

## Simple Cardiac Screening of NCAA and USAC Collegiate Athletes Using Smartphone Electrocardiogram

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The recent development of modern smartphone technology is quickly revolutionizing the medical field. For the last 100 years, the standard 12-lead electrocardiogram (ECG) has been the primary tool in clinically diagnosing cardiac disease and arrhythmias in patients. In large diverse populations, new smartphone technology could provide a new platform for a cost effective, efficient, and accurate cardiac screening tool. The AliveCor ECG device (AliveCor, San Francisco, CA) allows wireless acquisition of a single-lead ECG on any iOS or Android device. Results can be downloaded and reviewed using an internet browser. **PURPOSE:** In this feasibility study, we screened competitive collegiate athletes using a smartphone ECG. We assessed the rate and rhythm pre- and post-exercise. We compared the smartphone ECG with the standard 12-lead ECG tracings. **METHODS:** A total of 20 subjects ( $21 \pm 4$  yrs, 10 male, 10 female) provided written informed consent. A standard 12-lead ECG was obtained at rest followed by a smartphone generated 12-lead ECG. A one-minute smartphone ECG of lead I was recorded pre-exercise. Exercise was completed at  $\leq 80\%$  of perceived rate of exertion (PRE) or  $\leq 80\%$  of maximum predicted heart rate (MPHR). A one-minute smartphone ECG was acquired within ten seconds of terminating physical exertion. All ECGs were de-identified and interpreted by a board-certified cardiology electrophysiologist. The main outcome measure was the difference in voltage (mV) between the smartphone ECG and the standard 12-lead ECG. **RESULTS:** Smartphone ECG tracings were consistent with the standard 12-lead ECG in all 20 subjects. ( $P = 0.08 \pm 0.1$  mV,  $Q = 0.03 \pm 0.4$  mV,  $R = 2.19 \pm 0.8$  mV,  $S = 0.51 \pm 0.5$  mV,  $T = 0.38 \pm 0.4$  mV). No critical cardiac conditions were detected in either the smartphone ECG or standard 12-lead ECG (interpretation was normal sinus rhythm 40%; sinus bradycardia 60%). The observed mean  $HR_{max}$  was  $176 \pm 35$  bpm;  $HR_{recovery}$  was  $112 \pm 48$  bpm; absolute decrease in HR was  $63 \pm 32$  bpm; percent MPHR was 88%. **CONCLUSION:** The smartphone ECG compared favorably with the 12-lead ECG. This protocol can be easily adapted to enhance the preseason screening process carried out by athletic trainers.