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Comparative Study of Clinical Complications in Chronic Heart Failure and Atrial Fibrillation Patients

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Abstract Patients with chronic heart failure (CHF) and atrial fibrillation (AF) represent a vulnerable population with high risks of cardiovascular and thromboembolic complications. This study aimed to comparatively analyze the frequency and characteristics of complications in CHF and AF patients with and without a history of COVID-19 infection. A total of 285 elderly patients (aged 60–74) were divided into two groups: Group 1 (n=145) included patients with CHF, AF, and previous COVID-19 infection, and Group 2 (n=140) included patients with CHF and AF without COVID-19. Retrospective data analysis was performed focusing on thromboembolic events, bleeding episodes, cardiac decompensation, arrhythmias, and infectious complications. The incidence of thromboembolic events such as pulmonary embolism (12.4% vs. 5%, $p<0.01$) and ischemic stroke (15% vs. 8%, $p<0.05$) was significantly higher in the COVID-19 group. Major and minor bleeding events were also more frequent in Group 1 (10% and 20% vs. 4.3% and 12.1%, respectively, $p<0.05$). Cardiac complications, including heart failure decompensation and ventricular tachyarrhythmias, occurred at higher rates in patients with prior COVID-19. Additionally, bacterial pneumonia incidence was elevated (7.6% vs. 1.4%, $p<0.05$). These findings underscore the exacerbating effect of COVID-19 on the severity and frequency of complications in CHF and AF patients, highlighting the need for tailored clinical management and anticoagulant dosing.

Keywords Chronic heart failure, Atrial fibrillation, COVID-19, Thromboembolism, Bleeding, Cardiac decompensation, Arrhythmias, Pneumonia

1. Introduction

Chronic heart failure (CHF) and atrial fibrillation (AF) are two highly prevalent cardiovascular conditions that often coexist and contribute to significant morbidity and mortality worldwide. CHF results in impaired cardiac pumping function leading to inadequate systemic perfusion, while AF is characterized by irregular and often rapid heart rhythm causing an increased risk of thromboembolism. Both conditions independently and synergistically increase the risk of adverse events including stroke, hospitalization, and death [1,2].

The emergence of COVID-19 has introduced new complexities to the management of cardiovascular diseases. Caused by SARS-CoV-2 virus, COVID-19 has a demonstrated impact on the cardiovascular system through direct viral injury, systemic inflammation, and endothelial dysfunction. Patients with pre-existing cardiovascular diseases, especially CHF and AF, face heightened vulnerability to severe COVID-19 complications. Recent evidence suggests that COVID-19 infection induces a hypercoagulable state, increasing the risk of thromboembolic events such as pulmonary embolism (PE) and ischemic stroke. Furthermore, COVID-19-related inflammation and hypoxia exacerbate cardiac dysfunction, leading to decompensation and arrhythmias [3,4,5].

Despite these observations, there is limited comparative data quantifying the frequency and spectrum of complications in CHF and AF patients with and without COVID-19 infection. Understanding these differences is crucial to optimize clinical management and reduce morbidity and mortality in this vulnerable population. This study aims to analyze the incidence of thromboembolic, hemorrhagic, cardiac, and infectious complications in elderly patients with CHF and AF, comparing those with prior COVID-19 infection to those without, to inform future risk stratification and therapeutic strategies [6,7,8].

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2. Materials and Methods

This retrospective cohort study included 285 elderly patients aged 60 to 74 years diagnosed with chronic heart failure (CHF) and atrial fibrillation (AF) who were treated at the cardiology department of Andijan State Medical Institute, Uzbekistan. Patients were categorized into two groups based on their COVID-19 infection history: Group 1 (n=145) with documented prior COVID-19 infection and Group 2 (n=140) without such infection [9].

Demographic data, clinical history, and laboratory findings were collected from medical records. The primary outcomes assessed included the frequency of thromboembolic events (pulmonary embolism and ischemic stroke), bleeding complications (major and minor), cardiac events (heart failure decompensation and ventricular tachyarrhythmias), and infectious complications (bacterial pneumonia) [10].

Thromboembolic events were diagnosed based on clinical presentation supported by imaging studies such as Doppler ultrasonography, CT pulmonary angiography, and brain MRI. Bleeding events were classified according to standard criteria into major (requiring transfusion or intervention) and minor bleeding. Heart failure decompensation was diagnosed by worsening symptoms and signs requiring hospital admission or intensified therapy. Ventricular tachyarrhythmias were identified through ECG or telemetry monitoring. Bacterial pneumonia was confirmed by radiological findings and positive microbiological cultures [11,12].

Statistical analysis was performed using SPSS software. Categorical variables were presented as frequencies and percentages. Comparisons between groups were made using chi-square tests or Fisher's exact test as appropriate. A p-value of less than 0.05 was considered statistically significant. Confidence intervals were calculated for key complication frequencies to estimate the reliability of differences observed between groups.

The study adhered to ethical standards and was approved by the institutional review board of Andijan State Medical Institute [13].

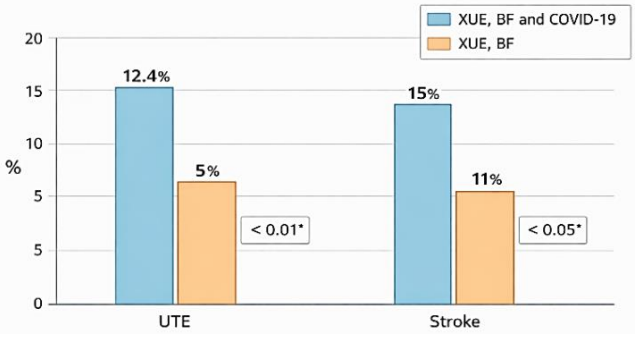
The study included 285 elderly patients (aged 60 to 74 years) with CVE and BF. Of these, 138 (48.4%) were women and 147 (51.6%) were men. The study was conducted in the cardiology department of the Andijan State Medical Institute, Andijan region. Patients were divided into 2 groups according to the presence or absence of viral infection in their medical history: Group 1 (n=145): CVE, BF and COVID-19, Group 2 (n=140): CVE and BF, without COVID-19 infection. The study methods were as follows: retrospective analysis of data and medical history. Assessment of complications, i.e. analysis of thromboembolic events, bleeding, cardiac events and infectious complications [14].

3. Results and Discussion

The results showed that the incidence of thromboembolic events was significantly higher in patients with COVID-19. Pulmonary embolism (PE) was 12% in group 1 and 5% in group 2. At the same time, cerebral stroke was recorded in 15% of patients in group 1 and 8% in group 2.

Table 1. The frequency of occurrence of analyzed complications

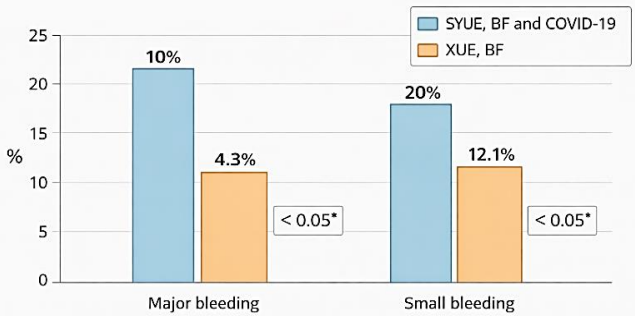
Complications	XUE, BF and COVID-19 N=145		XUE, BF N=140		p
	n	%	n	%	
UTE	18	12.4	7	5	<0.01
Stroke	22	15	11	8	<0.05



In the analysis of bleeding events, the results confirmed that patients with COVID-19 are at increased risk of bleeding due to coagulopathy on anticoagulants. Both major and minor bleeding events were observed in our study [15,16]. Major bleeding was reported in 10% of patients with COVID-19 (group 1) and 4% of patients without COVID-19 (group 2). Minor bleeding was reported in 20% of patients in group 1 and 12% of patients in group 2. These results indicate the need for careful dose selection and continuous monitoring of patients during anticoagulant therapy.

Table 2. The frequency of occurrence of analyzed complications

Complications	SYuE, BF and COVID-19 N=145		XUE, BF N=140		p
	n	%	n	%	
Major bleeding	15	10	6	4.3	<0.05
Small bleeding	29	20	17	12.1	<0.05



It should be noted that cardiac complications were also observed in the patients included in the investigation, according to which SAcute decompensation of the UE occurred in 25% of cases in patients in group 1 and 15% in patients in group 2. Significant differences were also found in the frequency of ventricular tachyarrhythmias, i.e., this

indicator was observed in 18% of cases in group 1 and 10% in group 2. Analysis of infectious complications showed that bacterial pneumonia was 7.6% (<0.05) in patients in group 1 and 1.4% in patients in group 2. The reliable interval analysis was (0.067, 0.173) in patients in group 1. This indicates that the true proportion, i.e., the exact frequency of thromboembolic events in patients with COVID-19, is most likely between 6.7% and 17.3%. For patients in group 2, the value is (0.015, 0.085), and the frequency of thromboembolism in group 2 patients is most likely between 1.5% and 8.5%. Thus, the frequency of thromboembolism in group 1 patients is higher than previously estimated. These intervals confirm the difference between the groups [17].

Table 3. The frequency of occurrence of analyzed complications

Complications	SYuE, BF and COVID-19 N=145		XUE, BF N=140		p
	n	%	n	%	
SYuE decompensation	15	25	6	15	<0.05
Ventricular tachyarrhythmias	29	18	17	10	<0.05
Bacterial pneumonia	11	7.6	2	1.4	<0.05

Thromboembolic Complications

The analysis revealed a significantly increased incidence of thromboembolic complications in patients with prior COVID-19 infection (Group 1). Pulmonary embolism (PE) occurred in 12.4% of these patients compared to 5% in Group 2 ($p<0.01$). Similarly, ischemic stroke was documented in 15% of Group 1 compared to 8% in Group 2 ($p<0.05$). This significant increase aligns with emerging evidence indicating that COVID-19 triggers a hypercoagulable state through mechanisms such as endothelial injury, cytokine storm, and platelet activation [18,19].

Confidence interval analysis further confirmed the robustness of these findings, with thromboembolism rates in Group 1 estimated between 6.7% and 17.3%, significantly exceeding the 1.5% to 8.5% range for Group 2. These data highlight that CHF and AF patients with a history of COVID-19 are at a markedly elevated risk of thrombotic events, underscoring the necessity for vigilant monitoring and prophylactic anticoagulation strategies [20].

Bleeding Events. Patients with COVID-19 also experienced higher rates of bleeding complications, likely related to anticoagulant therapy compounded by COVID-associated coagulopathy. Major bleeding events were observed in 10% of Group 1 versus 4.3% in Group 2 ($p<0.05$). Minor bleeding was reported in 20% of Group 1 compared to 12.1% in Group 2 ($p<0.05$). These findings suggest that the balance between preventing thromboembolism and avoiding bleeding complications is particularly challenging in this population.

Careful individualized dosing and frequent monitoring of anticoagulant therapy are essential to minimize hemorrhagic risks. These data also reinforce the need for development and implementation of refined anticoagulation protocols tailored to patients with prior COVID-19 infection [21].

Cardiac Complications. COVID-19 patients exhibited a higher frequency of cardiac decompensation, with 25% experiencing acute CHF exacerbation versus 15% in controls ($p<0.05$). Ventricular tachyarrhythmias were noted in 18% of Group 1 compared to 10% in Group 2 ($p<0.05$). The inflammatory milieu, hypoxia, and myocardial injury associated with COVID-19 likely contribute to these increased cardiac events. These arrhythmias and decompensations exacerbate clinical outcomes, increasing hospitalization and mortality risks [22].

Infectious Complications. Bacterial pneumonia was significantly more frequent in the COVID-19 group (7.6%) than in the non-COVID group (1.4%, $p<0.05$). The higher incidence may reflect immune suppression and lung tissue damage induced by COVID-19, increasing vulnerability to secondary infections. Preventive measures including vaccination, early infection detection, and prompt antibiotic therapy are crucial in this high-risk cohort [23,24].

Implications and Clinical Recommendations. This comprehensive analysis confirms that prior COVID-19 infection exacerbates the frequency and severity of multiple complications in elderly CHF and AF patients. The combined impact of hypercoagulability, inflammation, and myocardial stress leads to increased thromboembolic and cardiac adverse events, while anticoagulant use in this context raises bleeding risks [25].

Clinical management should integrate multidisciplinary approaches involving cardiology, hematology, and infectious disease expertise. Tailored anticoagulation strategies with close monitoring for bleeding, along with vigilant cardiac function surveillance, are imperative. Early detection and treatment of infections can reduce further complications [26].

Further prospective studies are warranted to refine management protocols and improve outcomes in this vulnerable population.

4. Conclusions

This study demonstrates that COVID-19 infection significantly increases the risk and severity of complications in patients with chronic heart failure and atrial fibrillation. Specifically, thromboembolic events such as pulmonary embolism and ischemic stroke occur at substantially higher rates in patients with prior COVID-19. These patients also face increased risks of both major and minor bleeding events, necessitating careful anticoagulant dose management.

Moreover, cardiac complications including acute heart failure decompensation and ventricular tachyarrhythmias are more frequent in the COVID-19 group, reflecting the impact of systemic inflammation and hypoxia on cardiac function. The incidence of bacterial pneumonia is also elevated, likely due to COVID-19-induced immune suppression and lung damage.

These findings highlight the need for personalized clinical strategies that balance thromboembolism prevention with

bleeding risk mitigation, alongside proactive management of cardiac and infectious complications. Enhanced surveillance and tailored therapies will be crucial to improving prognosis in this high-risk group.

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Disclosure

The authors declare that there are no conflicts of interest related to this study. This manuscript has not been previously published and is not currently under consideration for publication elsewhere. All authors have made substantial contributions to the conception, design, data collection, analysis, and interpretation of the study, and have approved the final version of the manuscript. No external funding was received specifically for this research. The study was conducted using the internal resources of Andijan State Medical Institute. No external editorial assistance, writing services, or paid review processes were utilized in the preparation of this manuscript. The findings presented in this study are based solely on the independent work of the authors.

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