

# Detrended Fluctuation Analysis Predicts Successful Defibrillation for Out-of-Hospital Ventricular Fibrillation Cardiac Arrest

Men-Tzung Lo, Ph.D.

Research center for adaptive data analysis,  
National Central University, Taoyuan, Taiwan

## ABSTRACT

**Background:** Repeated failed shocks for ventricular fibrillation (VF) in out-of-hospital cardiac arrest (OOHCA) can worsen the outcome. Clinically it is very importance to rapidly distinguish between early and late VF. We hypothesized that VF waveform analysis based on detrended fluctuation analysis (DFA) can help predict successful defibrillation.

**Methods and Results:** Electrocardiogram (ECG) recordings of VF signals from automated external defibrillators (AED) were obtained for subjects with OOHCA in Taipei city. To examine the time effect on DFA, we also analyzed VF signals ( $> 10$  minutes) in subjects who experienced sudden cardiac death during Holter study from Physionet. Waveform parameters including root-mean squared (RMS) amplitude, mean amplitude, amplitude spectrum analysis (AMSA), frequency analysis as well as fractal measurements including scaling exponent (SE) and DFA were calculated. A defibrillation was regarded as successful when VF was converted to an organized rhythm within 10 seconds after each defibrillation. A total of 155 OOHCA subjects (37 successful and 115 unsuccessful defibrillation) with VF were included for analysis. Among the VF waveform parameters, only AMSA ( $7.61 \pm 3.30$  vs.  $6.30 \pm 3.13$ ,  $P = 0.030$ ) and DFA  $\alpha 2$  ( $0.38 \pm 0.24$  vs.  $0.49 \pm 0.24$ ,  $P = 0.005$ ) showed significant difference between subjects with successful and unsuccessful defibrillation. The area under curves for AMSA and DFA  $\alpha 2$  were 0.63 (95% CI = 0.52-0.73) and 0.65 (95% CI = 0.54-0.75) respectively. Among the waveform parameters, only DFA  $\alpha 2$ , SE and dominant frequency showed significant time effect.

**Conclusions:** The VF waveform analysis based on DFA could help predict first-shock defibrillation success in patients with OOHCA. The clinical utility of the approach deserve further investigation.