

Speech analysis to evaluate acute heart failure patient clinical status

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Background/Introduction

Pulmonary congestion that accompanies heart failure (HF) can produce subtle changes in speech patterns, the measurement of which may be a valuable tool for assessing a HF patient clinical status.

Purpose

We investigated how speech signal processing algorithms detect these changes in patients with acute HF (AHF) throughout their admission and evaluate the potential clinical utility of this approach.

Methods

We recruited 40 patients admitted with AHF mean age 75 ± 12 (50% female) and mean LVEF 53 ± 15 . We studied the use of speech processing algorithms in digitally measured speech samples in these AHF patients at hospital admission ("wet") and discharge ("dry"). Patients were discharged after diuretic treatment and clinical improvement.

We analyzed speech patterns, expressed as numerical values denoted "speech measures" (SM), in a single arm, open label, non-interventional study. Each patient read out loud and recorded 3-5 prescribed sentences while wet and dry. These recordings underwent processing using a range of algorithms to report five different SMs, denoted SM1, SM2, SM3, SM4 and SM5. Data were presented as SM at admission (SMa), SM at discharge (SMd), and Delta SMs (DSMs) defined as the relative change from admission to discharge, i.e. $(SMd - SMa)/SMa$.

Results

Speech processing detected a substantial mean change in the 5 SMs between wet and dry states, (Figure 1, $p < 0.001$).

Conclusion

Speech processing provided a clear signal difference between the congested wet state at admission and the

compensated dry state at discharge, in these AHF patients. Such digital speech processing offers a readily available, non-invasive means of monitoring congestion and HF clinical status in HF patients that may be implemented in the hospital, in the clinic or in the outpatient setting.

