THE DIAGNOSTIC ACCURACY OF THE RAPID ULTRASOUND (RUSH) EXAM FOR SHOCK ETIOLOGY: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Background
Shock is a state of metabolic and circulatory dysfunction with a high risk of mortality without appropriate treatment. When the etiology of shock is unknown, the term “undifferentiated shock” may be used to denote shock state of unclear source (1). Hypotension alone, with or without evidence of shock, carries a high mortality rate as well, with a recent estimation of in-hospital mortality as high as 52% (2). The Rapid Ultrasound In Shock (RUSH) exam is a multi-organ ultrasound protocol suggested to be able to diagnose the category of shock, and therefore guide further directed treatment decisions.

Objective
The objective was to perform a diagnostic accuracy systematic review and meta-analysis of the ability of the RUSH to diagnose the etiology of undifferentiated shock in patients presenting to the Emergency Department (ED) in undifferentiated shock.

Methods
Ovid MEDLINE, Scopus, and Cochrane Central Register of Controlled Trials, and research meeting abstracts were searched up to February 2017 for studies of ED patients presenting with undifferentiated shock whom had a RUSH exam completed for diagnosis of shock etiology. QUADAS-2 was used to assess study quality and meta-analysis was conducted to pool results of individual categories of shock for assessment of sensitivity, specificity, positive likelihood ratio (+LR), and negative likelihood ratio (-LR). (3)

Results
A total of 4441 non-duplicated studies were identified, of which 51 underwent full text review; 3 were included for analysis. Study quality by QUADAS-2 was considered overall low risk of bias. Pooled +LR values ranged from 10.7 (95% CI 2.81 to 40.69) for hypovolemic shock to 77.24 (95% CI 15.62 to 382.06) for obstructive shock. Pooled -LR values ranged from 0.10 (95% CI 0.02 to 0.47) for obstructive shock to 0.28 (95% CI 0.12 to 0.69) for mixed-etiologypathy shock. (4)

Discussion
Multi-organ POCUS is an increasingly available resource that provides immediate information related to the pathology of shock states. These findings can affect management decisions, narrow differential diagnoses, and determine appropriate treatment. (6-8) Our search found only a handful of studies that have directly evaluated the diagnostic accuracy of the RUSH. The pooled positive likelihood ratios for the RUSH were strong across all etiologies ranging from 10.7 (95% CI 2.81-40.69) for hypovolemic to 57.5 (95% CI 11.41-292.25) for obstructive. Further, the RUSH’s performance for the diagnosis of obstructive shock was nearly perfect, but this observation needs to be tempered by the fact that there were very few cases of obstructive shock overall, and no cases of cardiac tamponade in the included studies. The RUSH was least accurate for the diagnosis of mixed-etiologic shock, with sensitivity of 75% (95% CI 43-95) and negative likelihood ratio of 0.28 (95% CI 0.12-0.69), limiting its value as the sole determinant for shock etiology.

Conclusion
The RUSH performs generally well to diagnose the category of shock in patients presenting with undifferentiated shock to the ED. However, given modest +LR values for several categories (notably distributive and mixed-etiologic), it is likely best employed as one component to a complete evaluation of a patient with undifferentiated shock, rather than be relied upon solely.

References