

# Ultrasound in Emergency Medicine



## MULTI-INSTITUTION VALIDATION OF AN EMERGENCY ULTRASOUND IMAGE RATING SCALE—A PILOT STUDY

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**Abstract—Background:** As bedside ultrasound (BUS) is being increasingly taught and incorporated into emergency medicine practice, measurement of BUS competency is becoming more important. The commonly adopted experiential approach to BUS competency has never been validated on a large scale, and has some limitations by design. **Objective:** Our aim was to introduce and report preliminary testing of a novel emergency BUS image rating scale (URS). **Methods:** Gallbladder BUS was selected as the test case. Twenty anonymous BUS image sets (still images and clips) were forwarded electronically to 16 reviewers (13 attendings, 3 fellows) at six training sites across the United States. Each reviewer rated the BUS sets using the pilot URS that consisted of three components, with numerical values assigned to each of the following aspects: Landmarks, Image Quality, and Annotations. Reviewers also decided whether or not each BUS set would be “Clinically Useful.” Kendall  $\tau$ s were calculated as a measure of concordance among the reviewers. **Results:** Among the 13 attendings, image review experience ranged from 2–15 years, 5–300 scans per week, and averaged 7.8 years and 60 images. Kendall  $\tau$ s for each aspect of the URS were: Landmarks: 0.55; Image Quality:

0.57; Annotation: 0.26; Total Score: 0.63, and Clinical Usefulness: 0.45. All URS elements correlated significantly with clinical usefulness ( $p < 0.001$ ). The correlation coefficient between each attending reviewer and the entire group ranged from 0.48–0.69, and was independent of image review experience beyond fellowship training. **Conclusion:** Our novel URS had moderate-to-good inter-rater agreement in this pilot study. Based on these results, the URS will be modified for use in future investigations. © 2015 Elsevier Inc.

**Keywords—**ultrasound education; competency; image rating scale; bedside ultrasound

## INTRODUCTION

Bedside ultrasound (BUS) is commonly utilized by emergency physicians to expedite patient care. It is also an essential component of the emergency medicine residency training core curriculum (1–4). Currently, BUS competency is largely defined by the number of images acquired and submitted for review by a trainee or

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practicing physician (5–7). This has also been adopted by many emergency departments (EDs) throughout the United States as a standard for credentialing and granting of BUS privileges.

Although this “fixed number” approach to BUS competency was forged by expert consensus and is easy to measure and implement, it never has been validated on a large scale. Defining competency based on the number of expert reviewed images alone also seems rigid from an educational point of view, because it does not take into account individual variation in skill acquisition and clinical utility of the acquired images. As BUS is being taught to more trainees and accepted as standard of care in EDs across North America, many feel there is a need for an individually tailored yet tangible measurement of competency. Jang et al. examined the learning curve of emergency physicians in acquiring first-trimester pregnancy and gallbladder BUS and concluded that “another method of competency assessment may be necessary” (8,9). The Residency Review Committee for Emergency Medicine has also recently changed the BUS training requirement from a minimum number of examinations to a document of competency (though “competency” was not further defined) (10).

Quantifying BUS attributes using an image rating scale may be an alternative method to assess BUS competency. A simple, validated, and consistently applied BUS image rating scale could be a useful tool to standardize and enhance the educational value of the ED BUS image review process. Instead of receiving feedback on interpre-

tive errors alone, physicians can regularly review their scores on the image rating scale and improve their skills in defective areas. If adopted by multiple institutions, it can potentially streamline BUS credentialing and privileging. To date, there has been no such standardized BUS image rating scale.

A technically adequate BUS study should entail adequate anatomical landmarks, good image quality, and adequate annotations to clarify the images when indicated. It should also help facilitate decision-making in the clinical setting. Based on these assumptions, we developed a three-component, eight-point BUS image rating scale (URS). Our objective was to report preliminary testing of this URS at training sites across the United States (U.S.).

## METHODS

This was a multi-site study evaluating the agreement among expert image reviewers applying a novel URS to selected BUS studies. The study was approved by the Advocate Health Care Institutional Review Board. Our URS consists of three components: Anatomical Landmarks, Image Quality, and Image Annotations, with numerical values assigned to each component as a measurement tool (Figure 1). It was developed by two of the investigators (SL, ML) and modified with input from participating reviewers.

A total of 20 BUS patient portfolios (consisting of both still images and clips) were selected retrospectively by

### Diagrams

#### Ultrasound Rating Scale (URS)

##### Landmarks

- 1- Unclear anatomical location. Landmarks for applications absent
- 2- Anatomical location identifiable. Landmarks for application inadequate to identify potential pathology
- 3- Anatomical location adequate. Landmarks for application adequate. Additional views and details desirable but unlikely to compromise diagnostic accuracy
- 4- Anatomical location evident. Landmarks for application evident. Additional views and details unnecessary
- 5- Anatomical location clearly evident. Landmarks for application clearly evident. Clear views and details

##### Image Quality

- 1- Poor overall image gain, contrast, resolution, and depth
- 2- Adequate overall image gain, contrast, resolution, and depth
- 3- Optimal overall image gain, contrast, resolution, and depth

##### Annotations

- 1- Insufficient —image itself cannot clarify application, or text annotation lacking
- 2- Sufficient-- image itself clarifies application, or text annotations supportive

Total possible score: 5 + 3 + 2 = 10 (range 3-10)

**Figure 1. Ultrasound Rating Scale.**

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