational vid requires gel 	Features ce with dual-headed pro hrough Wi-Fi or USB tinuous scanning on full vailable to augment stud deos available	obe charge ies	Size Device: 17 · 7.8 · 2.1 cm Dual Probe: 12.9 · 3.9 · 2.8 c	Weight Device: 365 g Dual probe: 120 g Sector probe: 85g Main unit with Dual probe: 400g	Transducers Two transducers in one probe: linear and sector						
SonoSite iViz	 Aircraft alumin transducers 64 GB flash dr Three swappa continuous sca Embedded ed Requires gel Can be droppe fully submergil 	um tablet with multiple ive & cloud storage ble batteries each with f an time ucational tools ed up to 3 feet; IPX-7 ra- ple in water	1-hour ted –	Tablet: 18.3 · 11.7 · 2.7 cm	Tablet: 570 g	Curved C60v, Linear L25v, Linear L38v, Phased P21v						
Philips Lumify	 Transducers a Uses tablet as depends on at requires gel How-to videos 	ttach to Android devices a power source - batter tached device available	s ry life	Curved transducer: 4.5 · 11.4 cm	Curved transducer: 136 g	Linear L12–4, Curved C5–2, Phased S4–1						
Butterfly iQ	 Transducer att unlimited cloud Built-in battery Does not use hours of contin No gel require Anodized alun Educational vi 	aches to Apple mobile of d storage ; wireless charging Piezo crystal technology nuous scanning on full c d ninum body; thermally e deos available	devices /; 2 harge fficient	Transducer: 18.5 · 5.6 · 3.5 c	Transducer: 313 m g	Single transducer emulates any kind of transducer						
Clarius C3 Convex	 Handheld devi Android. 60 min battery App based, wi access to ope Magnesium sh drops up to 1 r Educational vi 	ce – 3 probes-in-1 for i power, 3 swappable ba reless, does not require rate. well, waterproof & withsta meter deos available	DS and atteries internet ands	Device: 16.7 · 9.9 · 4.2 c	Device: 540 g	Three clip-on tips to scan entire body						

Note. Adapted from Canepa and Harris (2019)

Conclusions

The body of evidence related to the use of POCUS by military medics is limited but provides proof of concept.

More research with larger sample sizes and evaluation of patient outcomes is needed.

Acknowledgments

Funding Support: DJ9

Corresponding author: ioseph.k.maddry.mil@mail.mil