



# Handheld Ultrasound in Wilderness Settings: An Update to the Advanced Wilderness Life Support (AWLS) Text

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## BACKGROUND

- Point of care ultrasound is an increasingly utilized imaging modality both within hospital and out-of-hospital settings
- Its applicability extends to rural and austere settings because it is uniquely durable, portable and battery powered<sup>1-3</sup>
- Existing literature delineates uses for ultrasound in austere settings, rural clinics, combat and natural disasters. As handheld ultrasound becomes widely available, there is potential for use in wilderness settings such as extended backcountry expeditions
- Medical personnel carrying handheld ultrasound in these wilderness settings may lack information about this equipment, such as proper indications, limitations, and device considerations including durability and options for alternative coupling gels

## AIMS

- Investigate uses of portable ultrasound in wilderness and austere settings
- Distill uses and considerations of portable ultrasound into an introductory and accessible chapter in Advanced Wilderness Life Support text
- Identify an area within wilderness medicine ultrasound for further study

## METHODS

- A literature review was conducted to review ultrasound uses in wilderness, military, high altitude, austere and rural settings.
  - Databases: Scopus, PubMed
  - Search Terms: "austere OR wilderness" AND "ultrasound OR ultrasonography"
  - Dates: 1998 - 2020
  - 116 articles returned, 31 reviewed
- Handheld ultrasound product websites were reviewed, including Butterfly IQ, Phillips Lumify, GE Vscan, Sonosite iViz, and Clarius
- Ultrasound learning modalities were consulted for fundamentals<sup>4-5</sup>

## RESULTS: CHAPTER CONTENT

- The text is a 15 page chapter organized in the following subheadings with guiding pictures (as shown) on proper probe placement and pathology:

- Principles of Portable Ultrasound: Brief discussion of echogenicity, transducer types, and ultrasound terminology including gain, depth, and doppler

- Device Considerations: Review of considerations in austere settings, including: portability, durability, power, data storage, telemedicine capability, and gel substitutions



Fig 1: Ultrasound transducers from left to right: curvilinear, linear and phased array

- Indications in Wilderness Settings:

- Extended Focused Assessment with Sonography for Trauma (eFAST): In traumatic injury, evaluate for pericardial tamponade, pneumothorax, hemothorax, and peritoneal free fluid that typically represents internal bleeding



Fig 2: eFAST window of left upper quadrant with pathologic free fluid near spleen



Fig 3: eFAST pelvic window with pathologic free fluid near bladder

- Cardiac Exam: Assess left ventricular function and check for an obstructive process like pulmonary embolism

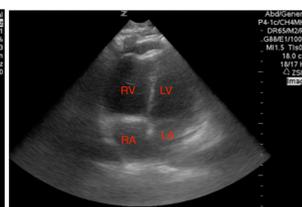


Fig 4: Standard cardiac windows to assess global function include parasternal long axis (left) and apical 4 chamber (right)

- Inferior Vena Cava (IVC) Exam: Assess IVC diameter to differentiate underlying cause of shock
- Musculoskeletal Exam: Assess for long bone fractures, joint dislocations, and joint effusions
- Dyspnea: Identify etiology including pneumothorax, pneumonia, pulmonary contusion, pulmonary embolus, or heart failure

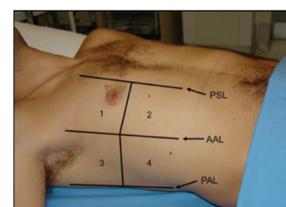


Fig 5: Thoracic exam includes 4 lung windows per side for total of 8 windows

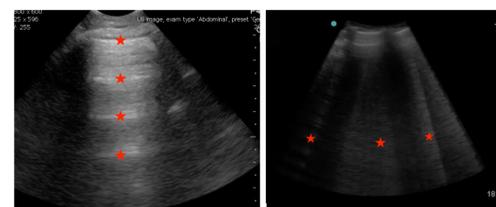


Fig 6: A lines are seen in a normal lung (left, starred), while B lines are pathologic (right, starred)

- Soft Tissue: Improve accuracy of assessing for abscess and cellulitis and to identify and remove foreign bodies
- Undifferentiated Abdominal Pain: Identify potential etiologies including ectopic pregnancy, gallstones, small bowel obstruction, appendicitis, and kidney stones

- An accompanying podcast was recorded to review the key points of the text

## DISCUSSION

- The following themes emerge from the literature review and are emphasized in the text:
  - Handheld ultrasound units should be considered for long expeditions where specialty resources may not be available, or where evacuation would be difficult or dangerous
  - Ultrasound has better specificity than sensitivity, so in the backcountry, its greatest utility is in ruling in emergent pathology such as with eFAST and getting the victim to care sooner<sup>1,6</sup>
  - Ultrasound is operator dependent and should be used as an adjunct to support but not replace clinical findings and to increase suspicion for a diagnosis.<sup>7</sup> This is important in the backcountry where other diagnostic testing is not available, and where ultrasound may be a new skill

## FUTURE DIRECTIONS

- Ongoing: Identify and compare ultrasound coupling alternatives (i.e., sunscreen, energy gels, liquid body soap) to commercial gel for use in austere wilderness settings

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