Kardiologia Polska 2013; 71, 4: 373–380; DOI: 10.5603/KP.2013.0065 ISSN 0022–9032

ARTYKUŁ ORYGINALNY / *ORIGINAL ARTICLE*

Use of transthoracic impedance cardiography and tissue Doppler echocardiography in the cardiovascular assessment of atrial fibrillation patients subjected to electroversion

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Abstract

Background: Atrial fibrillation (AF) is the commonest complex cardiac arrhythmia, affecting approximately 2% of the general population.

Aim: To describe cardiovascular changes in tissue Doppler echocardiography (TDE) and impedance cardiography (ICG) in AF patients subjected to cardioversion.

Methods: Forty-one patients (22 males and 19 females) with acute or persistent AF were examined by means of TDE and transthoracic ICG before electroversion, and then one week following the restoration of sinus rhythm. Additionally, the pre- and post-cardioversion serum levels of B-type natriuretic peptide (BNP) were determined.

Results: The restoration of sinus rhythm was reflected by a significant increase in the following ICG parameters (average changes are presented): stroke volume (+25 mL), stroke volume index (+11.8 m/m^2), contractility index (+12.6/s), end-diastolic index (+12.3 mL/m^2), acceleration index (+6/s^2), and left ventricular ejection time (+56 ms). These changes were accompanied by a significant increase in the TDE parameters of tricuspid annular systolic velocity and mitral annular systolic velocities. Moreover, a significant decrease in early diastolic velocities was also observed following the restoration of sinus rhythm, along with significantly lower levels of BNP.

Conclusions: Both TDE and ICG are modern, valuable diagnostic methods that complementarily explain changes occurring in the cardiovascular system of AF patients subjected to electroversion.

Key words: atrial fibrillation, tissue Doppler echocardiography, impedance cardiography, cardioversion

Kardiol Pol 2013; 71, 4: 373–380

INTRODUCTION

Atrial fibrillation (AF) is the commonest complex cardiac arrhythmia, affecting 1–2% of the general population. More than a third of all hospitalisations due to arrhythmia are associated with AF or its complications. Another important problem is the high percentage of AF recurrences. This is estimated at 10% in the first year following an initial AF episode, and increases by 5% per year in subsequent years [1]. Currently, class I and class III antiarrhythmic agents (in Poland these usually include propafenone and amiodarone), and electroversion, are used in sinus rhythm (SR) restoration.

The aim of electroversion is to eliminate the subjective symptoms reported by AF patients, and improve their quality of life through SR restoration. As early as the 1960s, analysis of small patient samples revealed that the restoration of SR is reflected by an objective improvement in physical capacity and haemodynamic parameters [2]. In later years, along with advances in echocardiography, research was undertaken to understand the mechanisms behind the positive effects of electroversion on the heart. In 1979, in their study of 15 patients, Orlando et al. [3] revealed that successful electroversion is reflected by an improved car-

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Received: 03.07.2012 **Accepted:** 10.10.2012

diac index (CI) and stroke volume index (SI) during cardiac catheterisation. However, these authors did not observe any significant changes in heart chamber measurements or mitral inflow parameters on echocardiographic examination [3]. In 1993, Japanese scientists observed an improvement in the left ventricular (LV) systolic function, manifested by an increase in the shortening fraction of some patients who were subjected to electroversion [4].

Echocardiography is a basic method of cardiologic imaging. It is used for the evaluation of myocardial structure and function. Two-dimensional (2D) imaging enables the measurement of the heart chamber volumes, while the Doppler technique allows the determination of flow velocity and myocardial motility. Ejection fraction (EF) is the most frequently used indicator of systolic activity in the LV. Furthermore, myocardial contractile function assessed by tissue Doppler imaging is of similar diagnostic value [5]. Diastolic function is represented by the reciprocal relationship of two peak velocities of the biphasic mitral inflow determined by means of classic Doppler echocardiography and the corresponding values of early diastolic annular velocity (E') and atrial diastolic annular velocity (A') determined by means of tissue Doppler echocardiography (TDE).

Impedence cardiography (ICG) measures the changes in the electrical resistance of tissues that occur in co-ordination with the cyclic changes in blood volume in the thoracic cavity caused by the heart's action. An association between the electrical impedance of the heart and its pump function was observed as early as the 1940s [6]. Since then, the value of ICG has been confirmed in the monitoring of chronic cardiac failure [7], the assessment of atrioventricular delay in resynchronisation therapy optimisation [8], the differential diagnosis of dyspnoea [9], and the diagnosis of syncope [10]. This widely known method of non-invasive cardiologic diagnostics developed along with technical improvements. At present, there is even a possibility of concurrent monitoring of many haemodynamic parameters thanks to simultaneous measurements of beat-to-beat arterial pressure, electrocardiography and transthoracic ICG.

The aim of this study was to describe cardiovascular changes in TDE and ICG in AF patients subjected to cardioversion. Patients with recurrent AF were considered as a reference group for subjects with permanently restored SR.

METHODS

Study group

This study included 41 patients with AF who were qualified for electroversion, and in whom SR was restored by the applied treatment. This group comprised both patients with acute episodes (< 48 hours, n = 19) and those with persistent AF (n = 22) who had been taking oral anticoagulants for at least three weeks prior to cardioversion. Most patients had concomitant diseases such as arterial hypertension (n = 28), type 2 diabetes (n = 9), heart failure (n = 7), ischaemic heart disease (n = 6), and chronic bronchial disorders (n = 3) (Table 1). Pregnant women were excluded from this study, along with patients with implanted artificial pacemakers, hyperthyroidism, severe heart disease in the form of LV systolic dysfunction (EF < 40%) or significant valvular disease, and patients with symptoms of haemodynamic instability.

In most patients enrolled in this study (n = 35), one of two antiarrhythmic drugs (amiodarone or propafenone) was implemented 24 hours prior to electroversion, along with electrolyte (potassium/magnesium) supplementation when needed. Thirty patients in whom this approach failed, and those who did not receive antiarrhythmic agents, were subjected to electroversion under short-term general anaesthesia. In 12 out of the 41 cases (treated pharmacologically and/or by electroversion), arrhythmia recurred within one week of the restoration of SR (Table 2).

Before intervention, the patients underwent diagnostic examinations: TDE, ICG, and serum B-type natriuretic peptide (BNP) measurement. These examinations were repeated under ambulatory conditions 7 ± 1 days after cardiac rhythm restoration.

The protocol for this study was approved by the Local Bioethical Committee at the Nicolaus Copernicus University in Torun and the Ludwik Rydygier Collegium Medicum in Bydgoszcz, and the patients gave their informed consent before the start of any procedure.

Impedance cardiography

ICG was performed using the Task Force Monitor (CNSystems) with electrodes placed on the neck and in the hypochondriac regions. The device recorded an electrocardiographic curve simultaneously with beat-to-beat arterial pressure monitoring in the fingers and oscillometric arterial pressure measurement on the contralateral arm. Due to the marked beat-to-beat variability of haemodynamic parameters, further analyses included the arithmetic means from 5-minute monitoring.

Tissue Doppler echocardiography

TDE was performed with the aid of the portable 'Vivid i' apparatus (GE). The 2D images were analysed in the apical four-chamber projection, with pulsatile Doppler for mitral inflow, and a pulsed-wave tissue Doppler with a sampling gate placed at the lateral (lat) and septal (ivs) parts of the mitral annulus, and the lateral part of the tricuspid annulus (TV). LV volume and left atrial area (LAA) were determined planimetrically. During AF, mean Doppler velocities were calculated for at least six beats, while during SR the means were calculated for three consecutive beats (Fig. 1A, B).

Echocardiographic and haemodynamic parameters were analysed separately in the subgroup of patients with restored SR (n = 29) and in those with recurrent AF (n = 12). In each subgroup, pre- and post-intervention values were compared

Table 1. Clinical characteristics

	All patients undergoing cardioversion (n = 41)	Patients with sustained sinus rhythm after one week (n = 29)	Patients with atrial fibrillation recurrence (n = 12)
History			
Age [years]	66.6 ± 13.0	64.5 ± 13.6	71.9 ± 10.9
Sex (male/female)	22/12 (53.7%/46.3%)	17/12 (58.6%/41.4%)	5/7 (41.7%/58.3%)
Left ventricular ejection fraction [%]	60.6 ± 7.7	58.3 ± 7.8	61.5 ± 7.0
Left ventricular dysfunction (EF < 60%)	15 ± 51.7	5 ± 41.7	20 ± 48.8
Duration of atrial fibrillation [days]	48.5 ± 91.6	50.8 ± 104.3	56.5 ± 75.4
Comorbidity (prevalence)			
Heart failure	7 (17.1%)	6 (20.7%)	1 (8.3%)
Hypertension	28 (68.3%)	19 (65.5%)	9 (75.0%)
Coronary artery disease	6 (14.6%)	6 (20.7%)	0 (0.0%)
COPD/asthma	3 (7.3%)	2 (6.9%)	1 (8.3%)
Diabetes	9 (22.0%)	7 (24.1%)	2 (16.7%)
Chronic renal disease	4 (9.8%)	2 (6.9%)	2 (16.7%)
Background treatment (prevalence)			
ACE-inhibitors	25 (61.0%)	17 (58.6%)	8 (66.7%)
Angiotensin II receptor blockers	8 (19.5%)	7 (24.1%)	1 (8.3%)
Beta-blocker	40 (97.6%)	28 (96.6%)	12 (100.0%)
Calcium blocker	4 (9.8%)	3 (10.3%)	1 (8.3%)
Diuretic	22 (53.7%)	17 (58.6%)	5 (41.7%)
Aldosterone receptor antagonists	11 (26.8%)	8 (27.6%)	3 (25.0%)
Statin	31 (75.6%)	22 (75.9%)	9 (75.0%)
Oral anticoagulant	31 (75.6%)	21 (72.4%)	10 (83.3%)
Propafenone	7 (17.1%)	4 (13.8%)	3 (25.0%)
Amiodarone	9 (22.0%)	5 (17.2%)	4 (33.3%)
Digoxin	2 (4.9%)	2 (6.9%)	0 (0.0%)
Acetylsalicylic acid	7 (17.1%)	6 (20.7%)	1 (8.3%)
Intervention (prevalence)			
Amiodarone	20 (48.8%)	16 (55.2%)	4 (33.3%)
Propafenone	14 (34.1%)	109 (34.5%)	4 (33.3%)
External cardioversion	30 (73.2%)	19 (65.5%)	11 (91.7%)
Parameters measured at admission			
Heart rate [bpm]	92.0 (23.9%)	94.7 (25.2%)	85.6 (17.3%)
Systolic blood pressure [mm Hg]	117.7 (22.7%)	117.3 (21.9%)	118.8 (25.6%)
Diastolic blood pressure [mm Hg]	75.8 (18.1%)	76.3 (16.7%)	74.8 (21.8%)

ACE — angiotensin converting enzyme; COPD — chronic obstructive pulmonary disease

Table 2. Recurrence of atrial fibrillation (AF) in patients with acute and persistent arrhythmia

	Sustained sinus rhythm	Recurrent AF
Total (n = 41)	29 (71%)	12 (29%)
Acute (n = 19)	16 (84%)	3 (16%)
Persistent (n = 22)	13 (59%)	9 (41%)

using Friedman's ANOVA and Kendall's coefficient of concordance. Calculations were performed using Statistica 9 (StatSoft®, Poland) software, with statistical significance defined as $p \leq 0.05$.

RESULTS

One week after intervention (pharmacotherapy and/or electroversion), TDE and ICG parameters were determined in

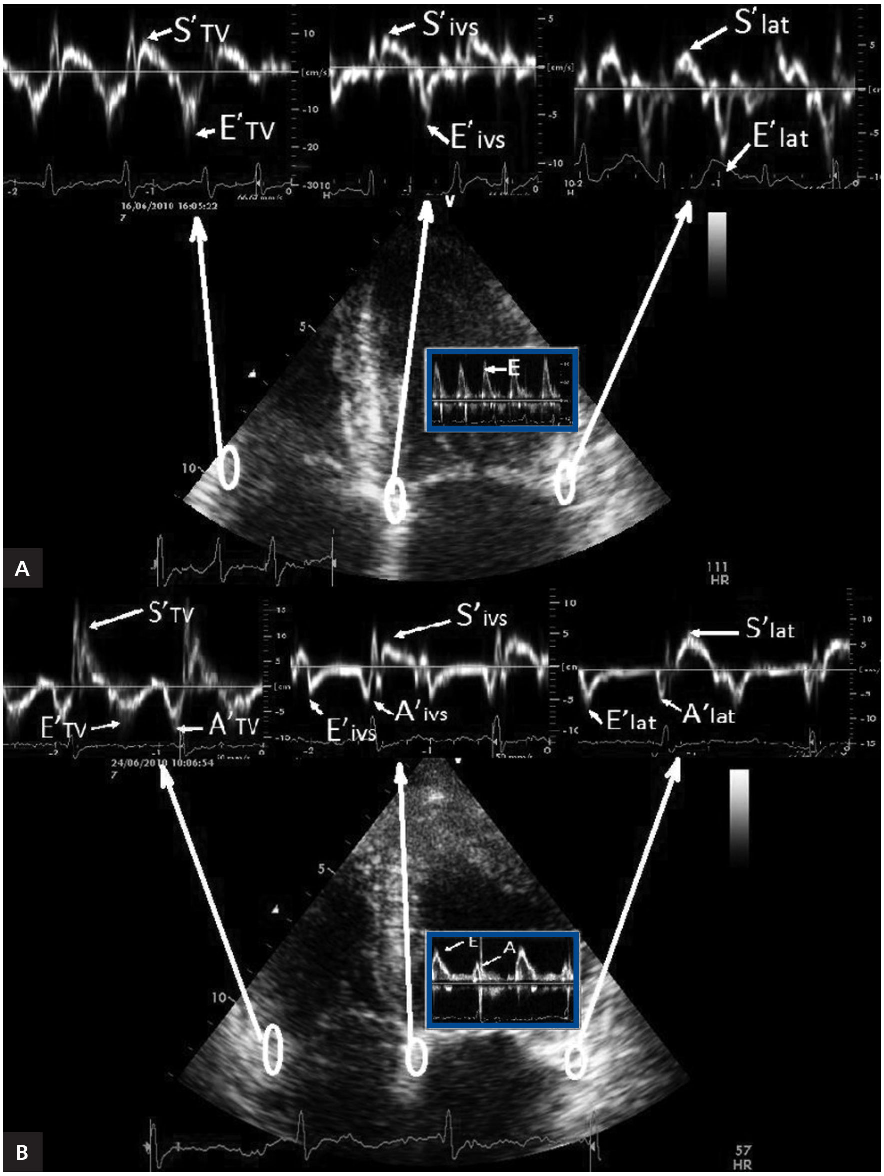

Figure 1. **A**. Transthoracic tissue Doppler echocardiography (TDE); apical four-chamber projection: tissue Doppler spectra (long arrows) obtained from three sample gate locations (ellipsoids). Measured parameters: early diastolic (E') and systolic (S') tissue Doppler annular velocities (short arrows), early-diastolic velocity (E) on mitral inflow spectrum determined by means of conventional echocardiography (blue frame); **B**. Transthoracic TDE following the sinus rhythm restoration: A wave (A) visible in the spectrum of mitral inflow (blue frame), along with A' wave resulting from atrial systole on tissue echocardiography

29 subjects with established SR, and compared to baseline values (Table 3). Following the SR restoration, heart rate (HR) was significantly lower (by 32.5 bpm on average, $p < 0.00000$) compared to the baseline values for this parameter. ICG revealed a significant increase in the stroke volume (SV), SI, index of contractility (IC), end-diastolic index (EDI), acceleration index (ACI) and LV ejection time (LVET) values. The significant increase in SV (observed both on ICG and classic echocardiography) was probably the result of a relatively higher increase in the LV end-diastolic volume (LVEDV) compared to the LV end-systolic volume (LVESV). On TDE, significant changes in the myocardial velocities of the mitral and tricuspid annuli were observed compared to the baseline values. Additionally, a significant decrease in the serum BNP was revealed (Table 3). No significant differences were observed with regard to arterial pressure values, cardiac output (CO), CI, LV work index (LVWI), peripheral resistance or thoracic fluid content. Furthermore, no significant improvement in the LVEF was observed on echocardiographic examination.

AF recurrence rate was higher in the population of patients with persistent arrhythmia but it did not reach statistical significance ($p < 0.07$) (Table 2).

Table 3. Average changes in cardiovascular parameters of atrial fibrillation (AF) patients (n = 29) determined seven days after sinus rhythm (SR) restoration

Parameter	Method	Unit	AF	SR	Average change	P
Stroke volume	ICG	mL	55	80	(+) 25	< 0.001
Stroke volume index	ICG	mL/m^2	26.8	38.6	(+)11.8	< 0.001
Index of contractility	ICG	/s	23.8	36.4	(+)12.6	< 0.001
End-diastolic index	ICG	mL/m^2	47.8	60.1	(+)12.3	< 0.001
Acceleration index	ICG	/s^2	36	42	(+)6	< 0.005
Left ventricular ejection time	ICG	ms	269	325	(+)56	< 0.001
Left ventricular end-diastolic volume	ECHO	mL	65	88	(+)23	< 0.001
Left ventricular end-systolic volume	ECHO	mL	37	49	(+)4	< 0.023
Stroke volume	ECHO	mL	36	55	(+)19	< 0.001
Left atrial area	ECHO	cm^2	20.2	21.8	(+)1.6	< 0.041
Early mitral inflow velocity	ECHO	cm/s	87.7	76.4	(–)11.3	< 0.018
Early-diastolic myocardial velocities:						
At the lateral part of the mitral annulus	TDE	cm/s	12.9	10.8	(–)2.1	< 0.001
At the septal part of the mitral annulus	TDE	cm/s	9.3	7.0	(–)2.3	< 0.008
At the tricuspid annulus	TDE	cm/s	16.6	10.8	(–)5.8	< 0.001
Systolic myocardial velocities:						
At the lateral part of the mitral annulus	TDE	cm/s	7.6	8.4	(+)0.8	< 0.027
At the septal part of the mitral annulus	TDE	cm/s	5.7	6.6	(+)0.9	< 0.010
At the tricuspid annulus	TDE	cm/s	11.8	13.1	(+)1.3	< 0.071
E/E' mean ratio	ECHO/TDI	–	8.46	9.29	(–)0.83	< 0.034
B-type natriuretic peptide	Serum	pg/mL	362	137	(–)225	< 0.001

ECHO — conventional echocardiography; ICG — impedance cardiography; TDE — tissue Doppler echocardiography; TDI — tissue Doppler imaging

In patients with recurrent AF (n = 12), no significant changes in the echocardiographic or ICG parameters, nor in BNP concentration, were observed one week after cardioversion compared to baseline values (Table 4).

DISCUSSION

Many previous studies have aimed to determine the mechanisms underlying the haemodynamic disorders observed during AF, and to understand how SR restoration may improve circulatory system function. However, the selection of diagnostic methods has been limited due to the imprecise determination of haemodynamic parameters (by radioisotope method) [11] or due to their invasive character (cardiac catheterisation) [12], small sample size, and the limited number of control examinations performed.

Nevertheless, there is sufficient evidence based on ergospirometric parameters which supports the potential improvement of the cardiovascular system capacity following SR restoration [13]. However, the mechanism underlying these favourable changes in the cardiovascular system is still not fully understood.

This study confirmed the usefulness of two novel techniques in the diagnostic evaluation of the circulatory system during SR and AF. To date, there has been no published research on the use of ICG in the evaluation of haemodynamic parameters in patients with AF. Searching through the literature, we have also failed to find any reports on the simultaneous application of such different non-invasive tests as ICG and TDE for these purposes. ICG, based on the cyclic changes in electrical resistance of the heart and large vessels, along with the continuous monitoring of arterial pressure based on pulse waves, allows the determination of volumetric parameters and their temporal relationships. Echocardiography reveals variability in heart chamber morphology, and using the Doppler effect of reflected acoustic waves illustrates the dynamics of the systolic and diastolic functions of the myocardium (by means of TDE) and valvular blood flow (on conventional echocardiography). Both methods enable determination of the most important haemodynamic parameters describing the heart's pump function (SV, HR, CO, CI, LVWI on ICG, and EF on TDE), LV contractility (IC, ACI on ICG, and systolic annular velocity [S'] on TDE), diastolic function of the LV (mitral inflow early velocity [E], mitral inflow atrial velocity [A], E' on TDE), preload of the LV (EDI on ICG), and afterload (arterial tension, total peripheral resistance — TPR, and total peripheral

Table 4. Average changes in cardiovascular parameters of atrial fibrillation (AF) patients (n = 12) determined seven days after cardioversion in the group with AF recurrence

Parameter	Method	Unit	AF	AF one-week	Average change	P
Heart rate	ECG	bpm	85.6	90.3	(+)4.7	< 0.248
Stroke volume	ICG	mL	51	54	(+) 3	< 0.564
Stroke volume index	ICG	mL/m²	29.1	27.4	(+)1.7	< 0.564
Index of contractility	ICG	/s	26.1	24.1	(–)2.0	< 1.000
End-diastolic index	ICG	mL/m²	96.1	47.9	(–)48.2	< 0.091
Acceleration index	ICG	/s²	37	38	(+)1	< 0.248
Left ventricular ejection time	ICG	ms	289	281	(–)8	< 0.131
Left ventricular end-diastolic volume	ECHO	mL	51	44	(+)7	< 0.091
Left ventricular end-systolic volume	ECHO	mL	20	15	(–)5	< 0.058
Stroke volume	ECHO	mL	31	29	(+)2	< 0.763
Left atrial area	ECHO	cm²	20.6	21.6	(+)1.6	< 0.0366
Early mitral inflow velocity	ECHO	cm/s	23.0	20.8	(–)2.2	< 0.132
Early-diastolic myocardial velocities:						
At the lateral part of the mitral annulus	TDE	cm/s	11.4	11.7	(+)0.3	< 0.739
At the septal part of the mitral annulus	TDE	cm/s	9.0	9.0	0.0	< 1.000
At the tricuspid annulus	TDE	cm/s	16.1	16.7	(+)0.6	< 0.763
Systolic myocardial velocities:						
At the lateral part of the mitral annulus)	TDE	cm/s	6.9	7.0	(+)0.1	< 1.000
At the septal part of the mitral annulus	TDE	cm/s	4.9	5.1	(+)0.2	< 0.654
At the tricuspid annulus	TDE	cm/s	10.4	10.4	0.0	< 0763
E/E' mean ratio	ECHO/TDI		9.72	8.91	(–)0.19	< 0.763
B-type natriuretic peptide	Serum	pg/mL	326	441	(+)115	< 0.206

ECHO — conventional echocardiography; ICG — impedance cardiography; TDE — tissue Doppler echocardiography; TDI — tissue Doppler imaging

resistance index — TPRI on ICG), as well as such temporal relationships as LVET (on ICG) and heart chamber volumes (LVEDV, LVESV, LAA on TDE). Additionally, the right ventricle function was evaluated (systolic annular velocity — S'TV, E'TV, A'TV on TDE) along with thoracic fluid content (TFC on ICG).

Dogan et al. [14] used Doppler tissue imaging with mitral annular velocity determination (A') during the assessment of atrial stunning following AF cardioversion. However, in this study no significant differences in E' and S' velocities of the mitral annulus were observed before or after cardioversion. In a study by Yu et al. [15], mitral and tricuspid annulus velocities were revealed as good indicators of systolic and diastolic dysfunction of both ventricles following electroversion performed by means of an implantable atrioverter. However, in this study post-electroversion parameters were compared only to baseline values determined prior to AF during SR.

Following SR restoration, the haemodynamic state of an AF patient changes because of the deceleration and regularity of the cardiac rhythm, and the improved filling of the cardiac ventricles due to haemodynamic atrial function. This study revealed a significant increase in SV during both classic echocardiography and ICG, the result of a more pronounced increase in LVEDV compared to LVESV, and a statistically insignificant increase in EF. Prolonged diastole during SR may be responsible for a more pronounced decrease in the early velocity of mitral inflow (E) compared to early-diastolic myocardial velocities (E'ivs and E'lat), and the resultant increase in LV filling pressure expressed by the E to E' mean ratio.

Interestingly, a marked decrease in BNP was significantly correlated with an increase in E/E' mean (p = 0.000). In this context, the results by Alboni et al. [16] published in 1995 seem particularly interesting. These authors revealed that lower end-diastolic pressure in the LV is observed during AF, with a simultaneous increase in pulmonary artery wedge pressure. Similar relationships, but with lower statistical power, were observed in the right-sided heart chambers; a decrease in the end-diastolic pressure in the right ventricle was accompanied by an increased pressure in the right atrium. An increase in the LV filling pressure, equivalent to an increase in the preload (expressed by EDI), seems to be reflected to some extent by improved haemodynamic conditions. This was confirmed on ICG by an increase in the IC and ACI.

Improved contractility of the LV, dependent on the degree of its stretching, known as the Frank-Starling law, is an established phenomenon of heart physiology. Up to a certain cut off value, there is a linear relationship between the LV filling pressure and LV contractility. Above this threshold, however, the contractility is worsened, leading to a volumetric overload of the LV. During AF, an irregular heart rate is responsible for suboptimal relaxation time and results in different LV filling pressures. An excessively short interval between consecutive cardiac cycles is reflected by the insufficient filling and stretching of the LV (leading to lower contractility parameters observed on ICG). An excessively long interval, in turn, may cause volumetric overload, which is reflected by an increase in BNP levels. Muntinga et al. [17] and Brookes et al. [18] had similar conclusions after their invasive and radioisotope studies dealing with the variability of beat-to-beat haemodynamic parameters depending on RR interval. Besides our presented results, we analysed the regression of a dependent variable (SV) observed during ICG after SR restoration. This analysis revealed that EDI ($p = 0.000$), along with the mitral inflow velocities of A ($p = 0.302134$) and E waves ($p = 0.676334$), were responsible for 74.4% of variability (data not shown). This confirmed that improved SV is to a great extent dependent on the improvement in LV filling as a result of electroversion performed due to AF.

Taking into account the phenomenon of atrial stunning which resolves gradually up to one month after conversion of SR according to tissue Doppler study by Melek et al. [19], the improvement of LV performance may be even more pronounced at that time. A contemporary study using the speckle tracking technique by Dell'Era et al. [20] shows that atrial stunning resolution may not only result from increase in strain of atrial walls, but also from better synchronisation of contracting muscle.

The new diagnostic methods used in the study seem to be complementary to standard echocardiography, and to some extent to surpass it. ICG both confirms echocardiography improvement of SV after cardioversion and explains its mechanism: improvement of contractility, increase in end-diastolic volume, and LVET. Classic echocardiography parameters alone fail to describe diastolic parameters including LV filling pressure. In fact, both ICG and TDE are much less dependent on observer bias. TDE wave recording compared to visual assessment of standard echocardiography parameters is less liable to technically poor images, and requires a less experienced researcher.

Limitations of the study

The main limitation of the study is the number of patients in the group with sustained SR during one-week visit ($n = 29$). The project of the study presumed inclusion of 46 successfully cardioverted patients with one-week follow-up. Five patients did not show up at the follow-up visit. The early recurrence rate was higher than described in the previous studies (29% vs. 13%) [21]. Echocardiography was performed by one professional examiner (accredited by the Echocardiography Association of Polish Cardiac Society — SEPTK) which may imply systematic inaccuracy. Doppler velocity imaging is susceptible to angle of acquisition and chest movements (disability of breath holding). Early diastolic tissue velocity is sometimes difficult to differentiate from isovolumetric diastolic velocity, even when corrected with ECG monitoring. Impedance parameters are dependent on careful electrodes placement which may slightly differ on follow-up visit.

CONCLUSIONS

The results of this study suggest a marked improvement in the systolic function of the LV resulting from its improved filling during diastole. This was further confirmed by a significant decrease in the serum concentration of BNP observed following electroversion.

Both TDE and ICG are modern, valuable diagnostic methods that complementarily explain changes occurring in the cardiovascular system of AF patients subjected to electroversion.

This research was supported by a scientific grant (no. 57/2009) from the Nicolaus Copernicus University Collegium Medicum in Bydgoszcz.

Conflict of interest: *none declared*

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Wykorzystanie biokardioimpedancji przezklatkowej i wybranych parametrów echokardiografii tkankowej w ocenie układu sercowo-naczyniowego u osób z migotaniem przedsionków poddawanych kardiowersji

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Streszczenie

Wstęp: Migotanie przedsionków (AF) jest najczęstszą złożoną arytmią dotyczącą ok. 2% populacji ogólnej.

Cel: Celem pracy było wyjaśnienie zmian zachodzących w układzie sercowo-naczyniowym u pacjentów poddawanych kardiowersji z powodu AF za pomocą echokardiografii z wykorzystaniem doplera tkankowego (TDE) i biokardioimpedancji (ICG).

Metody: Grupę 41 chorych (22 mężczyzn i 19 kobiet) z AF ostrym (19 osób) i przetrwałym (22 osoby) badano za pomocą TDE i ICG przed kardiowersją i tydzień po powrocie rytmu zatokowego. Wykonano wówczas także oznaczenie stężenia peptydu natriuretycznego typu B (BNP) w surowicy krwi.

Wyniki: Powrót rytmu zatokowego wiązał się z istotnym statystycznie wzrostem wartości parametrów uzyskanych metodą ICG: objętości wyrzutowej i jej wskaźnika, wskaźnika kurczliwości, wskaźnika objętości końcoworozkurczowej, wskaźnika akceleracji i czasu wyrzutu lewej komory. Zmianom tym towarzyszył wzrost parametrów TDE: prędkości skurczowej pierścienia trójdzielnego i mitralnego. Ponadto prędkości wczesnorozkurczowe mierzone w tych samych punktach były istotnie niższe po kardiowersji. Po powrocie rytmu zatokowego stwierdzano znamienny spadek stężenia BNP.

Wnioski: Biokardioimpedancja i echokardiografia tkankowa są nowoczesnymi, cennymi metodami diagnostycznymi w ocenie napełniania lewej komory i kurczliwości mięśnia sercowego u pacjentów z AF poddawanych kardiowersji.

Słowa kluczowe: migotanie przedsionków, echokardiografia tkankowa, biokardioimpedancja, kardiowersja

Kardiol Pol 2013; 71, 4: 373–380

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Praca wpłynęła: 03.07.2012 r. **Zaakceptowana do druku:** 10.10.2012 r.