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ATRIAL FIBRILLATION AND ATRIAL FLUTTER IN THE PRACTICE OF THE EMERGENCY MEDICAL TEAM IN POLAND

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ABSTRACT

Background: Atrial Fibrillation (AF) is one of the most common heart arrhythmias globally. It is characterized by irregular, chaotic contractions of the atrial muscle, leading to an irregular and often rapid heart rhythm. The prevalence of this arrhythmia increases with age, which is associated with both the aging population and cardiovascular risk factors such as hypertension, coronary artery disease, and diabetes.

Atrial Flutter (AFL) represents a less common variant of atrial fibrillation, occurring significantly less frequently - in relation to atrial fibrillation (AF), it is estimated to account for less than one-tenth of cases.

The aim of the study was to analyze emergency medical services delivered to patients diagnosed with atrial fibrillation (AF) and atrial flutter (AFL) in the Voivodeship of Warmia and Mazury (Poland). The patients were classified according to the 10th Revision of the International Classification of Diseases (ICD-10) [1].

Methods: The study was based on a retrospective data analysis. From a total population of 400,251 subjects (n= 400,251), 4715 patients were selected for the study. The majority of the patients were women (n=2941; 62.38%), whereas men accounted for 37.62% of the examined sample (n=1774). The analysis relied on a database administered by the Governor of the Voivodeship of Warmia and Mazury in Olsztyn [2]. The analyzed data included the area of intervention, the patient's age and sex, and the diagnoses made by physicians, paramedics, and emergency nurses. Three research hypotheses postulating the presence of relationships between the patient's sex and the diagnosis (1), the patient's age and the diagnosis (2), and a life-threatening emergency and the patient's age (3) were formulated.

Results: The results of the study suggest that the patient's sex affects the medical diagnosis. In particular, women were more frequently diagnosed with chest pain, whereas the probability of the remaining diagnoses was similar in both sexes. The patient's age does not significantly influence the diagnosis. The patient's sex is not a significant predictor of a life-threatening emergency.

Conclusion: The conducted study on the dataset from the Warmian-Masurian Voivodeship revealed significant correlations between demographic variables and the diagnosis of atrial fibrillation (AF) and atrial flutter (AFL) in patients. Analyzing this data may have significant implications for emergency medical systems, enabling the adaptation of intervention strategies to different patient categories.

Keywords: patient, hypertension, arrhythmia, arrhythmia treatment, rescue.

INTRODUCTION

Medical emergency services provide effective assistance to patients in health- and life-threatening situations, in particular patients with atrial fibrillation (AF) and atrial flutter (AFL). The response times of paramedic units, prehospital patient management, and the time of travel to the nearest hospital significantly affect the outcome of emergency interventions.

The Voivodeship of Warmia and Mazury (north-eastern Poland) has an area of 24,173 km²[3], and it is characterized by a weakly developed road network and a large number of small towns and villages. As a result, this region poses a considerable challenge for the National Medical Emergency Services.

This article presents detailed information about emergency medical services delivered to patients diagnosed with AF and AFL in the Voivodeship of Warmia and Mazury between 2020 and 2022.

Atrial fibrillation is the most common type of arrhythmia. According to estimates, AF affects around 2% of the adult population, but it is diagnosed in 10% of the population older than 75 years [4]. The prevalence of AF in the general population increases with age, from 0.12-0.16% in persons younger than 49 to 1.7-4.0% in persons aged 60-70 and 13.5-17.8% in the 80+ population [5,6]. Atrial fibrillation is diagnosed based on the presence of arrhythmia in an electrocardiogram (ECG). An episode lasting ≥ 30 s is required for the clinical diagnosis of AF [7].

According to the Global Burden of Disease (GBD) data, the age-adjusted prevalence of AF (per 1000 person-years) was estimated at 373.1 for women and 596.2 for men, which implies that in 2010, 12.6 million women and 20.9 million men around the world were affected by AF. In 2010, the age-adjusted incidence rate (per 1000 person-years) was 59.5 for women and 77.5 for men globally. According to the GBD, the overall disease burden, incidence, prevalence, and AF-associated mortality increased in both women and men between 1990 and 2010. The mortality associated with AF appears to be higher in women, although this observation is controversial [8].

Atrial fibrillation has been examined in detailed epidemiological studies, but research focusing on AFL has demonstrated that AFL is a less common type of arrhythmia than AF. Atrial flutter occurs less than 1/10 as often as AF. An analysis of the Marshfield Epidemiologic Study Area database revealed that the overall incidence of AFL is ~ 88 per 100,000 person-years. The incidence of AFL has been estimated at 5/100,000 in persons younger than 50, but it increases rapidly to 587/100,000 in the 80+ population [9].

Atrial flutter coexists with or precedes AF. In a longitudinal study, AF developed in 56% of the patients with isolated AFL [10]. Atrial fibrillation is associated with a 1.5- to 3.5 fold increase in the risk of death, and comorbidities play an important role [11]. In addition, AF accounts for approximately 3% of healthcare-related costs due to stroke, congestive heart failure, and unplanned hospitalization. Atrial fibrillation has numerous complications. It increases disease prevalence and mortality, while decreasing the patients' quality of life. The risk of AF is influenced by numerous factors, including age, as well as modifiable factors such as a sedentary lifestyle, obesity, and smoking. Modifiable factors can be controlled to decrease the incidence of AF in the population. Atrial fibrillation increases the risk of thromboembolic events, where ischemic cerebral stroke (ICS) is the most serious complication [11]. Stroke patients with AF have a worse prognosis than patients without AF. Approximately one-fifth of all strokes are attributable to AF.

Atrial flutter is the second most common type of supraventricular arrhythmia after AF. Atrial flutter usually occurs along the cavotricuspid isthmus of the right atrium, but it can also originate in the left atrium. Atrial flutter is generally resistant to pharmacotherapy, which is why ablation has been recommended as the gold standard in AFL treatment by European and American societies of cardiology [10].

The main aim of the study was to analyze emergency medical services delivered to patients with AF and AFL in the Voivodeship of Warmia and Mazury between 2020 and 2022. The detailed objectives were achieved by analyzing the operations of medical emergency units with particular emphasis on the patient's sex, the diagnoses made by paramedic units, the patient's age, and a life-threatening emergency.

MATERIALS AND METHODS

The study was conducted in Warmia and Mazury, the fourth largest Polish voivodeship (out of the total number of 16 voivodeships) with an area of 24,173 km². The Voivodeship of Warmia and Mazury is divided into 21 counties and 116 municipalities, including 16 urban municipalities, 33 urban-rural municipalities, and 67 rural municipalities [12]. The voivodeship has a population of 1,374,000, including 671,500 men and 703,200 women. Urban residents account for 59.2% and rural residents account for 40.8% of the voivodeship's population. The population age structure is as follows: children and adolescents – 18.5%, working age population – 59.6%, and elderly persons – 21.9% [12].

The empirical analysis involved a wide range of statistical methods. Data distribution and the relationships

between variables were determined in a frequency analysis with cross tabulation. The chi-squared test of independence (χ^2) was applied to identify the presence of significant relationships between nominal variables or between a nominal (dependent) variable and an ordinal (independent) variable. The results were presented in tables, where N denotes the size of the sample, and percent values are divided into three categories: in rows (%), in columns (%), and in total (%). The results were also presented in percent values to facilitate their interpretation. The Student's t-test for dependent samples was used to compare mean values in two associated groups and evaluate changes within groups under different conditions or over time. All analyses were conducted at a significance level of $p < 0.05$, which indicates that the observed differences or relationships were regarded as significant if the probability that the results were found by random chance was less than 5%. Statistical analyses were performed using IBM SPSS Statistics, Jamovi, Jasp, and MS Excel. The data were analyzed thoroughly with the use of various statistical tools to ensure the reliability and accuracy of the results.

The study was approved by the Research Ethics Committee of the University of Warmia and Mazury in Olsztyn (decision No. 11/2023). The study did not receive external funding.

RESULTS

CHARACTERISTICS OF THE STUDY POPULATION

Sex

The study population consisted of 4715 patients, mostly women (n=2941; 62.38%).

	Frequency	Percent	Cumulative percent
Women	2941	62.38	62.38
Men	1774	37.62	100.00
Total	4715	100.00	

Source: own study.

Area of intervention

Most paramedic interventions took place in areas with a population above 10,000 (n=2582; 54.76%). The remaining interventions took place in areas with a population of up to 10,000 (n=2133; 45.24%).

Area of intervention	Frequency	Percent	Cumulative percent
Population up to 10,000	2133	45.24	45.24
Population above 10,000	2582	54.76	100.00
Total	4715	100.00	

Source: own study.

Life-threatening emergency

Life-threatening emergency	Frequency	Percent	Valid percent	Cumulative percent
Yes	2771	58.77	58.78	58.78
No	1943	41.21	41.22	100.00
Data not available	1	0.02		
Total	4715	100.00		

Source: Authors' own study.

Diagnosis 1

Atrial fibrillation and AFL were diagnosed in all (100%) paramedic interventions.

Diagnosis_1	Frequency	Percent	Valid percent	Cumulative percent
Atrial fibrillation and atrial flutter	4715	100.00	100.00	100.00
Data not available	0	0.00		
Total	4715	100.00		

Source: Authors' own study.

Diagnosis 2

Chest pain and throat pain (ICD-10 R07) were most frequently diagnosed in valid cases (n=230; 50.22% of total valid cases). Shortness of breath (ICD-10 R06) was the second most frequent diagnosis (n=112; 24.45% of total valid cases), followed by unspecified chest pain (ICD-10 R07) (n=66; 14.41% of total valid cases). COVID-19 (virus identified, ICD-10 U07.1) was least frequently diagnosed (n=50; 10.92% of total valid cases).

Diagnosis_2	Frequency	Percent	Valid percent	Cumulative percent
Chest and throat pain	230	4.88	50.22	50.22
Unspecified chest pain	66	1.40	14.41	64.63
COVID-19, virus identified	50	1.06	10.92	75.55
Shortness of breath	112	2.38	24.45	100.00
Data not available	4257	90.29		
Total	4715	100.00		

Source: Authors' own study.

LIFE-THREATENING EMERGENCY

The majority of the analyzed cases were diagnosed as life-threatening emergencies (n=271, 58.78%).

Life-threatening emergency	Frequency	Percent	Valid percent	Cumulative percent
Yes	2771	58.77	58.78	58.78
No	1943	41.21	41.22	100.00
Data not available	1	0.02		
Total	4715	100.00		

Source: Authors' own study.

RELATIONSHIP BETWEEN A LIFE-THREATENING EMERGENCY AND THE PATIENT'S SEX

In the group of female patients, 1707 subjects experienced a life-threatening emergency, which accounts for 58.04% of the total number of cases in this group, whereas life-threatening emergencies were not diagnosed in 1234 women (41.96%). In men, a life-threatening emergency was diagnosed in 1064 cases

(60.01%) and was not diagnosed in 709 cases (39.99%).

Overall, life-threatening emergencies were diagnosed in 2771 cases (58.78% of the total number of cases) and were not diagnosed in 1943 cases (41.22%).

The chi-squared test revealed an absence of a significant relationship between a life-threatening emergency and the patient's sex (χ^2 (df=1, n=4714) =1.77; p = 0.17). These results indicate that the patient's sex is not a significant determinant of a life-threatening emergency.

Sex		Life-threatening emergency		Total
		Yes	No	
Women	Number of cases	1707.00	1234.00	2941.00
	% in row	58.04%	41.96%	100.00%
	% in column	61.60%	63.51%	62.39%
	% in total	36.21%	26.18%	62.39%
Men	Number of cases	1064.00	709.00	1773.00
	% in row	60.01%	39.99%	100.00%
	% in column	38.40%	36.49%	37.61%
	% in total	22.57%	15.04%	37.61%
Total	Number of cases	2771.00	1943.00	4714.00
	% in row	58.78%	41.22%	100.00%
	% in column	100.00%	100.00%	100.00%
	% in total	58.78%	41.22%	100.00%

Source: own study.

RELATIONSHIP BETWEEN THE PATIENT'S AGE AND DIAGNOSIS

Chest pain and throat pain (R07) were most frequently diagnosed (104 cases) in patients aged 76+, and this population group accounted for 46.43% of the total number of cases with this diagnosis. The above diagnosis was made in 94 cases in the 61-75 age group (41.96%) and in 24 cases in the 41-60 age group (10.71%). Only 2 patients aged 18-40 (0.89%) were diagnosed with chest and throat pain.

In the total number of patients diagnosed with unspecified chest pain (R07.4), the largest number of cases (39) was noted in the 76+ age group (60.00%). Unspecified chest pain was diagnosed in 24 cases in the 61-75 age group (36.92%) and in only 2 cases in the 41-60 age group (3.08%).

In the group of patients diagnosed with COVID-19 (virus identified, U07.1), the largest number of cases (25) was noted in the 76+ age group (51.02%). This diagnosis was made in 20 cases in the 61-75 age group (40.82%) and in 4 cases in the 41-60 age group (8.16%).

Shortness of breath (R06.0) was most frequently diagnosed (64 cases) in the 76+ age group (59.26%). This diagnosis was made in 38 cases in the 61-75 age group (35.19%) and in 6 cases in the 41-60 age group (5.56%).

Overall, the largest number of cases (232) was noted in the 76+ age group which accounted for 52.02% of all cases. There were 176 cases in the 61-75 age group (39.46%), 36 cases in the 41-60 age group (8.07%), and only 2 cases in the 18-40 age group (0.45%).

The chi-squared test revealed an absence of a significant relationship between the patient's age and the diagnosis (χ^2 (df=9, n=446) =11.00; p = 0.28). These results indicate that the patient's age is not a significant determinant of the type of diagnosis.

Diagnosis_2		Age group				Total
		18-40	41-60	61-75	76+	
Chest and throat pain	Number of cases	2.00	24.00	94.00	104.00	224.00
	% in row	0.89%	10.71%	41.96%	46.43%	100.00%
	% in column	100.00%	66.67%	53.41%	44.83%	50.22%
	% in total	0.45%	5.38%	21.08%	23.32%	50.22%
Unspecified chest pain	Number of cases	0.00	2.00	24.00	39.00	65.00
	% in row	0.00%	3.08%	36.92%	60.00%	100.00%
	% in column	0.00%	5.56%	13.64%	16.81%	14.57%
	% in total	0.00%	0.45%	5.38%	8.74%	14.57%
COVID-19, virus identified	Number of cases	0.00	4.00	20.00	25.00	49.00
	% in row	0.00%	8.16%	40.82%	51.02%	100.00%
	% in column	0.00%	11.11%	11.36%	10.78%	10.99%
	% in total	0.00%	0.90%	4.48%	5.61%	10.99%
Shortness of breath	Number of cases	0.00	6.00	38.00	64.00	108.00
	% in row	0.00%	5.56%	35.19%	59.26%	100.00%
	% in column	0.00%	16.67%	21.59%	27.59%	24.22%
	% in total	0.00%	1.35%	8.52%	14.35%	24.22%
Total	Number of cases	2.00	36.00	176.00	232.00	446.00
	% in row	0.45%	8.07%	39.46%	52.02%	100.00%
	% in column	100.00%	100.00%	100.00%	100.00%	100.00%
	% in total	0.45%	8.07%	39.46%	52.02%	100.00%

Chi2(n=9, n=446) =11.00; p=0.28

Source: Authors' own study.

RELATIONSHIP BETWEEN THE PATIENT'S SEX AND DIAGNOSIS

Chest pain and throat pain (R07) were more frequently diagnosed (152 cases) in women, and this population group accounted for 66.09% of the total number of cases with this diagnosis. In 78 cases, chest and throat pain was diagnosed in men (33.91%).

In the total number of patients diagnosed with unspecified chest pain (R07.4), the number of cases was equal in both sexes: 33 cases involved women (50% of the total number of cases) and 33 cases involved men (50%).

In the total number of confirmed cases of COVID-19 (virus identified, U07.1), 30 cases involved women (60.00% of the total number of COVID-19 cases) and 20 cases involved men (40.00%).

The distribution of cases with shortness of breath (R06.0) was also equal among the sexes. In 56 cases, this diagnosis was made in women (50.00% of the total number of cases), and in 56 cases, shortness of breath was diagnosed in men (50.00%).

Overall, 271 cases (59.17% of the total number of cases) involved women, and 187 cases (40.83%) involved men.

The chi-squared test revealed a significant relationship between the patient's sex and the diagnosis made by paramedics (χ^2 (df=3, n=458) =10.76; $p = 0.01$). These results suggest that the patient's sex affects the diagnosis made by the paramedics. In particular, women were more frequently diagnosed with throat and chest pain, whereas the probability of the remaining diagnoses was equal in both sexes.

Diagnosis		Sex		Total
		Women	Men	
Chest pain and throat pain	Number of cases	152.00	78.00	230.00
	% in row	66.09%	33.91%	100.00%
	% in column	56.09%	41.71%	50.22%
	% in total	33.19%	17.03%	50.22%
Unspecified chest pain	Number of cases	33.00	33.00	66.00
	% in row	50.00%	50.00%	100.00%
	% in column	12.18%	17.65%	14.41%
	% in total	7.21%	7.21%	14.41%
COVID-19, virus identified	Number of cases	30.00	20.00	50.00
	% in row	60.00%	40.00%	100.00%
	% in column	11.07%	10.70%	10.92%
	% in total	6.55%	4.37%	10.92%
Shortness of breath	Number of cases	56.00	56.00	112.00
	% in row	50.00%	50.00%	100.00%
	% in column	20.66%	29.95%	24.45%
	% in total	12.23%	12.23%	24.45%
Total	Number of cases	271.00	187.00	458.00
	% in row	59.17%	40.83%	100.00%
	% in column	100.00%	100.00%	100.00%

% in total	59.17%	40.83%	100.00%
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Source: Authors' own study.

DISCUSSION

According to research, AF and AFL commonly coexist in clinical practice [13]. Recent studies have shown that the prevalence of AF in patients with AFL ranges from 24% to 62% [14], [15]. Both types of arrhythmia can be the symptoms of the same electrical problem in the heart [16], and some researchers have argued that AFL rarely develops without antecedent AF which leads to tachycardia- or bradycardia-dependent interatrial block [17].

The present study analyzed the role of paramedic units in providing emergency assistance to patients with AF and AFL in the Polish Voivodeship of Warmia and Mazury. It was found that the response time is an important consideration, and that local conditions and the availability of infrastructure pose a challenge during paramedic interventions.

The aim of this study was to analyze emergency medical services delivered to patients diagnosed with AF and AFL over a period of three years. Three research hypotheses regarding the presence of relationships between the patient's sex and diagnosis, between the patient's age and diagnosis, and between a life-threatening emergency and the patient's age were formulated. Such analyses have been rarely conducted in the literature. Between 2015 and 2018, paramedic visits to patients aged 18-64 accounted for 50.5% (2018) to 51.9% (2015) of the total number of paramedic interventions in Poland. Visits to patients younger than 18 accounted for 6.0% (2018) to 6.4% (2015) of the total number of interventions, whereas visits to patients aged 65 and older accounted for 41.7% (2015) to 45.4% (2018) of all interventions [18].

RELATIONSHIP BETWEEN THE PATIENT'S SEX AND DIAGNOSIS

The results of the analysis indicate the presence of a significant relationship between the patient's sex and the diagnosis made by paramedics. Women were more frequently diagnosed with chest pain, whereas the probability of the remaining diagnoses was equal in both sexes. Atrial fibrillation affects 1-2% of the general population. The incidence of AF increases with age and is estimated at 10% in persons older than 75.

RELATIONSHIP BETWEEN THE PATIENT'S AGE AND DIAGNOSIS

Chest and throat pain, unspecific chest pain, COVID-19, and shortness of breath were most frequently diagnosed by paramedics in patients with AF and AFL. The analysis of the results indicates that chest pain was most frequently experienced by persons older than 76, followed by persons aged 61-75. Chest pain was least frequently diagnosed in the 18-40 age group. Similar observations were made in patients diagnosed with unspecific chest pain. The distribution of COVID-19 diagnoses in the evaluated age groups also followed a similar pattern. Shortness of breath was also most frequently diagnosed in the 76+ age group, and the number of cases decreased with age. Overall, the largest number of cases (232) involved patients aged 76 and older, and this age group accounted for 52.02% of the total number of cases. There were 176 cases in the 61-75 age group (39.46%), 36 cases in the 41-60 age group (8.07%), and only 2 cases in the 18-40 age group (0.45%).

Wojciech Mielczarek analyzed cardiac arrhythmias in the elderly and concluded that population aging contributes to an increase in the number of patients with AF. They account for 10% of the population aged 80 and older, whereas 70% of patients with AF are aged 65-85 years. Effective strategies should be developed to manage the growing number of elderly patients (75+) with AF and other types of arrhythmia [19].

RELATIONSHIP BETWEEN A LIFE-THREATENING EMERGENCY AND THE PATIENT'S SEX

The analysis did not reveal a significant relationship between a life-threatening emergency and the patient's sex. Overall, a life-threatening emergency was diagnosed in 2771 cases (58.78% of the total number of cases), and it was not diagnosed in 1943 cases (41.22%). Atrial fibrillation is the most common arrhythmia with an estimated lifetime risk of 25% [20].

The analysis of the data, which did not demonstrate a significant statistical association between the occurrence of a life-threatening emergency and the patient's gender, may suggest that gender is not a significant risk factor for such a condition. However, to fully understand these results, it is also worth considering other possible factors influencing the occurrence of life-threatening emergencies and analyzing the context of this data.

Despite the lack of a significant association between gender and the occurrence of a life-threatening

emergency, there are many other risk factors that may have an impact on its incidence. Attention should be paid to other variables such as patient age, the presence of coexisting conditions (such as heart disease, hypertension, diabetes), time from symptom onset to medical assistance, type of arrhythmia, presence of coexisting conditions, or previous treatments, all of which may influence the patient's condition.

In summary, although the absence of a significant statistical association between gender and the occurrence of a life-threatening emergency may suggest that gender is not a key risk factor, a more detailed examination of other possible risk factors and an analysis of the context of the data is necessary to fully understand these results.

The AF Screen International Collaboration was established in 2017 to promote discussion and research on screening for AF in an effort to reduce the risk of stroke and death. This collaborative group concluded that AF screening programs are effective, but should be tailored to the healthcare systems of individual countries [21]. According to the European Resuscitation Council guidelines, hemodynamically unstable patients should be identified based on the following symptoms:

- shock,
- loss of consciousness,
- myocardial ischemia,
- acute heart failure.

Patients with the above symptoms should undergo electrical cardioversion as soon as possible. Analgesic and sedative drugs should be administered accordingly [22].

CONCLUSIONS

Despite the fact that the National Medical Emergency Services play a key role in the system of emergency medical care, the quality of the provided services has been relatively rarely researched. Most studies have analyzed ambulance response times or prehospital time. Neukamm et al. (2011) emphasized the importance of paramedic training and adherence to the European Resuscitation Council guidelines [23].

The results of this study suggest that the patient's sex influences the type of diagnosis. Women were more frequently diagnosed with chest pain than men. In turn, the patient's age does not seem to significantly affect the diagnosis made by paramedic units. The patient's age is not significantly associated with a life-threatening emergency.

SUMMARY

The analysis of the data for the Voivodeship of Warmia and Mazury revealed certain associations between demographic data and the diagnoses of patients with AF and AFL. These findings could be used by medical emergency services to tailor rescue solutions to specific groups of patients.

RECOMMENDATIONS

Further research involving additional factors, such as lifestyle, comorbidities, and family history, is needed to determine the impact of different variables on the medical diagnosis and the effectiveness of medical emergency services. In addition, the operations of medical emergency units should be monitored and evaluated to improve the system. The effectiveness of medical rescue solutions should be analyzed based on the obtained results, and further research and analyses may provide more detailed information about the influence of demographic factors on the diagnoses of patients with AF and AFL.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

DECLARATIONS

Ethical Approval: The study was approved by the Research Ethics Committee of the University of Warmia and Mazury in Olsztyn (decision No. 11/2023). The study did not receive external funding.

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Availability of data and materials: The analysis relied on a database administered by the Governor of the Voivodeship of Warmia and Mazury in Olsztyn.

Competing interests: The authors declare that they have no competing interests"

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