

Cardiovascular Risk Factors and COVID-19 Incidence: Result From a Population-Based Study

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Received: 27 Mar. 2021; Accepted: 16 Aug. 2021

The coronavirus disease 2019 (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), with a rapid spread, has affected the whole world. Early reports cited cardiovascular disease (CVD) and its risk factors as important comorbidities toward the risk of COVID-19 infection and also the prediction of its prognosis (1). The Chinese Center for Disease Control and Prevention, on February 11, 2020, announced that while the overall case fatality rate was 2.3%, the rate among patients with CVD was 10.5%, accounting for the highest rate of all comorbidities (2). Subsequent reports have also proven the claim (3,4). However, this observation does not necessarily prove the causal relationship between CVD and its risk factors and the incidence of COVID-19 infection (4). Iran is one of the first countries to become involved with COVID-19. Two patients were officially announced positive for SARS-CoV-2 on February 19, 2020, and since then, there have been over 300000 diagnosed cases and more than 20000 casualties (5).

The Heart Assessment and Monitoring in RAjaie Hospital (HAMRAH) study is a population-based study conducted in Tehran, Iran (6). The study originally comprises 2 phases: a survey and a prospective cohort investigation. At the first stage, from September 2017 to December 2018, individuals between 30 and 75 years of age without known CVD were invited through a multistage random sampling process from the entire city of Tehran. A total of 2158 patients were enrolled in the first stage. Information on CVD risk factors, laboratory indices, electrocardiographic and echocardiographic features, diet, physical activity levels, psychological aspects, peripheral vascular disease status, and socioeconomic status (SES) were among the most

important data obtained from the study participants. The presence of diabetes mellitus (DM) (7) and hypertension (8) was defined based on the respective guidelines. The atherosclerotic cardiovascular disease (ASCVD) risk scores were presented as percentages and classified in 4 categories: low-risk (<5%), borderline-risk (5%-7.4%), intermediate-risk (7.5%-19.9%), and high-risk ($\geq 20\%$) (9). A 10-year follow-up was envisioned for the study. For the assessment of socioeconomic status, a score developed and validated for the Iranian population based on a 5-scale Likert-type questionnaire was employed. The questionnaire had a range from 5 to 30 points, with greater points denoting better socioeconomic status, and the score was reported as the relative percentage score (i.e., $100 \times \text{acquired score} / \text{maximum score}$). The study has been approved by Rajaie cardiovascular medical and research center ethical committee (IR.RHC.REC.1399.012).

In the beginning, 27 patients with overt CVD previously detected in the first stage of HAMRAH were excluded. A telephone interview was conducted with the study participants to enquire about their involvement with COVID-19 infection. Only a valid positive reverse transcription-polymerase chain reaction for COVID-19 was accepted as infection. Of 2131 eligible participants, 1885 responded to the study call. Twenty cases were confirmed to be COVID-19-positive. Baseline cardiovascular risk factors and laboratory indices were compared between the infected and non-infected participants. Two COVID-19-related mortalities and 3 non-COVID-19-related deaths were recorded during the telephonic follow-up. As is shown in Table 1, no statistically significant differences were detected between the COVID-19 and non-COVID-19 groups regarding

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COVID-19 and cardiovascular risk factors

CVD risk factors and SES score. It is worthy of note that there were twice as many participants with intermediate

ASCVD risk in the COVID-19-positive group than in the non-COVID-19 group (Figure 1).

Table 1. Cardiovascular risk factors, ASCVD risk scores, and SES status among COVID-19 and non-COVID-19 population in HAMRAH study

Variable	COVID-19 (+) (n=20)	COVID-19 (-) (n=1865)	P
Age (y) (median (IQR))	48.5 (43.5-58.5)	48 (39-58)	0.57
Female (%)	13 (65.0)	1140 (61.1)	0.72
Diabetes (%)	4 (20.0)	255 (13.7)	0.41
Hypertension (%)	7 (35.0)	439 (23.6)	0.23
Smoking Status	--	--	0.56
Current smoker (%)	1 (5.0)	183 (9.8)	--
Former smoker (%)	1 (5.0)	88 (4.7)	--
Non-smoker (%)	18 (90.0)	1594 (85.5)	--
Total cholesterol (median (IQR))	194.5 (156.7-237.2)	196 (170-223)	0.76
HDL (median (IQR))	41 (37.2-48.2)	44 (38-51)	0.36
LDL (median (IQR))	125 (102.2-148)	124 (100-141)	0.61
TG (median (IQR))	118 (98.2-201.2)	124 (90-180)	0.58
ASCVD (%) (median (IQR))	1.8 (0.7-9.4)	2.1 (0.7-6.5)	0.84
SES score (median (IQR))	9.6 (8.6 -)	12.6 (10-14)	0.32

ASCVD, atherosclerotic cardiovascular disease; COVID-19, coronavirus disease 2019; HDL, high-density lipoprotein; IQR, interquartile range; LDL, low-density lipoprotein; SES, socioeconomic status; TG, triglyceride

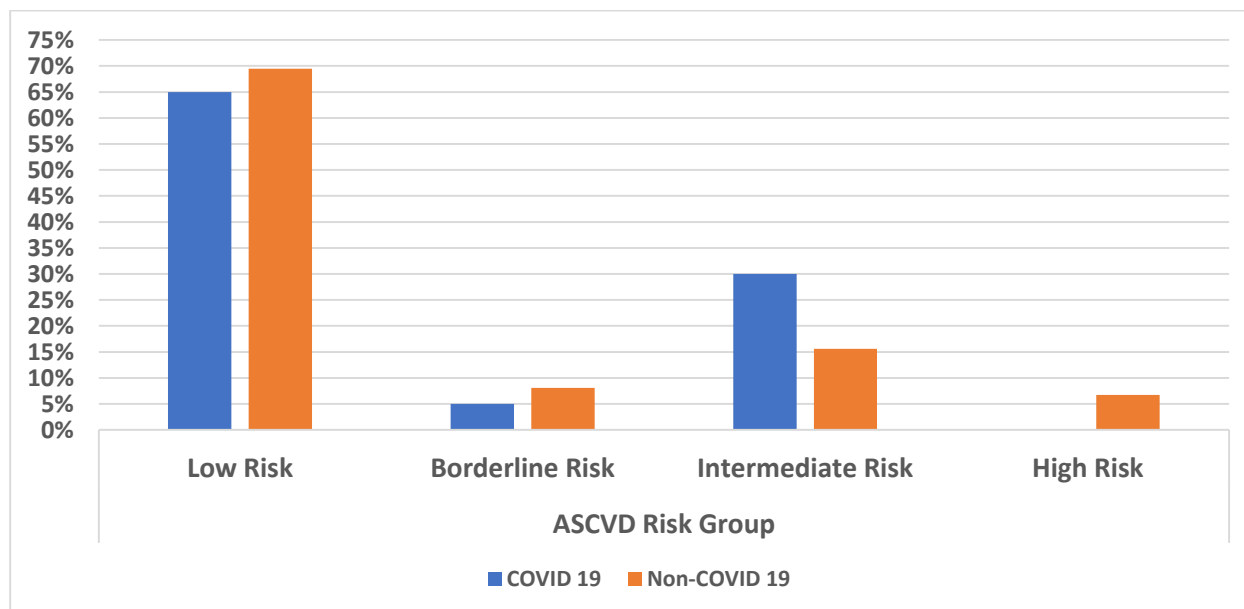


Figure 1. Comparison of the ASCVD risk score classification between the COVID-19 and non-COVID-19 population
COVID-19, coronavirus diseases 2019, ASCVD, atherosclerotic cardiovascular disease

The majority of all case series on hospitalized patients with COVID-19 show that CVD and its risk factors are among the most common comorbidities. Richardson *et al.*, reported that among 5700 patients admitted to 12 hospitals in the New York City area, 56.6% and 33.8% had hypertension and DM, respectively (3). Nonetheless, all large case series have analyzed hospitalized populations, which might incorporate possible selection bias. The potential confounding effects of age can be another issue in the study by Richardson and colleagues

and similar studies, as well. The fact that hypertension, DM, and other CVD risk factors are more commonly detected in the older population, who has an increased risk of COVID-19-induced hospitalization and mortality, may have affected their obtained results (4). The median age of the HAMRAH study participants is much lower than that of the participants in the mentioned case series.

The HAMRAH study, on the strength of its random sampling throughout the city of Tehran, could be an appropriate ground to test the true relationship between

CVD risk factors and the incidence of COVID-19 infection. Our report shows that none of the traditional CVD risk factors could predict the risk of COVID-19 infection in a population with no overt CVD.

Be that as it may, the HAMRAH study lacks a systematic COVID-19-related screening among its participants. The true prevalence of COVID-19 in our population might be underrepresented, and the mentioned association between CVD risk factors and COVID-19 infection should, therefore, be generalized cautiously. Further, our short report is limited by its low sample volume of patients with COVID-19. Still, the presented results indicate the urgent need for large-population investigations to more precisely and robustly delineate the relationship between CVD risk factors and COVID-19 infection.

References

1. Madjid M, Safavi-Naeini P, Solomon SD, Vardeny O. Potential Effects of Coronaviruses on the Cardiovascular System: A Review. *JAMA Cardiol* 2020;5:831-40.
2. Surveillances V. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19)—China, 2020. *China CDC Weekly* 2020;2:113-22.
3. Richardson S, Hirsch JS, Narasimhan M, Crawford JM, McGinn T, Davidson KW, et al. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City area. *JAMA* 2020;323:2052-9.
4. Fang L, Karakiulakis G, Roth M. Are patients with hypertension and diabetes mellitus at increased risk for COVID-19 infection? *Lancet Respir Med* 2020;8:e21.
5. Abdi M. Coronavirus disease 2019 (COVID-19) outbreak in Iran: Actions and problems. *Infect Control Hosp Epidemiol* 2020;41:754-5.
6. Bakhshandeh H, Maleki M, Noohi F, Boudagh S, Khalili Y, Alizadehasl A, et al. Heart Assessment and Monitoring in Rajaie Hospital (HAMRAH): A population-based cohort study. *Res Cardiovasc Med* 2020;9:29-34.
7. Association AD. 2. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes-2020. *Diabetes Care* 2020;43:S14-31.
8. Whelton PK, Carey RM, Aronow WS, Casey Jr DE, Collins KJ, Dennison Himmelfarb C, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation* 2018;138:e426-e83.
9. Goff Jr DC, Lloyd-Jones DM, Bennett G, Coady S, D'Agostino Sr RB, Gibbons R, et al. 2013 ACC/AHA guideline on the assessment of cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol* 2014;63:2935-59.