

## CLINICAL AND EPIDEMIOLOGICAL PARALLELS OF HEART FAILURE AND ATRIAL FIBRILLATION

©Yu. I. Karpenko, Chen Cheng

*Odesa National Medical University, Odesa, Ukraine*

**SUMMARY. The aim** – to assess the prevalence of HF in patients with AF.

**Material and Methods.** The study was performed on the basis of the regional clinical hospital (Odesa) in 2018–2021. Medical records of 2459 patients with HF were retrospectively studied. All patients were examined in accordance with the Unified Protocol of Medical Care, Order of the Ministry of Health of Ukraine No. 384 (2012). All patients were assessed for exercise tolerance using a 6-minute walk test. Statistical processing was performed by methods of analysis of variance and correlation.

**Results.** The average age of patients was 64.3–1.9 years, In 2.2 % of patients under the age of 60 was found AF, whereas amongst older patients there were 13.3 % cases. I st FC CH was in 34 (65.4 %) patients, III FC CH – in 34.6 %. The average test score with a 6-minute walk was 277.5±12.5 m, the average time of restitution after exercise – 32.3±3.7 s. The average score on the CHADS-VASC scale was 4.2±0.3 points, HAS-BLED – 2.9±0.2 points. The results of 6-minutes walking test correlated with the duration of AF ( $r=-0.66$ ).

**Conclusions.** 1. There were 2.2 % of patients under the age of 60 had AF, in older patients – in 13.3 % of cases. The constant form of AF is the most often noted variant.

2. Inverse correlation between the distance traveled by the patient in 6 minutes and the duration of AF ( $r=-0.66$ ) was found.

**KEY WORDS:** atrial fibrillation; heart failure; epidemiology.

**Introduction.** According to WHO experts, heart failure (HF) and atrial fibrillation (AF) will become epidemics of the 21st century, including due to increased life expectancy and success in reducing overall cardiovascular mortality [1–3]. Both conditions are becoming more common, with rapid costs for health services worldwide. The incidence of atrial fibrillation may double over the next 20 years, to 120–215,000 new cases per year by 2030 in Europe, whereas 44 % cases are characterized with persistent and 56 % with persistent AF. Thus, the combination of these two conditions will have a dramatic impact on health care and will require a reorientation of the health care system.

Pathophysiology and risk factors for HF and AF are closely related, usually the elderly with a significant burden of comorbidity. Atrial fibrillation is both a cause and a consequence of HF, with complex interactions leading to systolic and diastolic dysfunction. Atrial fibrillation is associated with a threefold increased risk of HF [1, 2]. Conversely, structural and neurohormonal changes in HF make the development and progression of AF much more likely, both in heart failure with reduced ejection fraction (HFrEF) and preserved ejection fraction (HFpEF) [4, 5]. Although in the first place, patients with concomitant HF and AF have a significantly worse prognosis [1, 4, 5]. Given the low outcomes associated with HF and AF, finding effective treatments for these patients is paramount [6]

The aim of the study was to assess the prevalence of HF in patients with AF.

**Material and methods.** The study was performed on the basis of the regional clinical hospital (Odessa) in 2018–2021. Treatment materials of 2459 patients with HF were retrospectively studied.

All patients were examined in accordance with the Unified Protocol of Medical Care, Order of the Ministry of Health of Ukraine No. 384 (2012) [7] and daily BP monitoring), clinical and laboratory (blood & urine analysis, lipid profile, liver samples, blood electrolytes, blood type, coagulogram, NUP).

All patients were assessed for exercise tolerance using a 6-minute walk test [7, 8].

Statistical processing was performed by methods of analysis of variance and correlation [9].

**Results.** When studying the medical histories of patients with CHF admitted to the COPD, it was found that the average age of patients was 64.3–1.9 years, with a predominance of men (64.4 %) in the sample. 2.2 % of patients under the age of 60 had AF, and older patients had AF in 13.3 % cases. The distribution of AF forms is shown in Figure 1.

Comorbid conditions occurred in all HF patients. Coronary heart disease was diagnosed in 100 % of patients, and every second (50.2 %) patient had history of strokes and TIA (14.5 % and 33.3 %, respectively). All patients were diagnosed with hypertension, including 198 (19.7 %) – symptomatic, mostly of renal origin. Type 2 diabetes was registered in 387 (38.1 %), rheumatic diseases – in 126 (12.4 %) patients.

The distribution by functional classes of CH was as follows: II FC CH – in 34 (65.4 %) patients, III FC CH – in 34.6 %. The average test score with a 6-minute walk

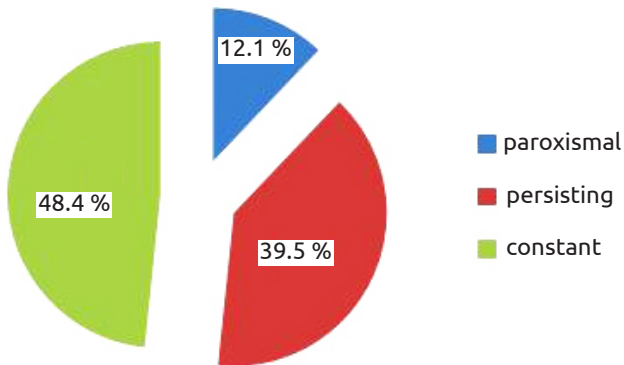


Figure 1 Distribution of AF forms in patients with CHF.

was  $277.5 \pm 12.5$  m, the average time of restitution after exercise –  $32.3 \pm 3.7$  s.

Most patients were characterized by shortness of breath during exercise, manifestations of orthopnea, paroxysmal nocturnal dyspnea, fatigue. Decreased tolerance to physical activity was manifested both by their intolerance (starting with the minimum) and by increasing the time of restitution. Manifestations of severe edematous syndrome were registered in 11.5 % of patients, in other patients there was pasty shins. Unfortunately, it was not possible to estimate jugular vein pressure in the present study, but positive hepato-jugular reflux in the majority (76.9 %) of patients indicates an increase. In addition, the symptom of bendopnea observed in many patients – shortness of breath when putting on and taking off shoes or socks, indicates increased postload.

It should be noted that bendopnea is a recently described symptom of heart failure, it was presented by Thibodeau et al. in 2014 [10]. In principle, doctors of the twentieth and even nineteenth centuries had similar observations, but they did not give this symptom any special name [11, 12].

The third heart tone (gallop rhythm) was observed in 11.5 % of patients. All patients had a lateral apical displacement. Nocturnal cough was observed in 30.5 % of patients, wheezing – in 16.7 %. 56.5 % of patients complained of deterioration of mnemonic functions (memory, concentration of active attention). Every second patient had symptoms of depression. 83.8 % complained of general weakness. 11.6 % had a history of fainting. Complaints of a strong heartbeat were found in 44.5 %. 25.0 % com-

plained of pathological weight gain ( $>2$  kg/week) and 35.4 % complained of weight loss. Pulmonary crepitation was observed in 4.2 % of patients, impaired breathing and dullness during percussion in the basal parts of the lungs – in 11.2 %. Coldness and chills of the extremities were noted by 13.8 % of patients. Acrocyanosis and pallor of the skin were detected in 55.7 % of patients.

The average heart rate was  $85.1 \pm 1.4$  beats per minute. (the normosystolic variant of AF prevailed), the average office BP –  $118.8 \pm 1.6 / 69.9 \pm 1.4$  mm Hg. Article (against the background of antihypertensive therapy). The average value of the pulse deficit in its presence is  $14.4 \pm 1.3$  bpm

When assessing the risks of ischemic and hemorrhagic events, it was found that the average score on the CHADS-VASC scale was  $4.2 \pm 0.3$  points, HAS-BLED –  $2.9 \pm 0.2$  points.

When comparing the severity of HF and the severity of AF, the presence of an inverse correlation between the distance traveled by the patient in 6 minutes and the duration of AF ( $r = -0.66$ ).

**Discussion.** The mechanisms and pathophysiology of atrial fibrillation in heart failure are well studied. Hypertension, smoking, obesity, diabetes, renal failure, sleep apnea and coronary artery disease are associated with an increased risk of developing both HF and AF. In HF, neurohormonal imbalance and activation of the renin-angiotensin-aldosterone system (RAAS) lead to maladaptive physiological changes, including increased filling pressure and subsequent exercise.

This can lead to increased left atrial distension and fibrosis, which contributes to the development of conduction abnormalities and facilitates the onset and maintenance of AF. The renin-angiotensin-aldosterone system also directly promotes proarrhythmic remodeling, with angiotensin II causing atrial fibrosis and anisotropic conduction. Patients with CH also show altered calcium metabolism and calcium overload of myocardial cells, which can lead to depolarization and arrhythmia.

**Conclusions:** 1. There were 2.2 % of patients under the age of 60 had AF, in older patients – in 13.3 % of cases. The constant form of AF is the most often noted variant.

2. Inverse correlation between the distance traveled by the patient in 6 minutes and the duration of AF ( $r = -0.66$ ) was found.

#### LITERATURE

1. Atrial Fibrillation and Heart Failure: Epidemiology, Pathophysiology, Prognosis, and Management / J. P. Arivaratnam, D. H. Lau, P. Sanders, J. M. Kalman // Card. Electrophysiol. Clin. – 2021. – No. 13 (1). – P. 47–62. DOI: 10.1016/j.ccep.2020.11.004.

2. Louka A. M. Clinical risk scores for the prediction of incident atrial fibrillation: a modernized review / A. M. Louka, C. Tsagkaris, A. Stoica // Rom. J. Intern. Med. – 2021. – No. 59 (4). – P. 321–327. DOI: 10.2478/rjim-2021-0018.

Огляди літератури, **оригінальні дослідження**, погляд на проблему, випадок з практики, короткі повідомлення

3. NT-proBNP as a marker for atrial fibrillation and heart failure in four observational outpatient trials / S. M. Werhahn, C. Becker, M. Mende [et al.] // *ESC Heart Fail.* – 2021 – No. 30. DOI: 10.1002/ehf2.13703. Epub ahead of print.
4. The Central Role of Left Atrium in Heart Failure / M. Carpenito, D. Fanti, S. Mega [et al.] // *Front. Cardiovasc. Med.* – 2021. – No. 13 (8). – P. 704–762. DOI: 10.3389/fcvm.2021.704762. PMID: 34485406; PMCID: PMC8414134.
5. The Role of Mitochondrial Dysfunction in Atrial Fibrillation: Translation to Druggable Target and Biomarker Discovery / L. Pool, L. F. J. M. Wijdeveld, N. M. S. de Groot, B. J. J. M. Brundel // *Int. J. Mol. Sci.* – 2021 – No. 22 (16). – P. 8463. DOI: 10.3390/ijms22168463. PMID: 34445167; PMCID: PMC8395135.
6. Про затвердження протоколів надання медичної допомоги за спеціальністю „Кардіологія” : Наказ МОЗ України від 03.07.2006 № 436 [http://www.moz.gov.ua/ua/portal/dn\\_20060703\\_436.html](http://www.moz.gov.ua/ua/portal/dn_20060703_436.html)
7. Діагностика і лікування хронічної серцевої недостатності: Рекомендації Європейського товариства кардіологів, 2016 р. : Електронний ресурс. – Режим доступу: <http://health-ua.com/article/4772-dagnostika-lkuvannya-hronichno-sertcevo-nedostatnost-rekomendatc-vropejsko>
8. Орлов В. Н. Руководство по электрокардиографии / В. Н. Орлов – М. : МИА, 2017. – 528 с.
9. Петри А. Наглядная статистика в медицине [Текст] : учеб. пособие: Пер. с англ. / А. Петри, К. Сэбин. – М. : ГЭОТАР-МЕДИА, 2003. – 143 с.
10. Characterization of a novel symptom of advanced heart failure: bendopnea / J. T. Thibodeau, A. T. Turer, S. K. Gualano [et al.] // *JACC Heart Fail.* – 2014. – No. 2 (1). – P. 24–31. DOI: 10.1016/j.jchf.2013.07.009. Epub 2014 Jan 8. PMID: 24622115.
11. Brandon N. Characterization of a novel symptom of advanced heart failure: bendopnea / N. Brandon // *JACC Heart Fail.* – 2014 – No. 2 (5) – P. 540. DOI: 10.1016/j.jchf.2014.05.009. PMID: 25301158.
12. Falk R. H. "Bendopnea" or "kamptopnea?": Some thoughts on terminology and mechanisms / R. H. Falk // *JACC Heart Fail.* – 2014. – No. 2(4). – P. 425. DOI: 10.1016/j.jchf.2014.03.011. PMID: 25103981.

#### REFERENCES

1. Ariyaratnam, J.P., Lau, D.H., Sanders, P., & Kalman, J.M. (2021). Atrial Fibrillation and Heart Failure: Epidemiology, Pathophysiology, Prognosis, and Management. *Card. Electrophysiol. Clin.*, 13(1), 47-62. DOI: 10.1016/j.ccep.2020.11.004. PMID: 33516407.
2. Louka, A.M. Tsagkaris, C., & Stoica A. (2021). Clinical risk scores for the prediction of incident atrial fibrillation: a modernized review. *Rom. J. Intern. Med.*, 59(4), 321-327. DOI: 10.2478/rjim-2021-0018. PMID: 33951355.
3. Werhahn, S.M., Becker, C., Mende, M., Haarmann, H., Nolte, K., Laufs, U., ... Wachter, R. (2021). NT-proBNP as a marker for atrial fibrillation and heart failure in four observational outpatient trials. *ESC Heart Fail*, 30. DOI: 10.1002/ehf2.13703. Epub ahead of print. PMID: 34850596.
4. Carpenito, M., Fanti, D., Mega, S., Benfari, G., Bono, M.C., Rossi, A., Ribichini, F.L., & Grigioni, F. (2021). The Central Role of Left Atrium in Heart Failure. *Front. Cardiovasc. Med.*, 8, 704-762. DOI: 10.3389/fcvm.2021.704762. PMID: 34485406; PMCID: PMC8414134.
5. Pool, L., Wijdeveld, L.F.J.M., de Groot, N.M.S., & Brundel, B.J.J.M. (2021). The Role of Mitochondrial Dysfunction in Atrial Fibrillation: Translation to Druggable Target and Biomarker Discovery. *Int. J. Mol. Sci.*, 22(16), 8463. DOI: 10.3390/ijms22168463. PMID: 34445167; PMCID: PMC8395135.
6. Nakaz MOZ Ukrayiny vid 03.07.2006 № 436 Pro zatverdzhennya protokoliv nadannya medychnoyi dopomohy za spetsialnistyu „Kardiologiya” – Order of the Ministry of Health of Ukraine dated 03.07.2006 No. 436 On the approval of protocols for the provision of medical care in the specialty "Cardiology". Retrieved from: [http://www.moz.gov.ua/ua/portal/dn\\_20060703\\_436.html](http://www.moz.gov.ua/ua/portal/dn_20060703_436.html) [in Ukrainian].
7. Diahnostyka i likuvannya khronichnoyi sertsevoyi nedostatnosti: Rekomendatsiyi Yevropeyskoho tovarystva kardiologiv, 2016 r.: Elektronnyy resurs – Diagnosis and treatment of chronic heart failure: Recommendations of the European Society of Cardiology, 2016: Electronic resource. Retrieved from: <http://health-ua.com/article/4772-dagnostika-lkuvannya-hronichno-sertcevo-nedostatnost-rekomendatc-vropejsko> [in Ukrainian].
8. Orlov, V.N. (2017). *Rukovodstvo po elektrokardiografii – Guide to Electrocardiography*. Moscow: MIA [in Russian].
9. Petri, A., & Sebin, K. (2003). *Naglyadnaya statistika v meditsine [Tekst] : ucheb. posobiye: Per. s angl. – Visual statistics in medicine [Text]: textbook Transl. from English*. Moscow : GEOTAR-MED [in Russian].
10. Thibodeau, J.T., Turer, A.T., Gualano, S.K., Ayers, C.R., Velez-Martinez, M., Mishkin, J.D., ..., Drazner, M.H. (2014). Characterization of a novel symptom of advanced heart failure: bendopnea. *JACC Heart Fail.*, 2(1), 24-31. DOI: 10.1016/j.jchf.2013.07.009. Epub 2014 Jan 8. PMID: 24622115.
11. Brandon, N. (2014). Characterization of a novel symptom of advanced heart failure: bendopnea. *JACC Heart Fail.*, 2(5), 540. DOI: 10.1016/j.jchf.2014.05.009. PMID: 25301158.
12. Falk, R.H. (2014). "Bendopnea" or "kamptopnea?": Some thoughts on terminology and mechanisms. *JACC Heart Fail.* 2(4), 425. DOI: 10.1016/j.jchf.2014.03.011. PMID: 25103981.

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## КЛІНІКО-ЕПІДЕМІОЛОГІЧНІ ПАРАЛЕЛІ СЕРЦЕВОЇ НЕДОСТАТНОСТІ ТА ФІБРИЛЯЦІЇ ПЕРЕДСЕРДЬ

©Ю. І. Карпенко, Чен Ченг

*Одеський національний медичний університет, Одеса, Україна*

**РЕЗЮМЕ.** Метою дослідження була оцінка поширеності СН у пацієнтів з ФП.

**Матеріал і методи.** Дослідження було проведено на базі обласної клінічної лікарні (м. Одеса) у 2018–2021 роках. Ретроспективно вивчені медичні карти 2459 хворих на СН. Усі пацієнти обстежені відповідно до Єдиного протоколу надання медичної допомоги, наказу МОЗ України № 384 (2012 р.). У всіх пацієнтів оцінювали переносимість фізичних навантажень за допомогою 6-хвилинного тесту ходьби. Статистичну обробку проводили методами дисперсійного та кореляційного аналізу.

**Результати.** Середній вік пацієнтів становив 64,3–1,9 року, у 2,2 % пацієнтів віком до 60 років виявлено ФП, тоді як серед пацієнтів старшого віку – 13,3 % випадків. І ФК СН була у 34 (65,4 %) хворих, ІІІ ФК СН – у 34,6 %. Середній бал тесту з 6-хвилинною ходьбою становив ( $277,5 \pm 12,5$ ) м, середній час відновлення після фізичного навантаження – ( $32,3 \pm 3,7$ ) с. Середній бал за шкалою CHADS-VASC становив ( $4,2 \pm 0,3$ ) бала, HAS-BLED – ( $2,9 \pm 0,2$ ) бала. Результати 6-хвилинного тесту ходьби корелювали з тривалістю ФП ( $r = -0,66$ ).

**Висновки.** 1. У пацієнтів віком до 60 років ФП було у 2,2 %, у пацієнтів старшого віку – у 13,3 % випадків. Постійна форма ФП є найпоширенішим варіантом.

2. Виявлено обернену кореляцію між відстанню, яку пройшов пацієнт за 6 хвилин, і тривалістю ФП ( $r = -0,66$ ).

**КЛЮЧОВІ СЛОВА:** фібриляція передсердь; серцева недостатність; епідеміологія.

Отримано 03.05.2022

Електронна адреса для листування: holmas.1988@gmail.com