Prevalence of arterial hypertension in patients with atrial fibrillation undergoing ablation — a prospective, cohort study

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Summary

Background Arterial hypertension is one of the major cofounders in the development of atrial fibrillation (AF) and hypertension is commonly found in AF patients. The aim of the study was to establish the prevalence of arterial hypertension in patients undergoing ablation, who are relatively young and healthy group of AF patients.

Material and methods 266 consecutive patients admitted for AF ablation were screened for arterial hypertension. All patients had their blood pressure measured on admission by, prior to the ablation procedure by a qualified physician, according to the current guidelines. Also, medical records of patients were reviewed for the previous diagnosis of hypertension or taking hypotensive agents.

Results The study group was predominantly male (65.0%; mean age 57.6 ± 10.1 years). Mean body mass index was 29.7 ± 5.0 kg/m^2. Paroxysmal AF was present in 69.5% of patients. In 72.9% of patients hypertension was diagnosed previously. On admission, mean systolic and diastolic blood pressure values were 131.7 ± 16.7 and 80.7 ± 11.1 mm Hg. 123 (46.2%) patients had systolic and/or diastolic blood pressure values respectively > 140 and//or > 90 mm Hg. Patients with previously diagnosed hypertension were older (58.7 ± 8.7 vs 54.6 ± 12.7 years; p = 0.003), had higher BMI (30.3 ± 5.0 vs 28.1 ± 4.8kg/m^2; p = 0.002), and more often history of diabetes (10.8% vs 1.4%; p = 0.03) compared to non-hypertensive group. There were no differences in terms of history of dyslipidaemia, stroke, myocardial infarction or family history of cardiovascular disease.

Conclusions In patients with AF undergoing ablation procedure, prevalence of diagnosed arterial hypertension is very high, much higher than in the general population. Nevertheless, majority of patients meet the criteria for adequate blood pressure control.

key words: arterial hypertension, atrial fibrillation, ablation

Background

Arterial hypertension and atrial fibrillation (AF) are one of the most prevalent diseases of the cardiovascular system. The incidence of both conditions increases with advancing age [1]. Therefore, due to the prolonging life expectancy, the total number of patients with arterial hypertension and AF is expected to grow in the forthcoming years. Both AF and arterial hypertension are responsible for considerable morbidity and mortality. Their coexistence further increases the risk and affects management of patients

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and treatment strategies. Currently, the treatment of arterial hypertension depends mostly on lifestyle modifications and pharmacotherapy, with invasive treatment still playing only a minor role in everyday practice [2]. Whereas, the treatment of AF, namely pursing the rhythm-control strategy, in many cases is achieved through catheter ablation. Current guidelines recommend ablation as one of the treatment options in patients with symptomatic AF in spite of an antiarrhythmic drug therapy or as first-line or second line therapy in selected patients, which prefer this kind of treatment [3, 4]. Unfortunately, effectiveness of AF ablations remains limited, partially due to poor control of risk factors for the arrhythmia recurrence, which include diabetes, metabolic syndrome, or left atrial dimensions [5]. Arterial hypertension contributes to the development of AF itself, as well as the established AF-recurrence predictors. Therefore, screening for arterial hypertension in AF patients and describing the profile of hypertensive patients, especially those undergoing ablation is of great importance.

Material and methods

We performed a prospective, observational, cohort study in order to establish the prevalence of arterial hypertension in consecutive Polish patients undergoing catheter ablation for AF. The study was conducted with respect to the Declaration of Helsinki. The study protocol was approved by the Ethics Committee by the Medical University of Warsaw and a written, informed consent was obtained from every study participant prior to the study enrolment.

The study cohort consisted of 266 consecutive patients who were hospitalized in a high-volume tertiary university cardiology clinic, where they were admitted for first-ever ablation for AF. All patients were qualified for the ablation procedure following the European Society of Cardiology (ESC) guidelines for the management of AF from 2010 and 2012 [3, 4]. The study protocol was described in detail previously [5, 6]. Exclusion criteria were age < 18 or ≥ 75 years, prior ablation of AF, MI, stroke or decompensation of heart failure within the last six months, untreated overt hyper- or hypothyroidism, current treatment with a continuous positive airway pressure device, and absence of written informed consent.

AF diagnosis was made based on at least one episode of the AF recorded in a 12-lead electrocardiogram (ECG) or an episode of documented AF in a 12-lead ECG and/or 24-hour ECG Holter monitoring in 6 months prior to the study enrolment.

AF was defined as at least 30 seconds of an irregular heart rhythm with no distinct P waves, and irregular RR intervals. In all cases the diagnosis was made by two independent expert cardiologists. Paroxysmal AF was defined as a self-terminating episode, whereas persistent AF was diagnosed when arrhythmia episode either lasted longer than 7 days or required termination by cardioversion. There were no cases of permanent AF in the study population because this diagnosis is made only if it was decided not to pursue rhythm control strategy.

All study participants were screened for arterial hypertension. Patients had their blood pressure measured on admission, prior to the ablation procedure, by a qualified physician Diagnosis of arterial hypertension was made when office blood pressure were equal or exceeded the values of 140 for systolic blood pressure (SBP) and/or 90 for diastolic blood pressure (DBP). The number of required measurements, measure techniques and settings were in accordance with the current guidelines for arterial hypertension diagnosis and management of the ESC and European Society of Hypertension [2]. The diagnosis was also made were there were eligible medical records available on previous diagnosis of arterial hypertension or taking prescription hypotensive agents.

All patients were also screened for other classical and non-classical cardiovascular risk factors including diabetes mellitus, dyslipidaemia, or history of cardiovascular disease. Diagnosis of all factors was made based on eligible medical records, taking prescription drugs applicable for the respective disease (i.e. hypoglycaemic agents for diabetes), or as a *de novo* diagnosis according to the current diagnostic criteria.

Statistical analysis was performed using the SAS software version 8.02 (SAS Institute, Inc., Cary, NC, USA). Continuous data are presented as mean ± standard deviation (SD) and were compared using the Mann-Whitney test or Student's t-test. Categorical variables were compared using either the χ^2 or Fisher exact tests. A p value of less than 0.05 was considered statistically significant, whereas the confidence intervals (CI) were 95%.

Results

This prospective cohort study covered 266 patients undergoing first-ever ablation for AF. The mean age of the study population was 57.6 ± 10.1 years and 65% of patients were male. The body mass index (BMI) in the study population was 29.7 ± 5.0 kg/m^2 and 69.5% of patients had paroxysmal AF, while

Table 1. Baseline characteristics of the study population

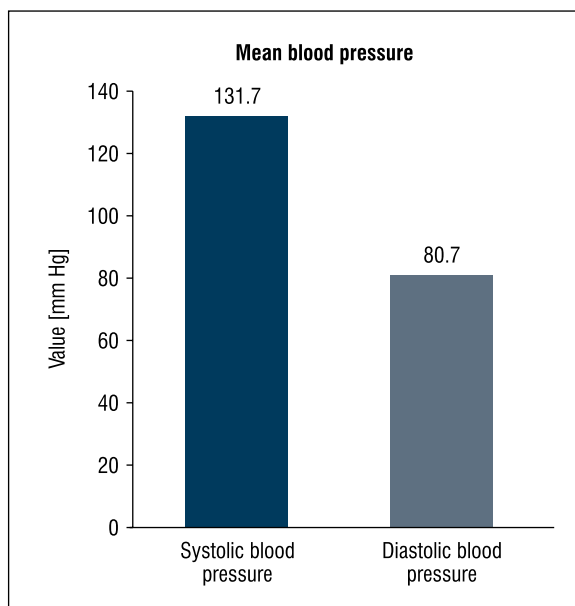| Parameter	Value n = 266
Age (years)	57.6 ± 10.1
BMI [kg/m²]	29.7 ± 5.0
SBP [mm Hg]	131.7 ± 16.7
DBP [mm Hg]	80.7 ± 11.0
HR (beats per minute)	75.0 ± 15.8
History of myocardial infarction	22 (8.3%)
Diabetes mellitus	17 (6.4%)
Previously diagnosed arterial hypertension	194 (72.9%)
Smoking	28 (10.5%)
History of stroke or TIA	22 (8.3%)
Dyslipidaemia	167 (62.8%)
Thyroid disease	68 (25.6%)
Family history of cardiovascular disease	104 (39.0%)
Paroxysmal AF	185 (69.5%)

Parameters are presented as mean ± standard deviation or n (%)
BMI — body mass index, SBP — systolic blood pressure, DBP — diastolic blood pressure, HR — heart rate, TIA — transient ischaemic attack, AF — atrial fibrillation

Figure 1. Mean blood pressure on admission

the rest was diagnosed with persistent AF. Detailed characteristics of the study population are listed in the Table 1.

As for the mean SBP and DBP values they were 131.7 ± 16.7 and 80.7 ± 11.0 mm Hg, respectively (Figure 1). One hundred ninety-four patients (72.9%) were previously diagnosed with arterial hypertension, while the values exceeding the threshold of ≥ 140 and/or 90 mm Hg on admission were found in 46.2% of patients. No data were available in the medical records on the degree of the previously diagnosed hypertension prior to the implemented treatment.

After dividing patients according to the presence of previously diagnosed arterial hypertension it was found that patients with the disease were older (58.7 ± 8.7 vs 54.6 ± 12.7 years; p = 0.003), and had higher BMI (30.3 ± 5 vs 28.1 ± 4.8 kg/m²; p = 0.002) than patients without the diagnosed arterial hypertension. As for the prevalence of comorbidities it was found that hypertensive patients more often had diabetes mellitus (10.8% vs 1.4%; p = 0.03) compared with patients without the diagnosis. SBP values were significantly higher in patients with previously diagnosed arterial hypertension (133.6 ± 16.1 vs 126.7 ± 17.6 mm Hg; p = 0.003) than those without the disease. No differences between the groups were found in terms of DBP (81.4 ± 11.4 vs 78.9 ± 10.1 mm Hg; p = 0.1).

No differences were seen in terms of the prevalence of other cardiovascular risk factors including:

history of myocardial infarction or stroke, dyslipidaemia, smoking and family history of cardiovascular disease (p > 0.05). The detailed information on the groups characteristics are presented in Table 2.

Discussion

The present study concerned patients undergoing ablation for AF. This group is somehow different from the general population of AF patients due to a number of factors. While there is no strict age limit for the catheter ablation procedure, it is rarely performed in patients older than 75 years [8]. Moreover, number of contraindications for the procedure contributes to lower number of comorbidities in AF ablation recipients. Therefore, compared to the unselected groups of AF patients, those undergoing ablation procedure tend to be in better general health and have lower comorbidity rate. As it was shown in the present study, the mean age of the participants was 57.6 years, whereas in the AF general population it tends to be over 70 years [9]. Nevertheless, the prevalence of arterial hypertension in the present group was high (72.9%), almost twice as high as in the corresponding age group of the general population [10]. Higher prevalence of the disease is attributable to two factors. First of all, prior to the ablation all patients were screened and treated by specialists therefore the rate of underdiagnosed cases of arterial hypertension remains low in this population. Second of all, there is a strong relationship between hypertension and development of AF.

Table 2. Patients' characteristics according to the presence of previously diagnosed hypertension.

Parameter	Patients with previously diagnosed hypertension (n = 194)	Non-hypertensive patients (n = 72)	p value
Age (years)	58.7 ± 8.7	54.6 ± 12.7	**0.003**
BMI [kg/m²]	30.3 ± 5	28.1 ± 4.8	**0.002**
SBP [mm Hg]	133.6 ± 16.1	126.7 ± 17.6	**0.003**
DBP [mm Hg]	81.4 ± 11.4	78.9 ± 10.1	0.1
HR (beats per minute)	76.4 ± 16.5	71.1 ± 13.2	0.06
History of myocardial infarction	18 (9.3%)	4 (5.6%)	0.46
Diabetes mellitus	21 (10.8%)	1 (1.4%)	**0.03**
Smoking	20 (10.3%)	8 (11.1%)	0.85
History of stroke or TIA	18 (9.3%)	4 (5.6%)	0.47
Dyslipidaemia	124 (63.9%)	43 (59.7%)	0.62
Thyroid disease	52 (26.8%)	16 (22.2%)	0.45
Family history of cardiovascular disease	77 (39.7%)	27 (37.5%)	0.89
Paroxysmal AF	129 (66.5%)	56 (77.8%)	0.08

Parameters are presented as mean ± standard deviation or n (%)
BMI — body mass index, SBP — systolic blood pressure, DBP — diastolic blood pressure, HR — heart rate, TIA — transient ischaemic attack, AF — atrial fibrillation
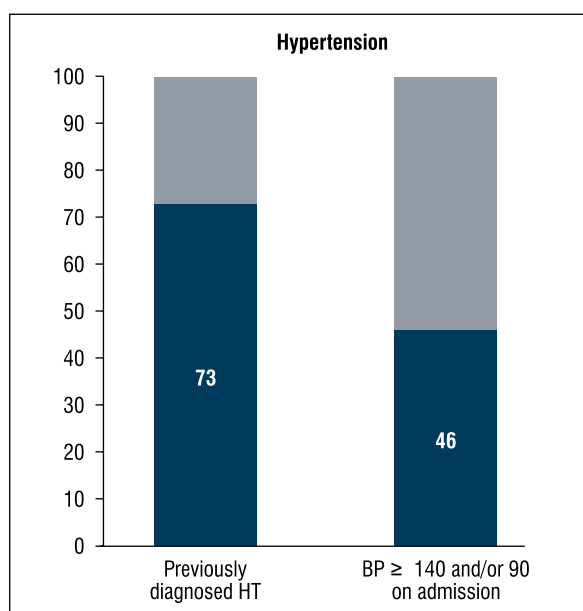

Figure 2. Prevalence of previously diagnosed arterial hypertension versus patients with blood pressure values meeting the criteria for hypertension diagnosis
BP — blood pressure, HT — arterial hypertension

Arterial hypertension is a disease associated with haemodynamic changes in the whole cardiovascular system, which lead to changes and damage to the end-organs. Cohort epidemiological studies of hypertensive patients show that those who subsequently developed AF had higher mean systolic blood pressure values than those who maintained the sinus rhythm [11]. In other studies the prevalence of arterial hypertension in AF patients was higher than 50%, and it was thought to be a sole cause of the AF in 15% of patients [12–14]. The proposed mechanism in which arterial hypertension causes the AF involves the structural changes in the left atrium that include left atrial stretch and enlargement, changes in left atrial mechanical function, altered left atrial electrophysiology, and increased atrial ectopic activity. Mostly, due to haemodynamic overload [15].

Other contributors to the AF development that were described in the literature involve advanced age, obesity, smoking, diabetes mellitus, thyroid dysfunction, or history of diseases such as heart valve disease, heart failure, myocardial infarction [16]. In the present study patients with previously diagnosed arterial hypertension were older, had higher BMI and higher prevalence of diabetes mellitus. As they are all contributors to the development of arrhythmia itself, there is a possibility that in this cohort, the hypertensive patients will be predisposed to higher risk of transition to the permanent form of the arrhythmia in the future or lower success rate after the ablation procedure.

Data on the impact of hypertension itself on the ablation procedure vary across the literature. Studies focused on establishing the parameters predictive of AF recurrence after the procedure do not identify arterial hypertension as one of the risk factors [17] or even list hypertension as one of the procedure success predictors [18]. This may be partially attributable to the fact that most of the AF ablation recipients with hypertension receive hypotensive treatment on

hospital discharge and the reduction of blood pressure values both pharmacological and invasive are associated with improvement of the success rate [19, 20]. Moreover, the successful procedure itself was described to be associated with a significant decrease in the systolic blood pressure values [21]. As the treatment of hypertension may reverse the structural changes in the heart, the optimistic finding of the present study was the in spite of high arterial hypertension prevalence, the mean SBP and DBP values were relatively low, which points to a good blood pressure control in this cohort.

Conclusions

Patients with AF undergoing ablation are a relatively young group, with a low comorbidity rate. Nevertheless, in this group of patients, prevalence of diagnosed arterial hypertension is very high, much higher than in the age corresponding group from the general population. Patients with diagnosed hypertension tend to be older, have higher BMI, and more often history of diabetes. Nevertheless, the mean SBP and DBP values on admission were not significantly elevated, which shows that the majority of patients meet the criteria for adequate blood pressure control.

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