Minerva Medica
EDIZIONI MINERVA MEDICA

Prognostic Value Of 12-Leads Admission Electrocardiogram In Low-Risk Patients Hospitalized For Covid-19

Journal: Minerva Medica
Paper code: Minerva Med-7894
Submission date: October 21, 2021
Article type: Original Article

Files:

1. Manuscript
   Version: 2
   Description: Manuscript
   File format: application/vnd.openxmlformats-officedocument.wordprocessingml.document

2. Figures 1
   Version: 1
   Description: Figure 1
   File format: image/jpeg

3. Supplementary Digital Material 2
   Version: 1
   Description: Supplementary Digital Material 1 (Tables)
   File format: application/vnd.openxmlformats-officedocument.wordprocessingml.document

Word counts

Abstract: 244 words

Manuscript: 2122 words

Title:

Prognostic Value Of 12-Leads AdmissionElectrocardiogram In Low-Risk Patients Hospitalized For Covid-19.

Running title:

ECG predictors of adverse clinical course.

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ABBREVIATIONS LIST

ACE-I, angiotensin-converting-enzyme inhibitors

AF, atrial fibrillation

COVID-19, coronavirus disease 2019

BMI, body mass index

BZD, benzodiazepine

CIs, confidence intervals

Cr, creatinine

CRP, C-reactive protein

DM, diabetes mellitus

ECG, electrocardiogram

eGFR, estimated glomerular filtration rate

HR, heart rate

Hs-cTn-I, high-sensitivity cardiac troponin-I

ICU, intensive care unit

IL, interleukin

IMV, invasive mechanical ventilation

LAFB, left anterior fascicular block

LBBB, left bundle branch block

LPFB, left posterior fascicular block

LVH, left ventricular hypertrophy.

LDH, lactate dehydrogenase

PCT, procalcitonin

PRWP, poor R wave progression

QTc, corrected QT interval

RBBB**,** right bundle branch block

RV, right ventricular

SARS-CoV-2,severe acute respiratory syndrome coronavirus 2

TIA, transient ischemic attack

TG, triglyceride

VPC, ventricular premature complex

ABSTRACT

Background: Cardiac involvement significantly contributes to coronavirus disease 2019 (COVID-19)mortality.12-lead electrocardiogram (ECG) represents a fast, cheap, and easy to perform exam with the adjunctive advantage of the remote reporting possibility. In this study, we sought to investigate if electrocardiographic parameters are able to identify patients, deemed at low-risk at admission,who will face in-hospital unfavourable course.

Methods: From March 1, 2020 through March 30, 2021, 384 consecutive patients with confirmed low-risk COVID-19 were hospitalized at the AziendaOspedalieroUniversitariaPoliclinico di Bari (Italy). Criteria for low-risk were: admission to the division of Pneumology or Infectious Diseases, no need for immediate (within 24 hours from admission) transfer to Intensive Care Unit or for respiratory support with invasive mechanical ventilation (IMV) or for circulation support (either mechanical or pharmacological). Admission ECGs were reviewed and interpreted by two expert cardiologists. The primary outcomes were in-hospital death and the composite outcome of in-hospitaldeath and IMV.

Results: In low-risk COVID-19 patients, atrial fibrillation (AF), poor R wave progression (PRWP), tachycardia, and right bundle branch block (RBBB) resulted as statistically significant and independent predictors of in-hospital all-cause mortality; AF, PRWP, Tachycardia, RBBB, and corrected QT interval showed to be statistically significant and independent risk factors for the occurrence of the composite endpoint of death and IMV.

Conclusions: Our study demonstrated for the first time that RBBB and PRWP, assessed upon admission with ECG, are associated with unfavourable clinical course in a baseline low-risk population hospitalized for COVID-19.

KEY WORDS

- COVID-19
- Electrocardiogram
- Atrial fibrillation
- Right bundle branch block

INTRODUCTION

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has caused a worldwide increase in hospitalizations for pneumonia and multi-organ disease.Overall,in-hospital mortality from coronavirus disease 2019 (COVID-19) is approximately 15-20%, ranging from less than 5% among patients younger than 40 years up to 60% for octogenarians and older patients.[1-5]When clinical conditions require intensive care unit (ICU) admission, the reported mortality rate raises to approximately 40%.[6, 7]

There is increasing evidence that cardiac involvement significantly contributes to COVID-19 mortality.[8-12]Cardiovascular complications associated with COVID-19 comprise myocarditis, acute myocardial infarction, acute heart failure, cardiomyopathy, and dysrhythmias. Cardiac damage recognises different pathogenic mechanisms including direct myocardial injury, thromboembolic events, and medication toxicity or adverse drug to drug interactions.[13-15]

Despite cardiac involvement is frequent and potentially life-threatening, not all inpatients currently undergo a complete cardiological evaluation at admission, especiallyduring the climax of the pandemic waves when high pressure is exerted on the healthcare systems. In this study, we sought to investigate if admission 12-lead electrocardiogram (ECG) can provide relevant information to predict the hospital prognosis of COVID-19 inpatientspresenting with an initial low-risk clinical profile. ECG represents indeed a fast, cheap, easy to perform, and widely used exam with the adjunctive advantage, in the context of a highly infectious disease, of the remote reporting possibility.

MATERIALS ANDMETHODS

Our observational single-center cohort study included all consecutive patients with confirmed SARS-CoV-2 infection hospitalized at the AziendaOspedalieroUniversitariaPoliclinico di Bari (Italy)from March 1, 2020 through March 30, 2021with a low clinical risk profile at admission. Allcases of COVID-19 were confirmed by real-time reverse-transcriptase polymerase chain reactionon nasopharyngeal swabs. Patients were deemed at low-risk if admitted to the division ofPneumology or

Infectious Diseases and did not require immediate(within 24 hours from admission) transfer to ICU, respiratory support with invasive mechanical ventilation(IMV), or circulation support either mechanical or pharmacological. Admission ECG was available for all patients. ECGs were reviewed and interpreted by twoexpert cardiologists blindedto each other and tothe clinical course of the patients; disagreements were resolved by consensus. ECG interpretation was standardized and focused on the following data: rhythm, heart rate, QRS axis, QRS amplitude and morphology, ST segment and T wave morphology, and QT interval. The ST segment level was measured at 80 msafter the J-point, and ST depression or elevation was adjudged if ≥ 1 mm in ≥ 2 contiguous leads. Patients with a duration of the QRS complex ≥ 120 mswereexcluded from ST, T,andQT analysis. QT interval was corrected (QTc) using the Bazett formula.

Laboratory data were extracted from the electronic health record and comprised, among others, the following parameters: D-dimer, high-sensitivitycardiac troponin-I (Hs-cTn-I), complete blood counts, C-reactive protein (CRP), interleukin-6 (IL-6), lactate dehydrogenase (LDH), and blood gas test.

The primary outcomes were in-hospitaldeathand the composite outcome of in-hospitaldeathandIMV.

Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

Data availability: the data associated with the paper are not publicly available but are available from the corresponding author on reasonable request.

STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS version 22 software (IBM, Inc., Armonk,NY). Data are presented as means ± standard deviationsfor continuous variables and proportions for categoricalvariables. Categorical variables were analyzed using the chi-square analysis andFisher's exact test for counts <5. Continuous variables were compared using paired Student's t-tests.P-value

<0.05 was determined to be significant. The relationship between outcomes and both ECGand clinical characteristicswas examinedusing univariate logistic regression analyses with odds ratio (OR) and 95% confidence intervals (CIs). Statistically significant (p <0.05) predictors of in-hospital mortalityand ofin-hospitaldeath and/or IMVwere entered into multivariable logistic regression models.

RESULTS

384 patients with low-risk COVID-19 at the time of hospitalization were included in the study. Clinical characteristics of the population at admission are shown in **Table I-II** (home therapy, laboratory and radiographic findings are depicted in **Supplementary Digital Material 1: Supplementary Table I-II**). During hospital stay a total of 29 (7.5%) patients died and 44 (11.5%) reached the composite outcome of death and IMV.

Cardiovascular comorbidities such as diabetes mellitus (DM) type 2, arterial hypertension, dyslipidemia, history of any heart diseaseand the use of any antiplatelet therapy or beta-blocker drugs resulted more prevalent in the group of patients facing in-hospital death or the composite outcome of in-hospitaldeath and IMV.

The electrocardiographic findings at admission are presented for the whole population and, in a comparative fashion, by groups based on the occurrence of the considered clinical outcomes (in-hospitalall-cause mortality and thecomposite of death and IMV); significant correlationswith main outcomes are depicted in **Table III** (overall data are available in **Supplementary Digital Material 1: Supplementary Table III**).

In the univariatelogistic regression analyses, electrocardiographic predictors of in-hospitaldeath resulted:atrial fibrillation (AF), poor R wave progression (PRWP) in V1-V6, tachycardia, low QRS voltage in precordial leads, ST segment depression in any lead, lateral ST segment depression, precordial ST segment depression, negative T wave, inferior negative T wave, lateral negative T wave, QTc, right bundle branch block (RBBB),and left anterior fascicular block (LAFB) (**Supplementary Digital Material 1: Supplementary Table IV**). The multivariate analysis confirmed that AF,

tachycardia, PRWP, and RBBBwere significantly associated with in-hospital mortality. (**figure1, Table IV**)

Similarly, in the univariate analysis electrocardiographic predictors of in-hospitaldeath and/or IMV were: AF, PRWP, lateral ST depression, precordial ST depression, negative T wavein any lead, lateral negative T wave, tachycardia, QTc, RBBB, and LAFB (**Supplementary Digital Material 1: Supplementary Table IV**).These variableswere afterward included into the multiple logistic regression: AF, PRWP, tachycardia, QTc,and RBBB resulted independentpredictors ofin-hospitaldeath and/or IMV. (**figure 1, table V**)

DISCUSSION

This was a retrospective analysis of electrocardiographic data from all consecutive patients with confirmed COVID-19 with low clinical risk profile at admission.

The main findings of the present study are:

1. in a low-risk COVID-19 population specific electrocardiographic parameters resulted associated with a poor prognosis during hospital stay, proving the usefulness and reliability of this fast, cheap, and easy to performexam in the prognostic stratification process;
2. tachycardia, AF, PRWP, and RBBB resulted independent predictors of in-hospital death; the same parameters, along with QTc, werealso strongly associated with the composite outcome of in-hospital death and/or need forIMV;
3. among all, RBBB was the strongest indipendent predictor of poor outcome during hospital stay for low-risk COVID-19 patients.

There is growing evidence that cardiac involvement significantly contributes to COVID-19 related mortality. [8-11] Four main pathophysiologic pathways to explain cardiac involvement in COVID-19 have been proposed: coronary artery thrombosis related to the hypercoagulable state[16], direct viral myocardial infiltration [17], demand-supply mismatch due to hypoxemia, andpro-inflammatory cytokinesstorm possibly leading to fulminant myocarditis [18].In spite of the relevant prognostic impact

of the cardiac involvement, during the pandemic peaks when high pressure is exerted on the healthcare systems, the shortage of human and instrumental resources cannot guarantee a complete cardiological evaluationto all COVID-19 patients. In this context the detection of electrocardiographic parameters able to predict early unfavourable outcome in a baseline low risk-populationseems of paramount importance; ECG represents indeed a fast and easy instrument which could be used to address the rationed healthcare resources where mainly needed.

Being rapid and low cost,ECG isroutinely performed to all patients hospitalized for COVID-19 in our center. Some other studies have already suggested the association between specific electrocardiographic patterns and patients prognosis.[19]Nevertheless, theseprevious analyses have always included all COVID-19 patients admitted to the Emergency Department and hospitalized thereafter. This "all-inclusive" approach significantly jeopardizes the prognostic validity of electrocardiographic findings since the inclusion of severely diseased patients raises the interpretation dilemma of considering baseline parameters as "simple markers" of already advanced disease rather than real predictors of subsequent unfavourable clinical course.

The uniqueness of our study is represented indeed by the restricted focus onlow-risk COVID-19 patients; proof of this is the overall in-hospital mortality in our populationof 7.5% which islower than most of the recent reports from unselected cohorts.[20, 21] The detection of early markers ofpoor outcomes in patients initially deemed at low risk ishighly worthwhile to let physicians identify the patients who deserve a closer monitoring, a more accuratecardiological evaluation, and a longer hospital stay.

Our analysis demonstrated that tachycardia, AF, PRWP, and RBBB are independent predictors of in-hospital death in a low-risk COVID-19 population; when the composite outcome of in-hospitaldeath and IMV is considered,also QTc should be addedto the abovementioned parameters.

AF in COVID-19 can result from multiple pathogenic pathways: enhanced inflammatory signalling eventually leading to inflammatory cytokines storm, direct viral endothelial damage, electrolytes and acid-base unbalances, and increased sympathetic activation. In a not negligible quote of cases, AF is triggered by the COVID-19 in the context of pre-existing cardiovascular

comorbidities.[22]The AF relateddetrimental hemodynamic effects and its thrombotic risk, further enhanced by the COVID-19 hypercoagulable state,couldexplain the increased mortality in this population,[20]as already suggested by previous studies.[23-25]

Moreover, PRWP is a common ECG finding that is often interpreted as suggestive, but not conclusively diagnostic, of anterior myocardial infarction. [26] Lately, PRWP has been also proposed as an early sign ofleft ventricle dysfunction in diabetic patients[27]and a predictorofoverall and cardiovascular mortality in healthy women.[28]Despite the relation between PRWP and mortality has been already reportedin smaller cohorts[29, 30],our data confirmed this finding in a larger population and suggested PRWP to be also associated with the occurrence of the composite outcome of death and IMV.

Also baseline RBBB proved to be associated with bothdeath and the composite of death and IMV. Pneumonia and respiratory failure are the principal clinical conditions leading to hospitalization in COVID-19 patients. Being RBBB a marker of right ventricular (RV) dysfunction, itcan express the increased afterload and over-distensionof the RV resulting from endothelial damage of the pulmonary circulation as a consequence of both the COVID-19 related thromboembolic complications andhypoxic vasoconstriction.RV dysfunction assessed by 2-dimensional speckle-tracking echocardiographywas indeed lastly suggested to be associated with a higher mortality in COVID-19 patients[31]. Moreover a recent study showedthat RBBB at the time of hospital admission was associated with worse survival[23].This study nevertheless did not discriminate between high and low-risk COVID-19 presentation as proved, relative to our investigation, by higher overall short-term mortality,amore elevated rate of coronary heart disease (14.4% vs 8.4%) and,aboveall,ofhome O_2 therapy (20.5% vs 1.1%). The two latter conditions can both raise question on the identification beyond doubt of the RV dysfunction as an outcome predictor rather than a simple marker of disease. Of note, noother ECG patterns suggestive of pulmonary embolism (S1Q3T3, S1Q3, isolated negative T3 wave) were associated with poor outcomes(**Supplementary Digital Material 1: Supplementary Table IV**),probably because all signs of more advanced RV dysfunction and severe clinical deterioration. As

proof, they are more frequently found in pulmonary embolismwhen complicatedby cardiogenic shock.[32]

QTc prolongation was previously proposed as a predictor of mortality [21]. Nevertheless, also regarding QTc calculation the timing is crucial in hospitalized patients. QT interval is indeed influenced by multiple factors which include pre-existing comorbidities (e.g. cardiovascular diseases), extra cardiac organs failure (e.g. advanced kidney disease) which frequently complicates the course of COVID patients, and medicationssuch as hydroxychloroquine. In this view, a rigorous approach wasadopted by Rubin and co-authors who demonstrated that Sars-CoV-2 infection led to significant mean QTc prolongation from baseline, independently of othercauses[33].Since in our study QTc was obtained upon admission and in a low-risk population, the established relation with the occurrence of death and/or IMV did not suffer from the mentioned potentially confounding factors.

Despite the topic,of great scientific interest, has been already explored by others, our study presents several peculiar strengths.First, as previously described, we restricted the analysis to a low-risk population affected by COVID-19 which allowed to identify "real" predictors of unfavourable clinical course. Moreover, low risk patients represent the category which can benefit the most from the modulation of the diagnostic and therapeutic choices during hospital stay. Second, we rigorously considered only baseline ECG for avoiding disease and drug related confounders. Third, we conducted adeeplydetailed and highly standardized ECG analysis including numerous ECG parameters.

On the other hand, some limitations needs to be recognized as well. First, the study design is observational and all therapeutic choices were up to treating physicians; as a consequence data would result in selection bias and the study should be considered as hypotheses generating. Second, for the great majority of our patients previous ECGs were missing and comparison unfeasible. Third, some anamnestic and laboratory data were missing.

CONCLUSIONS

In low-risk COVID-19 patients AF, PWPR, tachycardia, and RBBB resulted independent predictors of in-hospital all-cause mortality; AF, PWPR, Tachycardia, RBBB and QTc showed to be independent risk factors forthe occurrence of the composite endpoint of in-hospitaldeath and IMV. Our study demonstrated for the first time that RBBB and PRWP, assessed upon admission,are associated with unfavourable clinical course in a low-risk population with Sars-CoV-2 infection. Being ECG a fast, easy, and low-cost exam, this finding appearsof great interest since would guide physicians to identify the patients who could benefit the most from a stricter clinical monitoring, more accurate cardiological evaluation, and more aggressive pharmacological therapies.

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Conflicts of interest:

Prof. Biondi-Zoccai has consulted for InnovHeart and Replycare.

Dr Giordano was a proctor for Abbot.

The Remaining authors have no disclosures to report

Funding Sources: None

Author contributions: All authors have contributed to the study conception, design, and realization. All authors have also eventually reviewed and approved the final content of the article.

Acknowledgements: none.

This review did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Table I. Baseline characteristics.

	Overall (n=384)	In hospital death and/or IMV treatment (n=44)	Alive without IMV (n= 340)	p	In hospital death (n=29)	Alive (n=355)	p
Male, *n (%)*	206 (53.6%)	24 (54.5%)	182 (53.5%)	0.899	13 (44.8%)	193 (54.4%)	0.322
Female, *n (%)*	178 (46.4%)	20 (45.5%)	158 (46.5%)	0.899	16 (55.2%)	162 (45.6%)	0.322
Weight, *kg*	76.6 ±20.3	68.4 ±12.8	77.7 ±20.9	0.009	63 ±11.2	77 ±20.5	0.001
Height, *cm*	165.3 ±15.9	164.6 ±7.4	165.4 ±16.7	0.783	162 ±8.1	165 ±16.3	0.406
Hypertension, *n (%)*	176 (45.8%)	26 (59.1%)	150 (44.1%)	0.061	20 (69.0%)	156 (43.9%)	0.008
Dyslipidaemia, *n (%)*	80 (20.8%)	17 (38.6%)	63 (18.5%)	0.002	14 (48.3%)	66 (18.6%)	<0.001
DM 1, *n (%)*	4 (1.0%)	0 (0.0%)	4 (1.2%)	0.613	0 (0.0%)	4 (1.1%)	0.730
DM 2, *n (%)*	56 (14.6%)	13 (29.5%)	43 (12.6%)	0.003	9 (31.0%)	47 (13.2%)	0.015
BMI > 30, *n (%)*	61 (15.9%)	7 (15.9%)	54 (15.9%)	0.996	1 (3.4%)	60 (16.9%)	0.038
Current smoker, *n (%)*	13 (3.4%)	2 (4.5%)	11 (3.2%)	0.451	2 (6.9%)	11 (3.1%)	0.256
Previous smoker, *n (%)*	36 (9.4%)	5 (11.4%)	31 (9.1%)	0.397	3 (10.3%)	33 (9.3%)	0.526
eGFR< 30 ml/min, *n (%)*	16 (4.2%)	4 (9.1%)	12 (3.5%)	0.098	4 (13.8%)	12 (3.4%)	0.025
Any lung disease, *n (%)*	49 (12.8%)	10 (22.7%)	39 (11.5%)	0.052	9 (31.0%)	40 (11.3%)	0.006
Allergies, *n (%)*	59 (15.4%)	2 (4.5%)	57 (16.8%)	0.034	1 (3.4%)	58 (16.3%)	0.044
Any Heart disease, *n (%)*	66 (17.2%)	18 (40.9%)	48 (14.1%)	<0.001	15 (51.7%)	51 (14.4%)	<0.001
Coronary heart diseases, *n (%)*	33 (8.6%)	7 (15.9%)	26 (7.6%)	0.068	4 (13.8%)	29 (8.2%)	0.230
Valvular heart diseases, *n (%)*	9 (2.3%)	2 (4.5%)	7 (2.1%)	0.276	2 (6.9%)	7 (2.0%)	0.142
Previous Stroke / TIA, *n (%)*	16 (4.2%)	6 (13.6%)	10 (2.9%)	0.005	4 (13.8%)	12 (3.4%)	0.025
Connectivitis, *n (%)*	7 (1.8%)	0 (0.0%)	7 (2.1%)	0.424	0 (0.0%)	7 (2.0%)	0.575
Liver diseases, *n (%)*	7 (1.8%)	1 (2.3%)	6 (1.8%)	0.576	1 (3.4%)	6 (1.7%)	0.425
Cirrhosis, *n (%)*	1 (0.3%)	0 (0.0%)	1 (0.3%)	0.885	0 (0.0%)	1 (0.3%)	0.924
Cancer, *n (%)*	39 (10.2%)	8 (18.2%)	31 (9.1%)	0.061	7 (24.1%)	32 (9.0%)	0.019
Immunodepression, *n (%)*	38 (9.9%)	6 (13.6%)	32 (9.4%)	0.258	6 (20.7%)	32 (9.0%)	0.054

IMV, invasive mechanical ventilation; DM, diabetes mellitus; BMI, body mass index; eGFR, estimated glomerular filtration rate; TIA, transient ischemic attack.

Table II. Symptoms on admission.

Symptoms on admission	Overall (n=384)	In hospital death and/or IMV treatment (n=44)	Alive without IMV (n= 340)	p	In hospital death (n=29)	Alive (n=355)	p
Dyspnoea, *n (%)*	168 (43.8%)	33 (75.0%)	135 (39.7%)	<0.001	19 (65.5%)	149 (42.0%)	0.014
Tachypnea (>22 rpm), *n (%)*	87 (22.7%)	24 (54.5%)	63 (18.5%)	<0.001	12 (41.4%)	75 (21.1%)	0.012
Fatigue, *n (%)*	105 (27.3%)	14 (31.8%)	91 (26.8%)	0.479	9 (31.0%)	96 (27.0%)	0.643
Hypo/Anosmia, *n (%)*	29 (7.6%)	3 (6.8%)	26 (7.6%)	0.569	1 (3.4%)	28 (7.9%)	0.334
Disgeusia, *n (%)*	40 (10.4%)	2 (4.5%)	38 (11.2%)	0.134	0 (0.0%)	40 (11.3%)	0.036
Sore throat, *n (%)*	21 (5.5%)	2 (4.5%)	19 (5.6%)	0.559	2 (6.9%)	19 (5.4%)	0.483
Fever, *n (%)*	311 (81.0%)	36 (81.8%)	275 (80.9%)	0.882	22 (75.9%)	289 (81.4%)	0.463
Cough, *n (%)*	164 (42.7%)	21 (47.7%)	143 (42.1%)	0.474	13 (44.8%)	151 (42.5%)	0.810
Vomiting / Nausea, *n (%)*	17 (4.4%)	2 (4.5%)	15 (4.4%)	0.601	2 (6.9%)	15 (4.2%)	0.373
Diarrhoea, *n (%)*	46 (12.0%)	4 (9.1%)	42 (12.4%)	0.531	2 (6.9%)	44 (12.4%)	0.298
Myalgia / Arthralgia, *n (%)*	48 (12.5%)	2 (4.5%)	46 (13.5%)	0.063	0 (0.0%)	48 (13.5%)	0.018
Glasgow Coma Score, *mean(±SD)*	14.6 ±1.7	12.6 ±3.5	14.8 ±1.0	<0.001	11.7 ±3.5	14.8 ±1.2	<0.001
SBP <90 mmHg and/or DBP <60 mmHg, *n (%)*	22 (5.7%)	13 (29.5%)	9 (2.6%)	<0.001	10 (34.5%)	12 (3.4%)	<0.001

IMV, invasive mechanical ventilation; SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table III.ECG characteristics upon admission.

ECG	Overall (n=384)	In hospital death and/or IMV treatment (n=44)	Alivewithout IMV (n= 340)	p	In hospital death (n=29)	Alive (n=355)	p
Sinus Rhythm, *n (%)*	361 (94.0%)	34 (77.3%)	327 (96.2%)	**<0.001**	19 (65.5%)	342 (96.3%)	**<0.001**
Sinus Arrhythmia, *n (%)*	2 (0.5%)	2 (4.5%)	0 (0.0%)	**0.013**	2 (6.9%)	0 (0.0%)	**0.006**
AF, *n (%)*	21 (5.5%)	8 (18.2%)	13 (3.8%)	**0.001**	8 (27.6%)	13 (3.7%)	**<0.001**
Tachycardia, *n (%)*	50 (13.0%)	17 (38.6%)	33 (9.7%)	**<0.001**	14 (48.3%)	36 (10.1%)	**<0.001**
Low QRS voltage (precordial), *n (%)*	50 (13.8%)	9 (20.5%)	41 (12.1%)	0.119	8 (27.6%)	42 (11.9%)	**0.023**
RBBB, *n (%)*	26 (6.8%)	7 (15.9%)	19 (5.6%)	**0.02**	5 (17.2%)	21 (5.9%)	**0.037**
LAFB, *n (%)*	39 (10.2%)	11 (25.0%)	28 (8.2%)	**0.002**	10 (34.5%)	29 (8.2%)	**<0.001**
RBBB and tachycardia, *n (%)*	5 (1.3%)	4 (9.1%)	1 (0.3%)	**0.001**	3 (10.3%)	2 (0.6%)	**0.004**
Absent / poor R wave progression (V1-V6), *n (%)*	32 (8.3%)	10 (22.7%)	22 (6.5%)	**0.001**	7 (24.1%)	25 (7.1%)	**0.006**
QTc (msec)	410.2 ±32.7	425.0 ±34.6	407.0 ±31.6	**0.001**	433.0 ±35.8	408.0 ±31.8	**<0.001**
ST depression, *n (%)*	9 (2.3%)	3 (6.8%)	6 (1.8%)	**0.072**	3 (10.3%)	6 (1.7%)	**0.024**
Lateral ST depression (V5-V6-DI-aVL), *n (%)*	3 (0.8%)	2 (4.5%)	1 (2.7%)	**0.036**	2 (6.9%)	1 (0.3%)	**0.016**
T wave inversion, *n (%)*	36 (9.4%)	9 (20.5%)	27 (7.9%)	**0.013**	7 (24.1%)	29 (8.2%)	**0.012**
Lateral T wave inversion(V5-V6-DI-aVL), *n (%)*	19 (4.9%)	7 (15.9%)	12 (3.5%)	**0.003**	7 (24.1%)	12 (3.4%)	**<0.001**
Inferior T wave inversion (DII-DIII-aVF), *n (%)*	9 (2.3%)	3 (6.8%)	6 (1.8%)	0.072	3 (10.3%)	6 (1.7%)	**0.024**

AF, atrial fibrillation; RBBB, right bundle branch block; LAFB, left anterior fascicular block; QTc, corrected QT interval; AV, atrio-ventricular.

Table IV. Univariate and multivariate logistic regression: ECG predictors of all-cause mortality

	Univariate logistic regression analysis			Multivariate logistic regression analysis		
ECG findings	**OR**	**CI 95%**	**p**	**OR**	**CI 95%**	**p**
AF	10.022	3.743-26.832	**<0.001**	7.401	1.623-33.751	**0.010**
Tachycardia	8.270	3.695-18.512	**<0.001**	4.263	1.430-12.714	**0.009**
absent/poor R progression V1-V6	4.200	1.636-10.781	**0.003**	4.381	1.087-17.665	**0.038**
Low QRS voltage (precordial)	2.839	1.183-6.815	**0.020**	2.996		0.064
ST depression	6.712	1.587-28.385	**0.010**	1.790		0.760
ST depression lateral	26.222	2.304-294.494	**0.008**	1.954		0.808
ST depressionprecordial	13.074	1.772-96.475	**0.012**	1.525		0.824
T wave inversion	3.577	1.409-9.079	**0.007**	0.436		0.499
T wave inversion inferior	6.712	1.587-28.385	**0.010**	4.851		0.212
T wave inversion lateral	9.095	3.257-25.398	**<0.001**	3.296		0.360
QTc	1.020	1.009-1.031	**0.001**	1.008		0.241
RBBB	3.313	1.148-9.560	**0.027**	8.039	1.229-52.603	**0.030**
LAFB	5.917	2.517-13.908	**<0.001**	2.337		0.217

AF, atrial fibrillation; QTc, corrected QT interval; RBBB, right bundle branch block; LAFB, left anterior fascicular block; OR, odds ratio; CI, confidence interval.

Table V. Univariate and multivariate logistic regression: ECG predictors of in-hospital death and/or invasive mechanical ventilation.

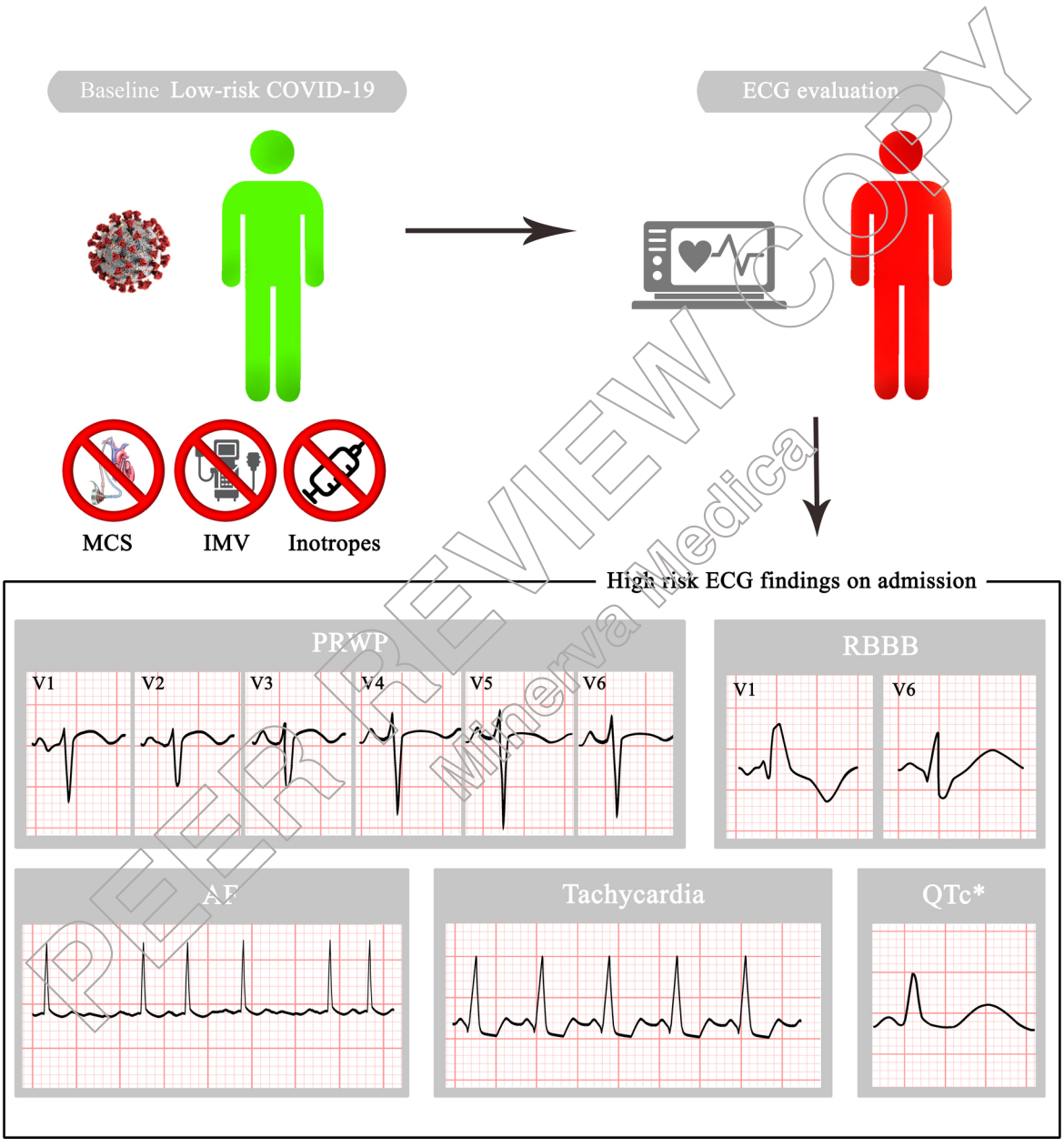
	Univariate logistic regression analysis			Multivariate logistic regression analysis		
ECG findings	**OR**	**IC 95%**	**p**	**OR**	**IC 95%**	**p**
AF	5.59	2.171-14.390	<0.001	3.878	1.029-14.611	**0.045**
absent/poor R progression V1-V6	4.251	1.859-9.720	0.001	5.313	1.847-15.282	**0.002**
ST depression laterale	16.143	1.433-181.862	0.024	3.060		0.481
ST depression precordial	8.048	1.104-58.639	0.040	3.266		0.345
T wave inversion	2.981	1.298-6.845	0.010	1.812		0.416
T wave inversion lateral	5.171	1.917-13.947	0.001	0.981		0.984
Tachycardia	5.857	2.894-11.856	<0.001	3.294	1.387-7.822	**0.007**
QTc	1.018	1.008-1.028	<0.001	1.011	1-1.023	**0.048**
RBBB	3.196	1.260-8.109	0.014	9.196	1.600-52.852	**0.013**
LAFB	3.714	1.695-8.138	0.001	0.883		0.844

AF, atrial fibrillation; QTc, corrected QT interval; RBBB, right bundle branch block; LAFB, left anterior fascicular block; OR, odds ratio; CI, confidence interval.

Figure 1.

Electrocardiographic predictors of in-hospital death and/or IMV in low-risk patients hospitalized for COVID-19.

In low-risk COVID-19 patients, AF, PRWP, tachycardia, and RBBB are independent predictors of in-hospital all-cause mortality; AF, PRWP, Tachycardia, RBBB, and corrected QT interval (*) are independent risk factors for the occurrence of the composite endpoint of death and IMV. MCS, mechanical circulation support; IMV, invasive mechanical ventilation; PRWP, poor R wave progression; RBBB, right bundle branch block; AF, atrial fibrillation; QTc, QT corrected interval.



Supplementary Digital Material

Download supplementary material file: Minerva Med-7894_Supplementary Digital Material2_V1_2021-10-28.docx