

The incidence and prognostic significance of cardiac arrhythmias and conduction abnormalities in patients with acute coronary syndromes and renal dysfunction

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Abstract

Background: The incidence of cardiac arrhythmias, including atrial fibrillation (AF) in chronic kidney disease, is unknown, although AF is several times more common in patients with end-stage kidney disease than in the general population.

Aim: To assess the incidence, types and management of cardiac arrhythmias and conduction abnormalities in patients with acute coronary syndromes (ACS) and renal dysfunction. We also evaluated the prognostic significance of arrhythmias in this patient group.

Methods: We analysed 86 patients with renal dysfunction (GFR < 60 mL/min) out of 1005 patients hospitalised in our department between 2008 and 2009 for unstable angina and ST-elevation and non-ST-elevation myocardial infarction.

Results: Cardiac arrhythmias were observed in 44 (51.1%) patients with AF being the most common (27 patients, 31.4%), predominantly in the paroxysmal form (21.4%). A total of 14 (16.3%) patients had cardiac arrhythmias requiring temporary or permanent pacing. Only 4 (4.6%) patients showed transient conduction abnormalities due to hyperkalaemia in the course of renal failure, while the remaining 10 (11.6%) patients demonstrated conduction abnormalities due to ACS. A total of 3 (3.5%) patients had other arrhythmias (atrial tachycardia, ventricular arrhythmias). During the follow-up period (mean duration: 14.3 months) 7 out of 44 patients (15.9%) with renal dysfunction and arrhythmia and 2 out of 42 patients (4.7%) without arrhythmia died ($p < 0.05$).

Conclusions: Cardiac arrhythmias occur more often in patients with ACS if renal dysfunction is also present and are associated with poor prognosis.

Key words: arrhythmias, acute coronary syndromes, renal dysfunction

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INTRODUCTION

Atrial fibrillation (AF) is the most commonly encountered cardiac arrhythmia in clinical practice. The number of patients with AF in Poland is estimated at 320–350 thousand with over a third (i.e. more than 100 thousand) presenting with permanent AF [1]. The AF in patients with end-stage kidney disease is 10–20 times more prevalent than in the general population [2] and increases the risk of death by 50–65%. The risk of death in patients

with AF undergoing haemodialysis is comparable to the risk associated with a history of myocardial infarction (MI) [3]. The most important complication of AF is ischaemic stroke, which is 10 times more prevalent in this patient group than in the general population [4]. Over one year of follow-up about 35% of patients with AF undergoing haemodialysis develop a thromboembolic event [5]. At the same time, prophylactic anticoagulant treatment is associated with an increased risk of bleeding [5].

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The incidence of AF in non-dialysis chronic kidney disease (CKD) patients has not been well established. The AF has been shown to be more common in patients with glomerular filtration rate (GFR) < 60 mL/min compared to individuals with normal renal function [6]. In the KAMS study, the incidence of AF increased as GFR decreased for any age range irrespective of other cardiovascular (CV) risk factors. The incidence rate was 0.9% in patients over the age of 40 and reached 3.9% in patients over the age of 70 [7]. A similar correlation has been demonstrated in the Heart and Soul Study [8].

The aim of our study was to assess the incidence and prognostic significance of cardiac arrhythmias and conduction abnormalities in patients with acute coronary syndromes (ACS) and renal dysfunction.

METHODS

Out of 1005 patients hospitalised between 2008 and 2009 in our department for ACS (unstable angina, ST-elevation MI or non-ST-elevation MI) renal dysfunction was diagnosed during the hospitalisation based on the estimated GFR values calculated from the Cockcroft-Gault formula. The threshold value of GFR < 60 mL/min was adopted according to the KDOQI (Kidney Disease Outcomes Quality Initiative) guidelines (stage 3 or higher CKD).

In this group, we analysed the incidence, types and management of cardiac arrhythmias and conduction abnormalities. The presence of cardiac arrhythmias was evaluated throughout the entire hospitalisation period based on resting ECG and telemetry and, according to clinical indications, based on a 24-h ambulatory ECG monitoring. Both symptomatic and asymptomatic arrhythmias were included. We also evaluated the impact of in-hospital arrhythmias on post-discharge prognosis through telephone contact with the patients or their relatives. Table 1 summarises patient characteristics.

Statistical analysis

The results are presented as arithmetic mean \pm SD or numbers and percentages. For variables with a normal distribution, assessed with the use of the Kolmogorov test, between-group comparisons were conducted with the t-Student test, while for variables with a non-normal distribution, the Mann-Whitney test was used. Qualitative variables were compared between the groups using the χ^2 test. A p value < 0.05 was considered statistically significant. The calculations were carried out using Statistica 6.0 PL. *Post-hoc* NIR test was used for multivariate analysis.

RESULTS

Cardiac arrhythmias were identified in 44 (51.1%) patients, 27 (31.4%) of whom had AF — predominantly paroxysmal, rarely (10%) permanent. Fourteen (16.3%) patients had bradyarrhythmias requiring temporary or permanent pacing. Three (3.5%) patients had other arrhythmias (atrial tachycardia, ventricular arrhythmias; Fig. 1). One patient required dialysis.

Table 1. Characteristics of the study group of patients with acute coronary syndrome and renal dysfunction (GFR < 60 mL/min)

Patients	86 (8.5%)
Age [years]	69.4 \pm 8.2
Women	35 (40.1%)
Systolic blood pressure [mm Hg]	141.8 \pm 20.5
Diastolic blood pressure [mm Hg]	84.2 \pm 12.9
Total cholesterol [mg/dL]	181.7 \pm 37.1
HDL-cholesterol [mg/dL]	38.3 \pm 8.6
LDL-cholesterol [mg/dL]	112.2 \pm 33.5
Triglycerides [mg/dL]	156.0 \pm 65.0
Type 2 diabetes mellitus	21 (24.4%)
GFR 30–59 mL/min	70 (81.4%)
GFR < 30 mL/min	16 (18.6%)
Anaemia (haemoglobin < 12 mg/dL)	24 (27%)
Reason for hospitalisation:	
Myocardial infarction (STEMI, NSTEMI)	64 (74.4%)
Unstable angina	22 (25.6%)
Ejection fraction < 40%	40 (46.5%)

Of the 14 patients with conduction abnormalities, 4 (4.6%) patients had transient conduction abnormalities due to hyperkalaemia in the course of renal failure. Potassium levels ranged from 6.8 to 7.5 mEq/L. All these patients required temporary pacing for 2–3 days, during which time they received a typical drug treatment to correct the electrolyte imbalance resulting in elimination of the conduction abnormalities. In the remaining 10 (11.6%) patients, the conduction abnormalities resulted from ACS and required implantation of a permanent pacemaker.

In 19 out of the 27 patients with AF a strategy to restore and maintain sinus rhythm (SR) was adopted: 14 patients received amiodarone and 5 patients underwent electrical cardioversion. The remaining 8 patients with AF were treated with beta-blocker in order to achieve ventricular rate control.

Table 2 provides a comparison of the 27 patients with ACS and AF with impaired renal function vs patients with normal renal function (128 patients). The AF in the course of ACS was significantly more common in the renal dysfunction group compared to patients with normal renal function (27 [31.4%] vs 128 [14.0%], $p < 0.005$). The patients with AF, ACS and renal dysfunction were characterised by an older age, greater prevalence of anaemia, more than half of them had systolic cardiac failure, they were more often hospitalised for MI and less often hospitalised for unstable angina. Of all the CV risk factors assessed, only age and ejection fraction (EF) < 40% showed a significant correlation with the presence of cardiac arrhythmias during hospitalisation ($p < 0.01$).

The mean follow-up period was 14.3 (range: 8–30) months. A total of 7 out of 44 patients (15.9%) with renal dysfunction

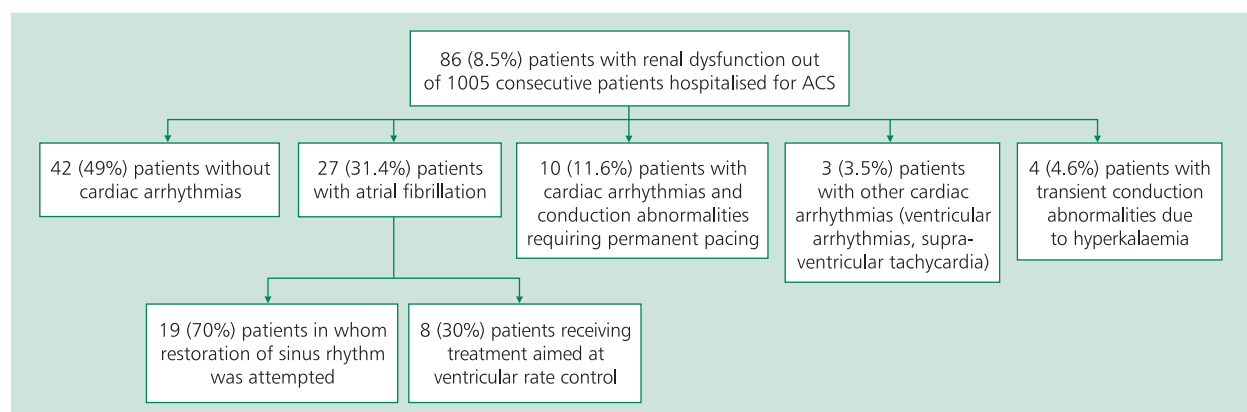


Figure 1. The incidence of cardiac arrhythmias in the group of patients with acute coronary syndrome (ACS) undergoing screening for renal dysfunction

Table 2. Comparison patients with acute coronary syndrome and atrial fibrillation with or without renal dysfunction

	Renal dysfunction (GFR < 60 mL/min)	Normal renal function (GFR > 60 mL/min)	P
Patients	27 (31,4%)	128 (14%)	< 0.005
Age [years]	67.9 ± 10.3	60.1 ± 21.8	< 0.05
Women	11 (40.1%)	59 (46.1%)	NS
Systolic blood pressure [mm Hg]	140.2 ± 19.9	142.7 ± 20.6	NS
Diastolic blood pressure [mm Hg]	87.9 ± 11.5	92.1 ± 13.4	NS
Anaemia (haemoglobin < 12 mg/dL)	7 (26.3%)	11 (8.6%)	< 0.05
Reason for hospitalisation:			
Myocardial infarction (STEMI, NSTEMI)	20 (74%)	78 (60.1%)	< 0.05
Unstable angina	7 (25.9%)	50 (39%)	< 0.05
Ejection fraction < 40%	14 (52%)	27 (21.1%)	< 0.05

and cardiac arrhythmias and 2 out of 42 patients (4.7%) without cardiac arrhythmias died during the follow-up period ($p < 0.05$). Multivariate analysis included the following factors: EF < 40%, haemoglobin on admission and the presence of cardiac arrhythmias during hospitalisation. It was shown that age ($p = 0.004$), left ventricular systolic dysfunction ($p = 0.001$) and cardiac arrhythmias during hospitalisation ($p < 0.002$) were independent factors adversely affecting the prognosis in the post-discharge period in patients with ACS and renal dysfunction (Table 3).

DISCUSSION

Paroxysmal AF was the most common cardiac arrhythmia we observed in the population of patients with ACS and renal dysfunction. Similar observations were made by Atar et al. [9], although their study involved patients with end-stage CKD. Coronary artery disease, age and right atrial diameter were independent risk factors for AF in this group of patients. In

Table 3. Risk factors for mortality in the group of patients with acute coronary syndrome and renal dysfunction: a multivariate analysis

Risk factor	Odds ratio	95% CI	P
Age	1.03	1.01–1.05	0.0004
EF < 40%	1.01	1.00–1.02	0.001
Arrhythmia during hospitalisation	1.11	1.046–1.100	0.002
Haemoglobin on admission	0.84	0.68–1.05	0.15

CI — confidence interval; EF — ejection fraction

our analysis, age and EF < 40% significantly correlated with the occurrence of cardiac arrhythmias in the study group. In a study by Bozbas et al. [10], the incidence of supra-ventricu-

lar arrhythmias in dialysed patients was 16% and all these cases were AF. Other investigators showed that the incidence of AF in non-dialysis CKD patients was 21.2%. However, they failed to find a correlation between GFR and the presence of AF [11]. Watanabe et al. [6] found that moderate CKD (GFR < 60 mL/min) increased the incidence of AF compared to patients with normal renal function. They also observed that the risk of AF increased in a linear fashion with GFR decrease. They showed that patients diagnosed with AF at inclusion in the study had higher serum creatinine levels and lower GFR compared to patients without AF. During the follow-up, these patients developed renal failure more often [6].

The incidence of AF in the population of patients with ACS has been estimated at 6% to 21% in the literature [12, 13]. In our study, the incidence of AF was higher (31%) and this high rate of cardiac arrhythmias was most likely due to the fact that these were patients hospitalised for ACS with co-existing renal dysfunction.

Elevated levels of inflammatory markers (C-reactive protein, fibrinogen and interleukin-6) [14] and increased activation of the renin-angiotensin-aldosterone system [15] are the likely reasons for such common occurrence of AF in chronic renal failure. It was also shown that anaemia accompanying CKD was an independent risk factor for mortality in patients with AF [16]. Anaemia was present in 27% of our patients.

Bradyarrhythmias requiring permanent pacing were present in 14 of our patients (16.3%). Bloom et al. [17] showed that renal failure, both moderate and severe (GFR < 60 mL/min), significantly increased the risk of infection related to the implantation of a pacemaker system. We observed no cases of infection related to pacemaker implantation in our patients.

Restoration of SR was attempted in 2/3 of our patients with ACS, renal dysfunction and AF. A similar treatment strategy in the group of patients with ACS and AF was followed by other investigators [18]. Pharmacological conversion to SR in our patients with AF was attempted with amiodarone. Napoli et al. [19], on the other hand, used propafenone in patients with AF and CKD, as the drug is mainly metabolised in the liver. This strategy was effective and safe, but these patients were in a stable coronary and haemodynamics condition. In our group of patients with ACS, more than a half were patients with systolic heart failure and EF < 40%, hence the selection of amiodarone. Propafenone is contraindicated in this setting. Nilsson et al. [20] showed that the strategy of restoration and maintenance of SR using antiarrhythmic drugs in patients with ACS and AF was associated with increased mortality and showed no influence on long-term prognosis. On the other hand observations made by other authors, showed that the development of AF in the course of ACS [13, 18] and moderate renal failure occurring in the acute phase of MI [21] adversely affect prognosis, increasing both 30-day and annual mortality. We showed that the presence of AF in

patients with ACS and impaired renal function resulted in a 3-fold increase in annual mortality compared to patients with ACS and normal renal function. The development of AF in the course of ACS in patients with renal dysfunction was associated with older age, with the presence of anaemia, which increases the risk of death and in-hospital CV complications of ACS [22], and with left ventricular systolic dysfunction, which identifies patients with a more extensive MI.

Limitations of the study

The main limitation of our study was the small sample size and the retrospective design. We did not have the information whether our patients were patients with CKD diagnosed and treated before hospitalisation (who would therefore be at a higher risk of CV events in the future) or patients in whom renal dysfunction was diagnosed for the first time during the hospitalisation for ACS.

CONCLUSIONS

Cardiac arrhythmias, most commonly AF, are observed in over half of the patients with ACS and renal failure. The presence of cardiac arrhythmias during hospitalisation turned out to be an independent factor adversely affecting the post-discharge prognosis in these patients. Cardiac arrhythmias are more common in patients with ACS if renal dysfunction co-exists.

Conflict of interest: none declared

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Zaburzenia rytmu i przewodzenia: częstość występowania oraz ich wpływ na rokowanie u pacjentów z ostrymi zespołami wieńcowymi i dysfunkcją nerek

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Streszczenie

Wstęp: Częstość występowania zaburzeń rytmu serca, w tym migotania przedsionków (AF), w przewlekłej chorobie nerek nie jest znana, przy czym u osób ze schyłkową chorobą nerek AF występuje wielokrotnie częściej niż w populacji ogólnej.

Cel: Celem pracy była analiza częstości występowania zaburzeń rytmu i przewodzenia, ich rodzaju i metod postępowania terapeutycznego w grupie chorych z ostrym zespołem wieńcowym (OZW) oraz dysfunkcją nerek. Oceniono również wpływ występowania zaburzeń rytmu i przewodzenia na rokowanie w tej grupie pacjentów.

Metody: Analizą objęto 86 osób z dysfunkcją nerek (GFR < 60 ml/min) (8,5%) spośród 1005 chorych hospitalizowanych w Klinice Kardiologii Uniwersytetu Medycznego w Białymstoku w latach 2008–2009 z powodu niestabilnej choroby wieńcowej i zawału serca z uniesieniem i bez uniesienia odcinka ST.

Wyniki: U 42 (49%) pacjentów nie stwierdzono zaburzeń rytmu i przewodzenia. Wśród pozostałych 44 (51,1%) osób najczęstszą arytmia (27 chorych; 31,4%) było AF — najczęściej napadowe, rzadko (10%) utrwalone. U 14 (16,3%) pacjentów występowały zaburzenia rytmu i przewodzenia wymagające czasowej lub stałej elektrostymulacji serca. Jedynie 4 (4,6%) osoby miały przemijające zaburzenia przewodzenia w wyniku hiperkaliemii w przebiegu niewydolności nerek, u pozostałych 10 (11,6%) chorych zaburzenia przewodzenia były wynikiem OZW. U 3 (3,5%) pacjentów występowały inne zaburzenia rytmu (częstoskurcz przedsionkowy, komorowe zaburzenia rytmu). W okresie obserwacji (śr. 14,3 miesiąca) w grupie pacjentów z dysfunkcją nerek oraz zaburzeniami rytmu i przewodzenia (44 chorych) zmarło 7 (15,9%) pacjentów, natomiast w grupie chorych bez arytmii (42 osób) — 2 (4,7%) pacjentów ($p < 0,05$).

Wnioski: Zaburzenia rytmu i przewodzenia występują częściej u chorych z OZW, jeśli mają oni dysfunkcję nerek, a rokowania są niekorzystne.

Słowa kluczowe: zaburzenia rytmu, ostre zespoły wieńcowe, dysfunkcja nerek

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