RFID-BASED AUTOMATIC SCORING SYSTEM FOR 6-MIN WALK TESTING IN CKD PATIENTS

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Background

Poor physical performance assessed in 6-minute walk tests (6MWT), an established metric of motor fitness, predicts a high risk of mortality and cardiovascular events in patients with chronic kidney disease (CKD). Radio-frequency identification (RFID) has a great potential for physical activity monitoring. An RFID-based automatic scoring system can eliminate human errors by automatic tracking and scoring. .

Objectives

The aim of this study was 1. to develop a RFID-based autoscoring system for 6-minute walk tests (6MWT) which can be used indoor (hospital, dialysis center), 2.to assess if RFID-based 6MWT is feasible and comparable to classical 6MWT in a group of CKD patients.

Patients

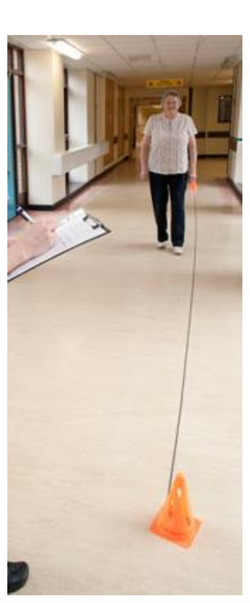
Thirty seven CKD patients participated in the study (17 men, 20women) and completed 6MWT and RFID-based modified 6MWT with two-day gap between tests. Mean age of patients (pts)was 44,7 20 years, mean BMI 25,5 0,2 kg/m^2; 30 pts was in CKD stage 2-4 and 7 pts in stage 5.

Methods

The platform designed for RFID-based autoscoring contains a WiFi module for wireless data communication (2,4GHz), a radio frequency identification (RFID using 13,56MHz) component for patient identification (holding a card), and a micro-controller unit for data acquisition and process control. Both tests were performed in the same conditions (hospital corridor with definite 20m distance, the same temperature, morning hours, the same footwear). Oxygen saturation (SaO_2), pulse rate, and the degree of dyspnea (Borg scale) were determined before and at the end of the walk.

Results

All RFID-based 6MWTs were scored without any errors or missing data. Due to human errors in counting completed loops in 4 pts the classical 6MWT was necessary to repeat. Surprisingly, for all patients results in classical 6MWT were about 10% higher than in RFID-based 6MWT: 407 79 (IQR 360-460)meters vs. 363 73m (IQR 329-399). CKD st.5 patients achieved shorter distance than CKD st.2-4 in classical 6MWT (369 vs 416m, p=0,04). Figure1 displays results in Bland-Altman and linear regression plots between both methods of 6MWTs. For all CKD pts the coefficient of determination for linear regression was 0,69. Higher internal consistency was noticed in CKD st.5 patients (rho=0,84) than in CKD st.2-4 (rho=0,67).



6 minute walk test (conventional)

RFID-based 6MWT

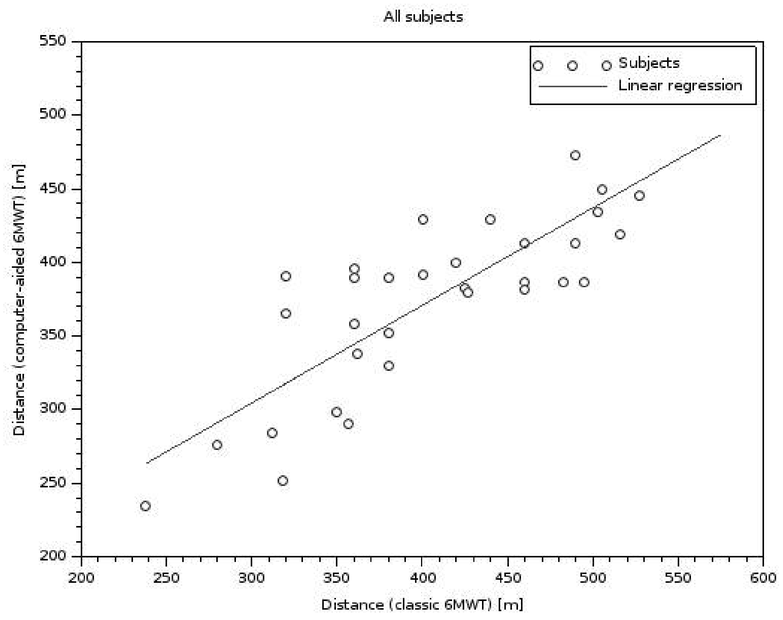


Figure 1. linear regression plots between both methods of 6MWTs

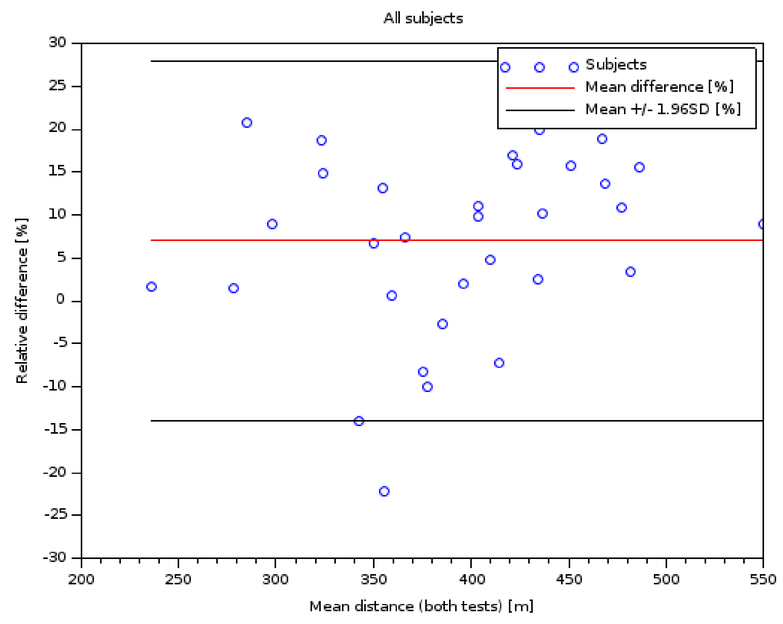


Figure 2. Bland-Altman plots between both methods of 6MWTs.

Conclusions:

In this first pilot testing of RFID-based automatic scoring system for 6MWT in CKD patients we found medium strong correlation with classical 6MWT. Results from RFID-based tests were app.10% lower than in classical 6MWT what should be taken into account in further development of the platform or requires correction when interpreting the score. The proposed system enables simultaneously fitness testing of many CKD patients, eliminates human errors and it could significantly reduce the burden of test administers/medical personnel.

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