DOI 10 26724/2079-8334-2023-3-85-171-174
UDC 616. 12-008.313:616.988-036

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INFLUENCE OF THE TRANSMITTED INFECTION OF COVID-19 ON THE PREVALENCE AND COURSE OF ATRIAL FIBRILLATION IN HOSPITALIZED PATIENTS

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The study was devoted to the analysis of heart rhythm and conduction disorders, namely atrial fibrillation in patients after a COVID-19 infection. 179 patients who were hospitalized from 09.20.2020 to 12.21.2021 were included in the screening. The main part of the study was made up of 116 people (64.8 %) with atrial fibrillation who suffered from a coronavirus infection. Group 1 was formed by 80 (69 %) patients who had AF before COVID-19. Group 2 – 36 patients (31 %) who had this arrhythmia after undergoing COVID-19. Control group – 49 patients with AF who had no history of COVID-19 infection. Other rhythm disturbances – 63 patients (35.2 %). Atrial fibrillation occurred more often than other heart rhythm and conduction disorders 64.5 % versus 35.2 % (p <0.001). Atrial fibrillation is the most common arrhythmia and has a worse course in hospitalized patients after a previous infection with COVID-19.

Key words: rhythm, arrhythmia, atrial fibrillation, SARS-CoV-2, COVID-19

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ВПЛИВ ПЕРЕНЕСЕНОЇ ІНФЕКЦІЇ COVID-19 НА ПОШИРЕНІСТЬ І ПЕРЕБІГ ФІБРИЛЯЦІЇ ПЕРЕДСЕРДЬ У ГОСПІТАЛІЗОВАНИХ ПАЦІЄНТІВ

Дослідження було присвячено аналізу порушень ритму та провідності серця, а саме фібриляції передсердь у пацієнтів після перенесеної інфекції COVID-19. Для проведення скринінгу було включено 179 пацієнтів, які були госпіталізовані з 20.09.2020 р. по 21.12.2021 р. Основну частину дослідження склали 116 осіб (64,8 %) з фібриляцією передсердь, що перенесли коронавірусну інфекцію. Групу 1 сформувало 80 (69 %) пацієнтів, які мали ФП до COVID-19. Групу – 36 пацієнтів (31 %) у яких дана аритмія з`явилася після перенесеної коронавірусної інфекції. Контрольна група – 49 пацієнів з фібриляцією передсердь, в яких не було в анамнезі COVID-19. Інші порушення ритму – 63 хворих (35,2 %). Фібриляція передсердь зустрічалася частіше за інші порушення ритму та провідності серця 64,5 % проти 35,2 % (p <0.001). Фібриляція передсердь є найпоширенішою аритмією та має гірший перебіг у госпіталізованих пацієнтів після перенесеної інфекції COVID-19.

Ключові слова: ритм, аритмія, фібриляція передсердь, SARS-CoV-2, COVID-19

The study is a fragment of the research project "To study the influence of damaged infection andchronic stress due to martial law on the course of atrialfibrillation", state registration No. 0122U201827.

Coronaviruses have been known since 1937, when for the first time in laboratory conditions it was possible to isolate a strain of the infectious bronchitis virus in chickens. They are characterized by a wide tropism and can affect, in addition to the respiratory tract, the liver, kidneys, intestines, nervous system, heart and eyes [1, 6]. Before the emergence of the SARS-associated coronavirus, it was believed that coronaviruses cause quite serious diseases in animals, and only mild diseases of the upper respiratory tract in humans [2].

Everything has changed with the appearance of a new respiratory disease, which was named the coronavirus disease of 2019 – COVID-19 (Coronavirus disease 2019), the causative agent is the SARS-CoV-2 coronavirus, which became the seventh known human coronavirus [3, 4]. The first episodes of the disease were recorded in December 2019 in Wuhan (Hubei, China) as a viral infection with pneumonia and respiratory syndrome [5]. There is information that a person could be infected with this virus as early as September 2019, as well as the possibility of an artificial origin of SARS-CoV-2 [3, 6]. Coronavirus infection (CI) has reached a pandemic level since March 2020 and caused a significant collapse in the health care sector. At the time of writing, about 700 million cases have been registered in the world and more than 6 million infected people have died [15]. Myocardial injury during COVID-19 is common, and patients with cardiac disease have a higher risk of myocardial damage and a worse outcome [7, 8]. Atrial fibrillation (AF) is the most common arrhythmia. Experts estimate that by 2050, 6-12 million people worldwide will have suffered from this disease in the US and 17.9 million people in Europe by 2060. This arrhythmia is a major risk factor for ischemic stroke and causes an important economic burden with significant morbidity and mortality[9].

The infection with COVID-19 is an acute disease with an average incubation period of five to six days, in some cases up to 14 days [10].

According to the available literature, among patients with CI, AF was one of the most common arrhythmias, it was detected in 19-21% of all cases [5]. According to the Danish national registry, in most patients with the first symptoms of AF, they delayed or refused help, which probably caused prolonged AF paroxysms. Perhaps because of the pandemic, they were afraid of contact with health services, which delayed the initiation of anticoagulation therapy and increased the risk of thromboembolic complications. It is likely that only those who survived these complications were ultimately hospitalized and analyzed [5, 12].

The purpose of the study was to determine the prevalence and characteristics of the course of atrial fibrillation in hospitalized patients who have suffered from COVID-19.

Materials and methods. The first stage of the study, a screening analysis was performed of 179 patients with various types of heart rhythm and conduction disturbances, including patients over 18 years of age who had a CI more than 30 days ago and had a negative PCR test, were hospitalized in the Department of Clinical Arrhythmology and Electrophysiology for 15 months: from 09.20.2020 to 12.21.2021.

All patients signed informed consent to participate in the study. The research protocol was approved by the local ethics commission in accordance with the main provisions of the Council of Europe Convention on Human Rights and Biomedicine, the World Medical Association Declaration of Helsinki on the ethical principles of conducting human medical research and current regulations of the Ministry of Health of Ukraine.

After screening, 116 patients with AF were selected for the main part of the study, who formed the main group (MG) aged from 35 to 80 years, with an average age of 63.8 ± 0.6 years: 56 men and 60 women, who from 1 to 12 months ago (on average 5.1 ± 0.2 months) suffered a COVID-19 infection. Group 1(G1) – 80 patients had AF before CI – group AF(+)CI(-). The duration of arrhythmia before CI in them was from 1 to 30 years (6.4 ± 0.5 years on average). Group 2 (G2) – 36 people (31 %) had AF after undergoing CI – group AF(-)CI(+). The time from the transferred CI to the worsening of the condition was 2.01+0.19 months, and from the worsening of the condition to the moment of hospitalization and the corresponding examination – 3.1 ± 0.2 months. As the 1st control group (CG), 49 patients with AF without a history of CI were examined: 34 men and 15 women aged 35 to 80 years (mean age 59.0 ± 0.2 years). 17 of them (35 %) had Paroxysmal AF (Par.AF), 22 (45 %) – Persistent AF (Pers.AF), and 10 (20%) – Permanent AF (Perm. AF).

The main part of the mathematical processing of the material was performed on a personal computer using the standard statistical programs Statistics 10 for Windows (StatSoftInc., Oklahoma, USA) and IBM SPSS Statistics 20. For quantitative indicators, the primary statistical processing included the calculation (M±m, where M – arithmetic mean, m – standard deviation of the mean) or absolute and relative values.

Results of the study and their discussion. As can be seen from the above data, in most patients – 65 % (that is, in almost 2/3 of the total number) the reason for hospitalization was atrial fibrillation (AF), which is logical, since, firstly, this type of arrhythmia is the most common worldwide a frequent cause of hospitalizations [14], and secondly, it is reasonably considered to be potentially dangerous, as it is one of the main causes of cardioembolic strokes [13]. The analyzed cohort of 116 needs (64.8 %) with MG was characterized by a reliable advantage with AF. Other heart rhythm and conduction disorders were the reason for hospitalization of 63 patients (35.2 %), which is significantly less ($p<0.001$) in accordance with AF. Namely: supraventricular tachycardia – in 26 patients (16.2 %), impaired impulse formation and conduction – in 12 patients (6.7 %), premature recovery of the myocardium. More details are given in the form of a diagram in Fig. 1.

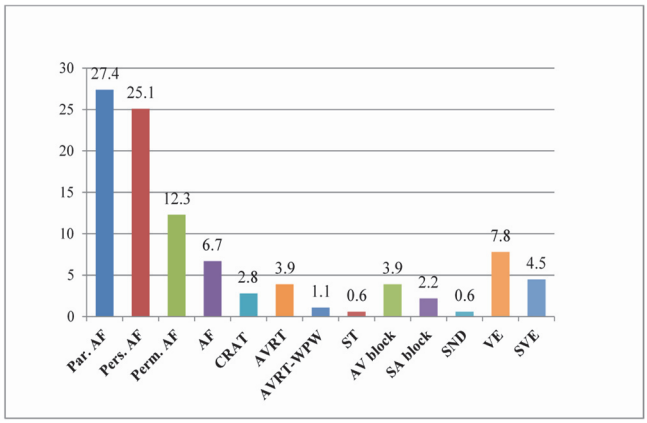

Fig 1. Screening for the detection of heart rhythm and conduction disorders.

Note. Par.AF – paroxysmal atrial fibrillation; Pers.AF – persistent atrial fibrillation; Perm. AF – permanent atrial fibrillation ; CRAT – continuous recurrent atrial tachycardia; AVRT – atrioventricular

tachycardia; AVRT-WPW – atrioventricular reciprocal tachycardia in WPW syndrome; AF – atrial flutter; ST – sinus tachycardia ; AV block – atrio-ventricular block; SA block – sinoatrial block; SND – sinus node dysfunction ; VE – ventricular extrasystole; SVE – supraventricular extrasystole.

We performed a comparative analysis of examined patients depending on the form of arrhythmia and age, which is shown in Table 1.

Table 1

Quantitative composition and age characteristics of MG and CG

Group and subgroups	n =	(%)	Age (years)	Group and subgroups	n =	(%)	Age (years)	p (years)	p (%)
MG	116	100	63.6±0.8	CG	49	100	61.1±1.2	not reliable	not reliable
Par. AF	49	2.2	62.9±1.2	Par. AF	17	4.7	60.0±2.2	not reliable	not reliable
Pers. AF	45	8.8	65.2±1.5	Pers. AF	22	4.9	60.0±2.4	not reliable	not reliable
Perm. AF	22	9.0	63.9±2.9	Perm. AF	10	0.4	62.0±4.0	not reliable	not reliable

Note. MG – main group, CG – control group, p – the significance of the difference between groups depending on age and arrhythmia

As can be seen from Table I, the age of the patients of the main group (MG) did not differ from the first control group (CG).

Anamnesis before CI, 80 patients of the AF(+) group had:

– 56 patients – 70 % Par. AF;

– 11 patients – 13.8 % Pers. AF;

– 13 patients – 16.2 % Perm AF.

Of the patients (G1) who had AF before CI, 37 (46.3 %) had and remained Par.AF or Pers.AF. Of these, 27 patients (73.0 %) had increased frequency of paroxysms, 17 patients (45.9 %) had increased duration, but did not exceed 7 days, and 16 of them (43.2 %) had increased duration and frequency of paroxysms. In 19 patients with Par.AF before CI, after this disease there was a transition to Pers.AF (33.9 %). 5 out of 11 patients had and still have Pers. AF (45.5 %). And 6 patients with Pers.AF before CI (54.5 %) developed Post.AF. Of the 13 patients in whom Post AF was present before CI, 6 people (46.2 %) developed tachyform arrhythmia, 1 patient (7.7 %) developed bradyform arrhythmia, and 6 (46.2 %) developed Post AF. FP has not changed.

Of patients (G2) who did not have arrhythmia before CI – 12 people out of 36 (33.3 %) developed Par.AF, and in 21 patients (58.3 %) AF immediately became persistent character, and 3 developed Post.AF (8.4 %). The development of various forms of AF occurred in them from immediately to 10 months (on average, 2.0 ± 0.35 months) after CI. This arrhythmia lasted an average of 3.1 ± 0.35 months. until the moment of inclusion in the examination.

We found that during the pandemic, which recently ended, in patients who suffered from COVID-19, the course of existing AF not only worsened, but also the number of new cases of this arrhythmia increased, which became the cause of hospitalizations. This is confirmed by data from a study in which 9,574 patients with COVID-19 were analyzed, 1.687 (17.6 %) developed AF, and these patients experienced significantly higher in-hospital mortality compared to patients with sinus rhythm [13].

These results emphasize the fact that CI itself can function as an independent risk factor for the development of cardiac arrhythmias and is associated with worse clinical outcomes, although quite often patients with atrial fibrillation have a large number of following pathologies that, under unfavorable conditions, can provoke new ones paroxysms of AF. The exact etiology of atrial fibrillation in patients with COVID-19 is currently unknown. Despite the paucity of research on this topic, some researchers have attempted to link cytokine storm, hypoxemia, endothelial dysfunction, electrolyte disturbances, microvascular inflammation, platelet activation, fibrin deposition, and sympathetic nervous system activation to the induction of atrial fibrillation [4, 11]. It is important to understand that COVID-19 and AF are a lethal combination, as they together increase the risk of pulmonary embolism, stroke, and venous thromboembolism [12]. Analyzing the literature data, we found that of 30,999 patients with COVID-19 who were hospitalized in 120 medical facilities in the United States, AF developed in approximately 1,517 patients (5.4 %) who had associated cardiovascular risk factors [8], which confirms our hypothesis. The data on the demographic incidence of AF in patients with CI became interesting, this type of heart rhythm disorders was more common in Europeans (15 %), followed by Americans (11 %), Asians (6 %) and Africans (2 %) [13].

This supports the fact that AF is the most common form of arrhythmia in patients with COVID-19 and may be the first sign even before overt respiratory distress. Almost 20 % of patients with COVID-19 have a history of AF, but new-onset AF is also a common complication of COVID-19, with a risk of 10 to 18 % [7]. The appearance of paroxysms of AF in patients after a CI is associated with an unfavorable prognosis. In general, AF independently increases the risk of stroke, the duration of hospitalization, death and complicates the clinical course of AF, so studying the features of the course of this arrhythmia is extremely important for the further management of such patients.

Conclusions

Based on the results of the screening examination of patients who suffered from the infection of COVID-19 and were hospitalized in the clinic, we established the following:

1. In most patients – 65 % (that is, almost 2/3 of the total number)) the reason for hospitalization was atrial fibrillation;

2. In 31 % of patients AF was detected for the first time and appeared 2.0±0.1 months after CI;

3. Patients with a persistent form of AF compared to the main group of such patients had more $p<0.05$. Therefore, the transferred coronavirus infection not only worsens the course of all forms of this arrhythmia, but also increases the probability of the first registered persistent form of AF.

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Стаття надійшла 4.09.2022 р.