Risk stratification model for telemedicine-based cardiac rehabilitation

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Background: Physical training (PhT) is highly cost-benefit maneuver in patients with heart disease, as a part of an integral Cardiac Rehabilitation Program. Exercise-related adverse outcomes are low, mainly due to an adequate cardiovascular risk stratification and the correct prescription and supervision of PhT. Exercise testing (ET) is the cornerstone of this process. Advances in telecommunication technologies have boosted the possibility to deliver cardiac rehabilitation via the internet, a low cost and non-face-to-face intervention. However, it is not advisable to perform a remote stress test through digital media.

Purpose: The aim of this study is to estimate the effect of excluding exercise test data from the traditional risk stratification model on the prediction of individual adverse outcomes.

Methods: A cohort of patients with heart disease who participated in an outpatient hospital-based cardiac rehabilitation program was studied. All patients underwent a clinical evaluation, along with an ET. The data obtained were used to stratify the risk of adverse events during PhT. The physical exercise program was prescribed on an individual basis. Each patient performed 30 minutes of cycle ergometry, five times a week, with a moderate effort perception (6–20 Borg scale). All sessions were supervised by a cardiologist using continuous ECG telemetry and blood pressure measurement. Resistance training was complemented with a gymnastic circuit (kinesiotherapy). A bivariate and a logistic regression multivariable analysis were performed with clinical or paraclinical variables that had been previously used in risk stratification models and showed a statistically association with the outcome (traditional model). In order to simulate the lack of an exercise stress test, these data were excluded from multivariate regression model (TELERISK), Figure 1.

Results: Six hundred and thirty-nine patients with cardiovascular disease were studied. No major adverse outcome was recorded. Patients presented several minor adverse outcomes, including mainly arrhythmias (n=485), such as sinus bradycardia, sinus pauses, premature supraventricular complexes, supraventricular tachycardia, atrial fibrillation, premature ventricular complexes, ventricular bigeminy, ventricular couplets and non-sustained ventricular tachycardia. Other minor outcomes were exercise-induced ischemia (n=31), exercise-induced hypotension (n=15), hypertensive response to exercise (n=31) and dizziness (n=7). The predictive capacity of the TELERISK model was significantly lower (AUC=0.661) than that observed for the traditional model (AUC=0.766), Figure 2.

Conclusion: The predictive capacity of the risk stratification model for adverse events during physical training in patients with cardiovascular disease decreases significantly when excluding data from the exercise test.

Variables included in TELERISK model.

Variable	B	S.E.	Wald	p value	Exp (B)
LVEF (%)	-0.030	0.010	8.323	0.004	0.970
METs (DASI)	-0.200	0.080	6.333	0.012	0.819
Inferior Q wave	0.711	0.283	6.310	0.012	2.037
Constant	4.140	0.765	29.266	< 0.001	62.811

Regression coefficient (B), standard error (S.E.), left ventricle ejection fraction (LVEF), Duke Activity Status Index (DASI).

Figure 1. Telerisk multivariable model

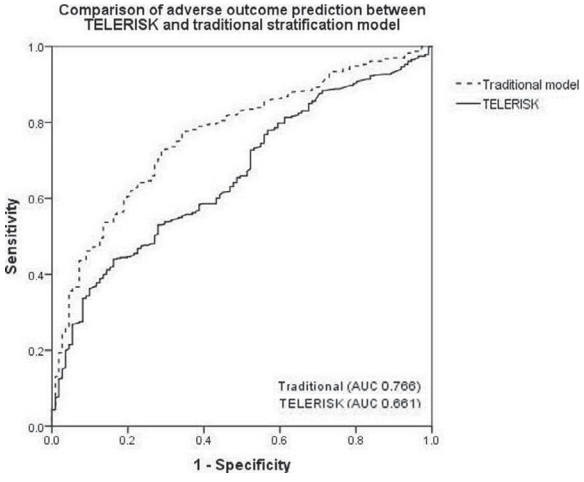

Figure 2. Outcome prediction ROC curve