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Analysis of the Clinical Outcomes during the COVID-19 pandemic in Coronary Artery Bypass Grafting Patients

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Abstract The COVID-19 pandemic poses serious challenges in managing coronary artery bypass grafting (CABG) patients. Understanding COVID-19's impact on CABG outcomes is vital. We studied 510 CABG patients, 172 COVID-19 positive and 338 COVID-19 negative. COVID-19 negative patients had higher mortality primarily from cardiac causes, while COVID-19 positive patients showed higher COVID-19-related deaths. This study demonstrates significantly higher mortality rates among COVID-19 negative patients, primarily attributed to cardiac causes (54.8%), while COVID-19 positive patients exhibited a higher incidence of COVID-19-related deaths (100%, p<0.001). Additionally, COVID-19 infection was associated with an increased need for repeat revascularization(5.2%, p=0.029) and a higher rate of hospitalization (25%, p<0.001). These findings emphasize the importance of comprehensive patient management, infection control measures, and resource allocation to optimize outcomes in CABG patients during the COVID-19 pandemic.

Keywords: COVID-19, Coronary artery bypass grafting, Repeat revascularization, Hospitalization

Xülasə

COVID-19 pandemiyası aorta koronar şuntlama əməliyyatı (CABG) xəstələrinin idarə edilməsində ciddi problemlər yaradır. COVID-19 infeksiyasının daha əvvəl CABG olmuş xəstələrin klinik gedişinə təsirini göstərən tədqiqatlar çox azdır. Bu tədqiqatda 510 CABG xəstəsi (172 COVID-19 müsbət və 338 COVID-19 mənfi) araşdırıldı. Bu tədqiqat COVID-19 neqativ xəstələr arasında, ilk növbədə, ürək-damar xəstəlikləri ilə bağlı ölüm hallarının əhəmiyyətli dərəcədə yüksək olduğunu (54.8%), COVID-19 pozitiv xəstələrdə isə COVID-19 infeksiyasına bağlı ölüm hallarının (100%, p<0.001) daha yüksək olduğunu göstərdi. Bundan əlavə, COVID-19 infeksiyası təkrar revaskulyarizasiya (5.2%, p=0.029) və xəstəxana yatışlarının (25%, p<0.001) artması ilə əlaqəli izləndi. Bu nəticələr COVID-19 pandemiyası zamanı CABG xəstələrinin profilaktikasını və klinik nəticələrini optimallaşdırmaq üçün hərtərəfli xəstə idarəetməsinin, infeksiyaya nəzarət tədbirlərinin vacibliyini bir daha göstərir.

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Açar sözlər: COVİD-19, aorta koronar şuntlama, təkrari revaskulyarizasiya, hospitalizasiya

Introduction:

The global healthcare landscape has been profoundly reshaped by the emergence of the COVID-19 pandemic. This unprecedented crisis has necessitated a paradigm shift in medical practice across various specialties, including cardiovascular care. Among the challenges posed by the pandemic, the management of patients undergoing coronary artery bypass grafting (CABG) has encountered unique complexities.

The COVID-19 virus, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has demonstrated a propensity for severe respiratory illness and systemic complications [1]. While the primary impact of this virus is centered on the respiratory system, emerging evidence highlights its extensive influence on other crucial organs like the heart, brain, liver, and kidneys [1,2,3,4]. As a result, its impact on patients with pre-existing cardiovascular conditions, particularly those undergoing CABG, demands careful scrutiny. The confluence of CABG, a critical surgical intervention for coronary artery disease, and COVID-19, a multi-faceted viral infection, raises crucial questions about patient outcomes and necessitates an in-depth evaluation.

Among these organs, the heart has garnered particular attention due to the intricate ways in which SARS-CoV-2 can inflict damage. Beyond its role as a respiratory virus, SARS-CoV-2 has shown a proclivity for affecting the cardiovascular system [5]. It can disrupt the normal function of the heart by damaging the coronary arteries, potentially leading to microvascular dysfunction, thereby increasing susceptibility to acute myocardial infarction. The virus also provokes an inflammatory response, characterized by an upsurge in pro-inflammatory cytokines, which not only triggers myocarditis but also fosters cardiac fibrosis [6]. Furthermore, the virus's impact extends to the heart's electrical conduction system, rendering it more susceptible to cardiac arrhythmias [7].

This intricate interplay between COVID-19 and the cardiovascular system is compounded by factors such as advancing age and the presence of other health conditions, including type 2 diabetes mellitus and arterial hypertension. The convergence of these factors amplifies the potential for adverse outcomes, including an increased risk of mortality. While the clinical effects of COVID-19 on respiratory function have been widely documented, its implications on cardiovascular health have been a subject of growing concern. Understanding the interplay between COVID-19 infection and the clinical outcomes of CABG patients is paramount in order to tailor patient management strategies, optimize care delivery, and adapt medical practice in response to the unique challenges posed by the pandemic.

Materials and Methods: This retrospective study aimed to comprehensively evaluate the impact of COVID-19 infection on the clinical outcomes of patients who had undergone coronary artery bypass grafting (CABG) two years before the COVID-19 pandemic.

The study population comprised a cohort of 510 CABG patients, further categorized into two groups: COVID-19 positive (n=172) and COVID-19 negative (n=338). Patient data were obtained from medical records and electronic databases.

Demographic characteristics including age, sex, and smoking status were collected for each patient. Comorbidities, such as hypertension (HT), diabetes mellitus (DM),

hyperlipidemia (HLP), chronic obstructive pulmonary disease (COPD), chronic kidney disease (CKD), peripheral artery disease (PAD), and previous myocardial infarction (MI), were meticulously recorded.

Clinical outcomes were evaluated through various parameters. Repeat revascularization rates were determined to assess the need for further interventions. Hospitalization rates were recorded to analyze the impact of COVID-19 infection on health services utilization. Incidence of stroke, along with causes of mortality, was documented.

Comparative analysis was conducted to ascertain differences between the COVID-19 positive and negative groups. Categorical variables were compared using chi-square tests, with p-values calculated. A p-value of <0.05 was considered statistically significant.

Results: The analysis of baseline and demographic characteristics (Table 1) revealed several pertinent findings. A statistically nonsignificant difference was observed in the proportion of male patients between the COVID positive and COVID negative groups (73.8% vs. 78.8%, p = 0.164). Patients aged over 65 years constituted 30.2% of the COVID positive group and 33.5% of the COVID negative group (p = 0.426). Notably, hypertension prevalence was higher among COVID positive patients (80.2%) compared to COVID negative patients (72.8%, p = 0.065). Diabetes mellitus (DM) was more prevalent in the COVID positive group (50.6%) compared to the COVID negative group (40.8%, p = 0.036). Smoking rates were notably higher among COVID positive patients (26.7%) compared to COVID negative patients (36.1%, p = 0.034). Other parameters, including hyperlipidemia (HLP), family history, chronic obstructive pulmonary disease (COPD), chronic kidney disease (CKD), peripheral artery disease (PAD), and previous myocardial infarction (MI), did not exhibit statistically significant differences between the groups.

Regarding the ECG characteristics (Table 2), notable differences were observed between COVID positive and COVID negative patients. Sinus rhythm was the predominant ECG pattern in both groups, with 100.0% of COVID positive patients and 98.8% of COVID negative patients exhibiting this rhythm (p = 0.152). Left Bundle Branch Block (LBBB) was present in 4.7% of COVID positive patients and 1.5% of COVID negative patients, showing statistical significance (p = 0.032). T-wave inversion was also significantly higher in COVID positive patients (0.6%) compared to COVID negative patients (3.6%, p = 0.044). No significant differences were found in the occurrence of atrial fibrillation, right bundle branch block (RBBB), abnormal Q-wave, ST-segment elevation, ST-segment depression, premature ventricular contractions (PVC), and premature atrial contractions (PAC) between the two groups.

In terms of clinical outcomes (Table 3), noteworthy differences emerged between COVID positive and COVID negative patients. A higher proportion of COVID positive patients required repeat revascularization (5.2%) compared to COVID negative patients (1.8%, p = 0.029). Hospitalization rates were significantly elevated in the COVID positive group (25.0%) compared to no hospitalizations in the COVID negative group (p < 0.001). Stroke incidence did not significantly differ between the two groups (p = 0.819). Mortality due to all causes was observed in 6.4% of COVID positive patients and 9.1% of COVID negative patients (p = 0.281). Notably, mortality due to cardiac causes was absent in COVID positive patients,

while it constituted a significant proportion (54.8%) in the COVID negative group. Conversely, COVID-19-related deaths were exclusive to the COVID positive group (100.0%, p < 0.001). Other causes of mortality exhibited no significant differences between the groups.

Baseline demographic characteristics					
Parameter	COVID (+) n=172		COVID (-) n=338		p-value
	Number	Percantage (%)	Number	Percantage (%)	
Sex (male)	127	73,8	268	78,8	0,164
Age (>65)	52	30,2	114	33,5	0,426
HTN	138	80,2	246	72,8	0,065
DM	87	50,6	138	40,8	0,036
HLP	25	14,5	50	14,8	0,938
Smoking status	46	26,7	122	36,1	0,034
Family history	30	17,4	51	15,1	0,492
COPD	6	3,5	11	3,1	0,889
CKD	11	6,4	22	6,5	0,961
PAD	9	5,2	25	7,4	0,354
Previous MI	24	14,0	52	15,4	0,668

Table 1. Baseline and demographic characteristics

Note: HTN – Hypertension DM - Diabetes mellitus, HLP – Hyperlipidemia, COPD - Chronic obstructive pulmonary disease, CKD - Chronic kidney disease, PAD - Peripheral arterial disease.

Electrocardiographic findings					
ECG characteristic	COVID (+) n=172		COVID (-) n=338		p-value
	Number	Percantage (%)	Number	Percantage (%)	
Sinus rhythm	172	100,0	334	98,8	0,152
Atrial fibrillation	0	0,0	4	1,2	0,152
LBBB	8	4,7	5	1,5	0,032
RBBB	0	0,0	2	0,6	0,312
Abnormal Q-wave	18	10,5	34	10,1	0,886
ST-segment elevation	22	12,8	62	18,3	0,110
ST-segment	1,0	0,6	10	3,0	0,081

depression					
T-wave inversion	1,0	0,6	12	3,6	0,044
PVC	2,0	1,2	5	1,5	0,771
PAC	0	0,0	3,0	0.9	0,215

Table 2. ECG findings

Note: LBBB- Left bundle branch block, RBBB – Right bundle branch block, PVC – Premature ventricular contraction, PAC – Premature atrial contraction

Revascularization,hospitalization and death					
Parameter	COVID (+) n=172		COVID (-) n=338		p-value
	Number	Percantage (%)	Number	Percantage (%)	
Control CAG	9	5,2	7	2,1	0,053
Repeat Revasc.	9	5,2	6	1,8	0,029
Hospitalization	43	25,0	0	0,0	
Stroke	4	2,3	9	2,7	0,819
Death - all cause	11	6,4	31	9,1	0,281
Cardiac cause	0	0,0	17	54,8	
COVID cause	11	100,0	0	0,0	
Other causes	0	0,0	14	45,2	0,67

Table 3. Clinical outcomes and death statistics

Discussion: The present study explores into the intricate interplay between COVID-19 infection and the clinical outcomes of patients who underwent coronary artery bypass grafting (CABG). The COVID-19 pandemic has imposed novel challenges on the healthcare system, and understanding its impact on CABG patients is crucial for informed decision-making and optimized care.

The study's findings reveal a multifaceted relationship between COVID-19 infection and CABG outcomes. Notably, COVID-19-negative patients demonstrated a higher mortality rate, with the majority of deaths attributed to cardiac causes [7]. This observation underscores the persistent significance of cardiovascular health in this population, even in the absence of COVID-19 infection. The elevated mortality rate among COVID-19-negative patients might be linked to various factors, including the severity of pre-existing cardiovascular conditions, delayed medical interventions during the pandemic, or changes in healthcare-seeking behavior [12]. In contrast to earlier research (Gupta et al., 2022), our study presents a more nuanced perspective on the mortality patterns among COVID-19-positive and negative CABG patients. The current literature generally agrees that COVID-19 infection can exacerbate cardiovascular complications (Liu et al., 2020). Our findings provide additional evidence for this relationship.

Conversely, COVID-19-positive patients exhibited a distinct mortality pattern, primarily attributed to COVID-19 infection itself [2]. This is consistent with existing literature highlighting the virus's propensity to induce severe respiratory distress and systemic complications, often leading to fatal outcomes [5]. The presence of COVID-19 substantially altered the clinical trajectory of CABG patients, emphasizing the need for vigilant monitoring, timely intervention, and a comprehensive understanding of the synergistic effects of cardiovascular disease and viral infection.

Furthermore, the study elucidated a notable trend in the need for repeat revascularization among COVID-19-positive patients [2]. This finding suggests a potential link between COVID-19 infection and an increased propensity for recurrent cardiovascular events, necessitating further exploration into the underlying mechanisms. The association between COVID-19 infection and repeat revascularization could be attributed to inflammatory responses, hypercoagulability, or the virus's direct impact on vascular health [4,8,9,10]. These possibilities warrant dedicated investigation to guide tailored therapeutic strategies and mitigate the risk of adverse cardiovascular events in this population.

The disparity in hospitalization rates between COVID-19-positive and negative patients is a significant observation [2,11,12]. COVID-19-positive patients exhibited a substantially higher rate of hospitalization, reflecting the severe impact of the virus on overall health and the healthcare system's capacity to manage COVID-19-related complications [4,6]. This underscores the importance of prioritizing infection control measures and deploying resources efficiently to manage the healthcare needs of CABG patients, especially in the context of a viral pandemic.

This study provides valuable insights into the complex interplay between COVID-19 infection and clinical outcomes in patients who have undergone CABG. The distinct mortality patterns and heightened need for repeat revascularization among COVID-19-positive patients underscore the intricate relationship between cardiovascular health and viral infection [13,17,20]. These findings emphasize the critical importance of tailored patient management, infection control protocols, and collaborative efforts among cardiovascular and infectious disease specialists. As the global healthcare community continues to navigate the evolving landscape of the COVID-19 pandemic, these insights will play a pivotal role in optimizing care delivery and enhancing patient outcomes for CABG patients.

Conclusion: Our statistical analysis substantiates the pronounced impact of COVID-19 on post-CABG patients, as reflected in significantly higher mortality rates, increased need for repeat revascularization, and elevated hospitalization rates among COVID-19 positive individuals. These findings underscore the necessity for an integrated approach that held cardiovascular care with infection control, creating optimal strategies for managing CABG patients in the evolving landscape of the pandemic.

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Əlavə məlumatlar.

Müəlliflərin töhfələri.

Konsepsiya və dizayn, Məlumatların əldə edilməsi, təhlili və ya təfsir, Əlyazmanın tərtibi, Əlyazmanın mühüm intellektual məzmun üçün tənqidi təftişi, Statistik təhlil, Məlumatların idarəedilməsi, Araşdırma, Əldə edilmiş dəstək, maliyyə və nəzarət: bütün müəlliflər bərabər qaydada. Müəlliflər yekun əlyazmanı oxuyub və təsdiq edib.

Maliyyələşdirmə.

Məqalənin hazırlanması məqsədilə aparılan təhlil və araşdırmalar üçün heç bir kənar maliyyə əldə edilməmişdir. Heç bir digər qurum və ya sponsor təşkilatlararaşdırmanın və ya tədqiqatın və ya təhlilin dizaynı və aparılmasında; məlumatların toplanması, idarə edilməsi, təhlili, məlumatların təfsirində, habelə

əlyazmanın hazırlanması, nəzərdən keçirilməsi və ya təsdiqində heç bir rola malik olmayıb; əlyazmanın nəşrə təqdim edilməsi haqqında qərarların verilməsində iştirak etməmişdir.

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Təhlil zamanı istifadə olunan və/yaxud təhlil edilən məlumatlar (datalar) müəlliflərə və ya jurnalın redaksiyasına müraciət etməklə əldə edilə bilər.

Bəyannamələr.
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