ECG abnormalities and their relation to COVID-19 outcomes – a WHF study

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Introduction: COVID-19 is a respiratory tract infection caused by the Coronavirus (SARS-CoV-2) and its main clinical manifestations are respiratory. The cardiovascular system can also be affected, especially in patients with severe acute respiratory syndrome [1].

On the other hand, cardiovascular disease (CVD) and risk factors have been shown to be predictors of poor outcomes in COVID-19 [2]. Diverse electrocardiographic abnormalities can be found in this condition [3], although their value as a prognostic predictor have not been properly established due to heterogeneity in abnormalities evaluation and small sample sizes in related studies [4].

Purpose: The aim of the present study is to evaluate the association of electrocardiogram (ECG) findings to poor COVID-19 outcomes

Methods: This is a multicentric cohort study that followed hospitalized adults due to COVID-19, from low-middle and high-income countries as part of the World Heart Federation (WHF) Global Study on CVD and COVID-19 initiative [5]. Participants were followed up from hospital admission until 30 days post discharge. For the present study, participants with a valid ECG were included. ECG findings were described according to standardized measurements [heart rate, PR interval, QRS duration and axis, corrected QT interval (QTc)] and abnormalities (according to the Minnesota code system). Abnormalities utilized were grouped into ischemic abnormalities (q waves and ST-T abnormalities), atrial fibrillation (AF), prolonged QTc, sinus tachycardia (defined for the study as above 120 bpm), right and left bundle branch block and presence of any major abnormality. The primary outcome was defined as death from any cause. The secondary outcomes were intensive care unit (ICU) admission and cardiovascular events (myocarditis, pericarditis, myocardial infarction, acute heart failure, ischemic and hemorrhagic stroke). Multiple logistic regression was used to evaluate the association of ECG abnormalities to the outcomes of interest. Adjustments were made in a step by step fashion including gender, age, country of residence, cardiovascular risk factors (diabetes, hypertension, tobacco use) and presence of comorbidities (CVD, asthma, cancer, immunosuppression and chronic kidney disease).

Results: The clinical characteristics of the cohort are described in table 1. Figure 1 represents the odds ratio and its 95% confidence interval of having the defined outcomes when presenting a ECG abnormality for the final regression model.

Conclusion: ECG abnormalities were independently related to poor outcomes in COVID-19 after accounting for multiple confounders. Significant associations were more frequently found for ischemic abnormalities, heart rate above 120 bpm, atrial fibrillation and having at least one major electrocardiographic abnormality.

Table 1 - Clinical characteristics of the cohort

|	General Population	Present major electrocardiographic abnormality	Absent major electrocardiographic abnormality
Age M (SD)	58.14 (15.52)	64.43 (14.67)	56.76 (15.39)
Low/middle income country n, (%)	3212 (91.8)	494 (86.7)	2537 (92.4)
Male n, (%)	2128 (60.8)	359 (63.0)	1654 (60.2)
Smoking n, (%)	195 (7.2)	16 (3.6)	161 (7.6)
Hypertension n, (%)	1690 (49.7)	217 (38.2)	1311 (48.0)
Diabetes n, (%)	1197 (34.6)	237 (42.1)	882 (32.43)
Prevalent cardiovascular disease n, (%)	561 (16.3)	164 (28.9)	353 (12.9)
Asthma n, (%)	118 (3.4)	19 (3.4)	94 (3.5)
Chronic immunosuppression n, (%)	96 (2.8)	26 (4.6)	69 (2.5)
Chronic kidney disease n, (%)	299 (8.7)	69 (12.4)	214 (7.9)
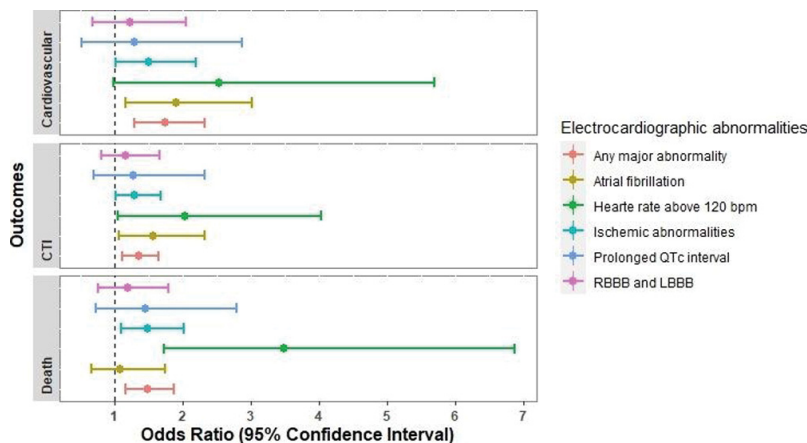
Figure 1. Odds ratios for ECG abnormalities