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Cardiovascular Polygenic Risk Scores and Mortality Risk in COVID-19 Patients

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The presence of cardiovascular disease (CVD) can significantly exacerbate the course of COVID-19 for an individual. This can be compounded with the severity of respiratory symptoms and heighten the risk of adverse cardiovascular events, such as myocardial injury and ischemic strokes. However, the genetic structure of this relationship, which hold the potential for developing personalized medical interventions, remain partially understood. Here, we generate Polygenic Risk Scores (PRS) for ten CVDs and analyze their impact on severe COVID-19 outcomes. We performed genome-wide association study (GWAS) from UKBiobank dataset (N=459,119) and computed PRS using BOLT-LMM and LDpred involving 10-fold cross-validation. From logistic regression on COVID-19 severity, PRS for different CVD showed significant odds ratios, such as coronary artery disease (1.166, 95% CI 1.116 – 1.219), heart failure (1.263, 95% CI 1.195 – 1.334) and cerebrovascular diseases (1.293, 95% CI 1.231 – 1.357). Then, to represent how CVD PRS affect survival times in patients infected with COVID-19, we analyzed Cox-proportional hazards models. We grouped patients based on high, medium and low CVD PRS quantiles and adjusted for severity of COVID-19, age, sex, genotyping array and top four principal components. By comparing hazard ratios (HR) of each PRS groups, we emphasize patients in higher PRS group has higher risk of death than patients in lower PRS group. Further genetic relationship between CVD and severe COVID-19 are investigated upon LD score regression and represented high genetic correlation in coronary artery disease(0.707), heart diseases(0.776) and cerebrovascular diseases(0.781). Altogether, these results suggest that it is appropriate to use PRS of CVD for estimating risk of severe COVID-19 and mortality in COVID-19 patients.