Remote Dielectric Sensing (ReDS) in ED Dypnea

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Background: The dielectric evaluation of lung water content may narrow the differential diagnosis of dyspnea, and can be obtained within 90 seconds. ReDS provides a non-invasive, transcutaneous measurement of lung fluid status. Physiologically normal lung fluid ranges from 20 to 35%. We evaluated the accuracy of ReDS to detect lung fluid in ED patients with undifferentiated shortness of breath.

Methods: This is a single-center convenience sample pilot study at an academic emergency department. Inclusion criteria were: chief complaint included "shortness of breath", ≥21 years of age, provided informed consent, and non-pregnant. Pateints were excluded for: chest trauma, the device did not fit or caused discomfort, anatomic abnormalities (e.g. dextrocardia), implanted devices (e.g. pacemaker or port-a-cath), or if they were too sick to participate. Demographics, vital signs and medical history were collected from medical records. Patients were fitted with the ReDS vest and data recorded. After discharge, a gold standard diagnosis and a volume status were adjudicated by two emergency medicine physicians blinded to ReDS data. ReDS data was evaluated with sensitivity (Sn), specifitiy (Sp) and receiver operating characteristic (ROC) for prediction of gold standard diagnosis.

Results: Of 57 enrolled patients, mean age was 63.02 (±13.74) years, 51% were male, with 52% Hispanic, 25% African American, 13% White, and 8% Asian. ReDS data ranged from 17 to 55%. Adjudicated diagnosis found 35% of patients had volume overload, of which ReDS detected 85%. Using a cutpoint of 35% (upper limit of physiologic lung-fluid), ReDS had a Sn, Sp, NPV, and PPV of 0.85, 0.78, 0.91, 0.68, respectively. Rule-out and rule-in ReDS cutpoints, providing 100% Sn and Sp were <28% and >41% respectively. The optimal cutoff point was determined to be 37% (AUC =0.92; CI 0.81 to 0.97; $p<0.0001$) with a Sn of 0.89, Sp of 0.83, NPV of 0.93, and PPV of 0.74.

Conclusion: At a cutpoint of 37%, the ReDS device has excellent sensitivity and negative predictive value in detecting pathologic lung fluid.