Canadian Agency for Drugs and Technologies in Health

RAPID RESPONSE REPORT: REFERENCE LIST

TITLE: **Portable Ultrasound Devices for the Assessment of Trauma in Rural or Remote Settings: Clinical Effectiveness**

DATE: 16 October 2014

RESEARCH QUESTION

What is the clinical effectiveness of portable ultrasound devices for the assessment of trauma in rural or remote settings?

KEY FINDINGS

No relevant literature regarding the clinical effectiveness of portable ultrasound devices for the assessment of trauma in rural or remote settings was identified.

METHODS

A limited literature search was conducted on key resources including PubMed, The Cochrane Library (2014, Issue 10), University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2009 and October 10, 2014. Internet links were provided, where available.

SELECTION CRITERIA

One reviewer screened citations and selected studies based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria	
Population	Any patient who has experienced a traumatic injury
Intervention	Portable ultrasound used by a multidisciplinary team (physicians, nurses)
Comparator	Fixed ultrasound machines, other portable ultrasounds
Outcomes	Clinical effectiveness, diagnostic accuracy, clinical benefit and harm

Study Designs	Health technology assessment reports, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies.

RESULTS

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, non-randomized studies, and evidence-based guidelines.

No relevant health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, or non-randomized studies regarding the clinical effectiveness of portable ultrasound devices for the assessment of trauma in rural or remote settings were identified.

Additional references of potential interest are provided in the appendix.

Health Technology Assessments
No literature identified.

Systematic Reviews and Meta-analyses
No literature identified.

Randomized Controlled Trials
No literature identified.

Non-Randomized Studies
No literature identified.

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APPENDIX – FURTHER INFORMATION:

Non-Randomized Studies – Other Settings

1. Bhoi S, Sinha TP, Ramchandani R, Kurrey L, Galwankar S. To determine the accuracy of focused assessment with sonography for trauma done by nonradiologists and its comparative analysis with radiologists in emergency department of a level 1 trauma center of India. J Emerg Trauma Shock [Internet]. 2013 Jan [cited 2014 Oct 15];6(1):42-6. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3589858
PubMed: PM23493113

   BACKGROUND: Focused assessment with sonography for trauma (FAST) is an important skill during trauma resuscitation. Use of point of care ultrasound among the trauma team working in emergency care settings is lacking in India. OBJECTIVE: To determine the accuracy of FAST done by nonradiologists (NR) when compared to radiologists during primary survey of trauma victims in the emergency department of a level 1 trauma center in India. MATERIALS AND METHODS: A prospective study was done during primary survey of resuscitation of nonconsecutive patients in the resuscitation bay. The study subjects included NR such as one consultant emergency medicine, two medicine residents, one orthopedic resident and one surgery resident working as trauma team. These subjects underwent training at 3-day workshop on emergency sonography and performed 20 supervised positive and negative scans for free fluid. The FAST scans were first performed by NR and then by radiology residents (RR). The performers were blinded to each other's sonography findings. Computed tomography (CT) and laparotomy findings were used as gold standard whichever was feasible. Results were compared between both the groups. Intraobserver variability among NR and RR were noted. RESULTS: Out of 150 scans 144 scans were analyzed. Mean age of the patients was 28 [1-70] years. Out of 24 true positive patients 18 underwent CT scan and exploratory laparotomies were done in six patients. Sensitivity of FAST done by NR and RR were 100% and 95.6% and specificity was 97.5% in both groups. Positive predictive value among NR and RR were 88.8%, 88.46% and negative predictive value were 97.5% and 99.15%. Intraobserver performance variation ranged from 87 to 97%. CONCLUSION: FAST performed by NRs is accurate during initial trauma resuscitation in the emergency department of a level 1 trauma center in India.

2. Weinberg ER, Tunik MG, Tsung JW. Accuracy of clinician-performed point-of-care ultrasound for the diagnosis of fractures in children and young adults. Injury. 2010 Aug;41(8):862-8.
PubMed: PM20466368

   INTRODUCTION: Injury is a major cause of death and disability in children and young adults worldwide. X-rays are routinely performed to evaluate injuries with suspected fractures. However, the World Health Organisation estimates that up to 75% of the world population has no access to any diagnostic imaging services. Use of clinician-performed point-of-care ultrasound to diagnose fractures is not only feasible in traditional healthcare settings, but also in underserved or remote settings. Our objective was to determine the accuracy of clinician-performed point-of-care ultrasound for the diagnosis of fractures in children and young adults presenting to an acute care setting. METHODS: We conducted a prospective cohort study of patients aged <25 years that presented to emergency departments with injuries requiring X-rays or CT for suspected fracture. Paediatric

emergency physicians with a 1h training session diagnosed fractures by point-of-care ultrasound. X-rays or CT were used as the reference standard to determine test performance characteristics. RESULTS: Point-of-care ultrasound was performed on 212 children and young adults with 348 suspected fractures. Forty-two percent of all bones imaged were non-long bones. The prevalence rate of fracture was 24%. Overall: sensitivity-73% (95% CI: 62-82%), specificity-92% (95% CI: 88-95%); long bones: sensitivity-73% (58-84%), specificity-92% (86-95%); non-long bones: sensitivity-77% (58-90%); specificity-93% (87-97%); age> or =18 years: sensitivity-60% (39-78%), specificity-92% (87-96%); age<18: sensitivity-78 (65-87%), specificity-93% (87-95)%. Majority of errors in diagnosis (>85%) occurred at the ends-of-bones. CONCLUSIONS: Clinicians with focused ultrasound training were able to diagnose fractures using point-of-care ultrasound with a high specificity rate. Specificity rates to rule-in fracture were similar for non-long bone and long bone fractures, as well as in skeletally mature young adults and children with open growth plates. Clinician-performed point-of-care ultrasound accuracy was highest at the diaphyses of long bones, while most diagnostic errors were committed at the ends-of-bones or near joints. Point-of-care ultrasound may serve as a rapid alternative means to diagnose midshaft fractures in settings with limited or no access to X-ray.

Review Articles

3. Holt T, Thompson M, Price CP, Heneghan C, Plüddemann A. Portable ultrasound devices [Internet]. London (UK): National Institute for Health Research, NHS; 2014 Jan [cited 2014 Oct 15]. (Horizon Scan Report 0036). Available from: http://www.oxford.dec.nihr.ac.uk/horizon-scanning/horizon-scanning-report0036-ultrasound.pdf

4. Nelson BP, Melnick ER, Li J. Portable ultrasound for remote environments, part I: feasibility of field deployment. J Emerg Med. 2011 Feb;40(2):190-7. PubMed: PM20097500

   BACKGROUND: In field medical operations, rapid diagnosis and triage of seriously injured patients is critical. With significant bulk and cost constraints placed on all equipment, it is important that any medical devices deployed in the field demonstrate high utility, durability, and ease of use. When medical ultrasound was first used in patient care, machine cost, bulk, and steep learning curves prevented use outside of the radiology department. Now, lightweight portable ultrasound is widely employed at the bedside by emergency physicians. The techniques and equipment have recently been extrapolated out of the hospital setting in a wide variety of environments in an effort to increase diagnostic accuracy in the field. OBJECTIVES: In this review, deployment of lightweight portable ultrasound in the field (by emergency medical services, military operations, disaster relief, medical missions, and expeditions to austere environments) is examined. The feasibility of field deployment and experiences of clinicians using ultrasound in a host of environments are detailed. In addition, special technological considerations such as telemedicine and machine characteristics are reviewed. CONCLUSIONS: The use of lightweight portable ultrasound shows great promise in augmenting clinical assessment for field medical operations. Although the feasibility of the technology has been demonstrated in certain medical and trauma applications, further research is needed to determine the utility of ultrasound use for medical illness in the field.

5. Nelson BP, Melnick ER, Li J. Portable ultrasound for remote environments, part II: current indications. J Emerg Med. 2011 Mar;40(3):313-21.
PubMed: PM20097504

BACKGROUND: With recent advances in ultrasound technology, it is now possible to deploy lightweight portable imaging devices in the field. Techniques and studies initially developed for hospital use have been extrapolated out of the hospital setting in a wide variety of environments in an effort to increase diagnostic accuracy in austere or prehospital environments. OBJECTIVES: This review summarizes current ultrasound applications used in out-of-hospital arenas and highlights existing evidence for such use. The diversity of applications and environments is organized by indication to better inform equipment selection as well as future directions for research and development. DISCUSSION: Trauma evaluation, casualty triage, and assessment for pneumothorax, acute mountain sickness, and other applications have been studied by field medical teams. A wide range of outcomes have been reported, from alterations in patient care to determinations of accuracy compared to clinical judgment or other diagnostic modalities. CONCLUSIONS: The use of lightweight portable ultrasound shows great promise in augmenting clinical assessment for field medical operations. Although some studies of diagnostic accuracy exist in this setting, further research focused on clinically relevant outcomes data is needed.

6. Mundy L, Hiller JE. Hand-held portable mini ultrasounds for applications including emergency rooms and ambulances [Internet]. Adelaide: Adelaide Health Technology Assessment (AHTA). 2010 Apr [cited 2014 Oct 15]. (Horizon Scanning Prioritising Summary Volume 26). Available from:
http://www.horizonscanning.gov.au/internet/horizon/publishing.nsf/Content/C8A5BA60BD01A93ECA257757000A2015/$File/PS_Mini%20hand%20heldultrasound.pdf

7. Gaebel K, Kaulback K, Robertson D, Blackhouse G, Xie F, Assasi N, et al. Portable ultrasonography in small emergency departments: a systematic review of the guidelines and clinical-effectiveness [Internet]. Ottawa: Canadian Agency for Drugs and Technologies in Health (CADTH); 2009 Mar [cited 2014 Oct 15]. Available from:
http://www.cadth.ca/en/publication/892