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CHA_2DS_2-VASc and HAS-BLED scores are not associated with cardiac defibrillators therapies

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Klíčová slova:
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SOUHRN

Cíl: CHA_2DS_2-VASc (srdeční selhání, hypertenze, věk > 75 let, diabetes mellitus, cévní mozková příhoda v anamnéze, cévní onemocnění, věkové rozmezí 65–74 let, pohlaví) a HAS-BLED (hypertenze, abnormální funkce ledvin/jater, cévní mozková příhoda, nestabilní INR, starší osoby, drogy/alkohol) jsou skórovací systémy, s jejichž pomocí lze hodnotit možnost vzniku cévní mozkové příhody a krvácení při fibrilaci síní. Cílem naší studie bylo posoudit vztah mezi implantovatelnými kardiovertery-defibrilátory (ICD) a hodnotami skóre CHA_2DS_2-VASc a HAS-BLED.
Metody: Po kontrole údajů o pacientech starších 18 let, jimž byl v období 2014–2019, bez ohledu na důvod, implantován ICD a u nichž bylo zjištěno, že jejich kardiostimulátor byl alespoň dvakrát zkontrolován v půlročním intervalu, bylo do naší retrospektivní studie zařazeno celkem 398 pacientů. Skóre CHA_2DS_2-VASc a HAS-BLED byla vypočtena během implantace zařízení a při posledním kontrolním vyšetření.
Výsledky: Léčba s použitím ICD se prováděla u 148 pacientů (vhodný výboj [n = 118] a nevhodný výboj [n = 30]); ICD nemělo implantováno 250 pacientů. Skóre CHA_2DS_2-VASc a HAS-BLED byla v obou skupinách podobná (p = 0,64, resp. p = 0,60). Skóre CHA_2DS_2-VASc a HAS-BLED byla při délce sledování s mediánem 5,5 roku u pacientů s vhodným a nevhodným výbojem podobná (p = 0,89, resp. p = 0,85). Podle multivariační regresní analýzy jsou nezávislými rizikovými faktory léčby pomocí ICD snížená ejekční frakce, použití jednodutinového ICD a dlouhodobý odstup od implantace (p < 0,05).
Závěry: Hodnoty CHA_2DS_2-VASc a HAS-BLED nejsou spojeny s léčbou pomocí ICD.

ABSTRACT

Aim: The CHA_2DS_2-VASc (heart failure, hypertension, age >75, diabetes mellitus, stroke history, vascular disease, 65–74 age range, gender) and HAS-BLED (hypertension, abnormal renal/liver function, stroke, bleeding history, labile INR, elderly, drugs/alcohol) are scoring system for using to estimate stroke and bleeding development in cases with atrial fibrillation. We aim to evaluate the relationship between the implantable cardioverter defibrillator (ICD) therapies and CHA_2DS_2-VASc and HAS-BLED scores.
Methods: 398 patients were included in this retrospective study after reviewing the data of the patients above the age of 18 who had ICD implantation for any reason between 2014–2019 and who were found to have at least two pacemaker check-ups with 6-month intervals. CHA_2DS_2-VASc and HAS-BLED scores were calculated during the device implantation and last control visit date.
Results: 148 of the patients received ICD therapy (appropriate shock [n = 118] and in appropriate therapy [n = 30]) and 250 of them did not receive any therapy. It was observed that the CHA_2DS_2-VASc and HAS-BLED scores were similar in the groups receiving and not receiving therapy (respectively, p = 0.64 and p = 0.60). CHA_2DS_2-VASc and HAS-BLED scores were similar in patients with appropriate shock or not (respectively, p = 0.89 and p = 0.85) with median follow-up period 5.5 years. Multivariate regression analysis showed that reduced ejection fraction, presence of single-chamber ICD, lapsing of a long time after the implantation were independent risk factors for ICD device therapies (p < 0.05).
Conclusions: CHA_2DS_2-VASc and HAS-BLED scores are not associated with device-based ICD therapies.

Keywords:
CHA_2DS_2-VASc
HAS-BLED
ICD
Shock
Therapy

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Introduction

The CHA_2DS_2-VASc (congestive heart failure, hypertension, age >75, diabetes mellitus, previous stroke or transient ischemic attack history, vascular disease, 65–74 age range, gender category) is a scoring system for estimating the risk of stroke development in cases with atrial fibrillation. It was shown that the higher score was associated with the greater the risk of stroke development.[1] Even though it was identified with atrial fibrillation, it was also reported to predict mortality in heart failure with reduced ejection fraction.[2] Similarly, a high CHA_2DS_2-VASc score was observed to cause increased mortality in patients with acute pulmonary embolism.[3] Besides, it was put forward that a high CHA_2DS_2-VASc score was also correlated with the increased risk of no-reflow and in-hospital mortality in patients who underwent primary percutaneous coronary intervention due to ST elevation myocardial infarction.[4] And HAS-BLED (hypertension, abnormal renal/liver function [1 point each], stroke, bleeding history or predisposition, labile INR, elderly [> 65 years], drugs/alcohol concomitantly [1 point each]) score is a scoring system developed to estimate the risk of bleeding in patients who received anticoagulant therapy.[1]

Despite increasing medical and device treatments in parallel with technological developments, cardiovascular deaths are still placed on the top in the world. One of the approaches that have been shown to decrease mortality in this field is the implantable cardiac defibrillator (ICD).[5,6] According to current guidelines, mainly reduced ejection fraction, presence of documented ventricular arrhythmias or a sudden cardiac arrest history are taken into account before ICD implantation.[6,7] However, device therapy is not observed in a significant part of the patients who had ICD implantation.[8,9] On the other hand, inappropriate shock therapies, which significantly affect the quality of life, can be observed in 15–25% of the patients, and the reason for inappropriate shock therapies in 60–70% of these patients was found to be atrial fibrillation with high ventricular response.[10,11]

The relationship of the main titles that comprise the CHA_2DS_2-VASc scoring system with each other, their effects on the development of atrial fibrillation and their negative effects on cardiac functions are known well. In this study, our aim is to evaluate the relationship between the forms of treatment applied by the device in patients with ICD implantation and the CHA_2DS_2-VASc and HAS-BLED scoring systems.

Material and method

Patient population

398 patients were included in the study after reviewing the data of the patients above the age of 18 who had ICD implantation for any reason in our clinic between 2014–2019 and who were found to have at least two pacemaker check-ups visits with 6-month intervals. We tried to include patients who were followed up for at least 1 year after implantation. Apart from ventricular tachycardia (VT) or ventricular fibrillation (VF), shock therapy was considered as inappropriate shock. Patients who did not receive any shock therapy but received anti tachycardia pacing therapy (ATP) were also noted. The CHA_2DS_2-VASc and HAS-BLED (hypertension, abnormal renal/liver function [1 point each], stroke, bleeding history or predisposition, labile INR, elderly [> 65 years], drugs/alcohol concomitantly [1 point each]) scores of the patients during the device implantation and last ICD control visit were calculated as previously described.[12,13] The patients were divided into two groups as patients who received ICD therapy (anti-tachycardia pacing and shock therapy) and patients who did not. The patients who received ICD therapy were again divided into two groups as patients who received appropriate ICD therapy and patients who did not. The basic demographic characteristics, additional systemic diseases (diabetes mellitus, hypertension, coronary artery disease, etc.) and echocardiographic data of the patients were noted. Meanwhile, the patients' basic electrocardiographic data such as heart rhythm, QT interval, and heart rate and their basic medical treatments were recorded. Basic echocardiographic data were obtained from the patient's files. The time that passed following the pacemaker implantation, the frequency of application for pacemaker check-up and the type of the pacemaker implantation were noted. Patients with hypertrophic cardiomyopathy or a known arrhythmogenic syndromes such as Brugada syndrome, long QT syndromes, and ICD therapy due to acute coronary syndromes who need coronary angiography or revascularization were excluded from the study. Besides, the laboratory values of the patients from the period of shock therapy were recorded, and in the patients who did not receive shock therapy, their laboratory values checked in their latest check-ups were recorded. Figure 1 demonstrates a flowchart of study design. The study protocol was approved by our Local Ethics Committee with 13.09.2019/93/2047 ID number.

Statistical analysis

While producing descriptive statistics, continuous variables were shown as mean ± standard or median (interquartile range), and nominal variables were presented as number of cases (n) and percentage (%). The normality distribution was evaluated with the Kolmogorov-Smirnov test. Baseline characteristics were compared with independent sample t test, Mann-Whitney U test, chi-square test or Fisher Exact test where appropriate. For the multivariate analysis, the possible factors identified with univariate analyses were further entered into the logistic regression analysis to determine independent predictors of ICD therapies. For all tests, a p value <0.05 was regarded as statistically significant. All statistical analyses were performed by means of SPSS for Windows (SPSS 16, Inc.).

Results

The results of 398 patients who had a mean age of 63.68±13.48 years and 77% of whom were men were evaluated. It was seen that 148 of the patients received ICD therapy and 250 of them did not receive any therapy. In 30.4% (n = 45) of the patients who were receiving ICD therapy, arrhythmia was terminated with antitachycardia pacing. Again, according to the monitored ICD therapies,

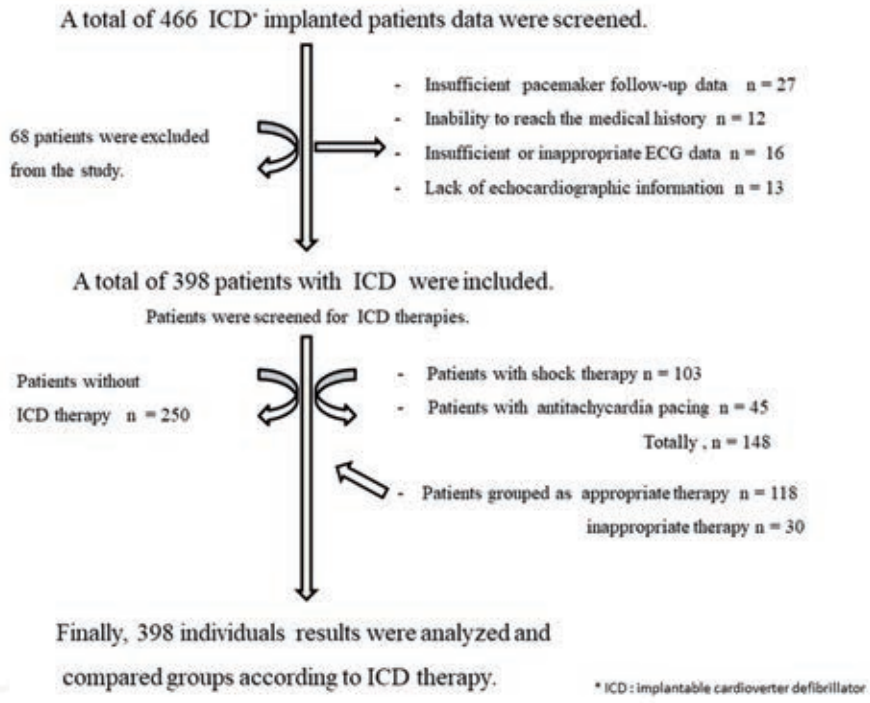

Fig. 1 – Flowchart demonstrates the method of study.

the patients were classified as patients who were receiving appropriate shock (n = 118) and patients who were not (n = 30), and their clinical characteristics were compared.

Accordingly, it was observed that the basic characteristics of the patient population who received and did not receive ICD therapy such as age, gender, hypertension, smoking, diabetes mellitus were distributed similarly, and there was no difference between the groups. The rate of ischemic cardiomyopathy was also observed to be similarly distributed in the groups who received therapy (60.6%) and who did not (59.6%) ($p = 0.761$). It was observed that the majority of patients were in sinus rhythm (n = 291, 73%), 8% (n = 32) had AF, and 18.8% (n = 75) were in pace rhythm at the time of pacemaker implantation. The mean CHA_2DS_2-VASc score was calculated as 2.77±1.42 in the whole study population during device implantation. It was observed that the CHA_2DS_2-VASc score during implantation date and last control visit were similar in the groups receiving and not receiving therapy (respectively, $p = 0.64$ and $p = 0.63$). When the patients with and without appropriate shock were examined, the CHA_2DS_2-VASc score was found to be similar (for implantation date p value = 0.89, for last control p value = 0.88). It was discovered that the majority of the patients receiving inappropriate shock received shock therapy due to atrial fibrillation (50%). The mean HAS-BLED score was calculated as 2.16±1.06 in the whole study population. It was observed that the HAS-BLED score was distributed similarly in all the groups and did not have statistical significance. In the patient population receiving shock therapy, it was witnessed that the ejection fraction was lower, and the left ventricular indiastolic/systolic diameters and the left atrium diameter were larger ($p < 0.002$), however, these differences were not observed in the patients who received and did not receive appropriate shock ($p > 0.018$). In Tables 1 and 2, the basic characteristics and comparative analyses of the study population are presented. Multivariate regression analysis was conducted to identify the independent risk factors for ICD treatment. Accordingly, reduced ejection fraction ($\beta = 0.977$, $p = 0.05$), presence of single-chamber ICD ($\beta = 0.369$, $p = 0.001$), lapsing of a long time after the implantation ($\beta = 1.151$, p = 0.001) were found to be the independent risk factors for ICD device therapies (Table 3).

Discussion

In this study which examines the data of a total of 398 patients it could not be revealed that the CHA_2DS_2-VASc score, which was shown to set forth the risk of thromboembolism in patients with atrial fibrillation, and the HAS-BLED score, which put forward the risk of bleeding, were not associated with device-based therapies (ATP, shock therapy) in patients with ICD. Moreover, we also found that these scores did not associate inappropriate ICD shock.

The implantable cardiac defibrillator therapy was shown to reduce mortality in the individuals who had high-risk of cardiovascular diseases and had been diagnosed with ischemic heart disease, dilated cardiomyopathy, congestive heart failure, or beginning ventricular arrhythmia.[14,15] It is known that 50–60% of the patients received ICD shocks within 9±11 months following the implantation.[16] Furthermore, ICD shocks, which included appropriate and inappropriate shocks, were reported to be correlated with psychological problems, low quality of

Table 1 – Demographic, clinical, and laboratory characteristics of study population

Variables	ICD therapy (+) n = 148	ICD therapy (–) n = 250	*p* value
Age (years)	63.6±13.7	63.7±13.3	0.97
Sex (female), n (%)	30 (20.3)	61 (24.4)	0.34
Dyslipidemia, n (%)	54 (36.5)	104 (41.6)	0.31
DM, n (%)	41 (28.6)	10 (24.4)	0.66
Hypertension, n (%)	75 (50.7)	124 (49.6)	0.84
Smoking, n (%)	43 (29.1)	79 (31.6)	0.75
Coronary artery disease, n (%)	59 (39.9)	101 (40.4)	0.92
Valve replacement, n (%)	8 (5.4)	10 (4.0)	0.32
Ischemic stroke, n (%)	13 (8.8)	16 (6.4)	0.38
LVEF (%)	34.5±11.2	37.7±11.0	0.006
LA diameter (mm)	43.4±7.5	41.7±6.8	0.02
LVEDD (mm)	57.9±10.3	55.4±8.8	0.02
LVESD (mm)	43.3±11.8	40.3±10.6	0.02
Systolic PAB (mmHg)	37.3±11.2	36.0±11.4	0.29
Heart rate (bpm)	69.7±14.9	71.2±14.0	0.35
QRS duration (ms)	112.1±38.2	107.5±35.2	0.25
QT duration (ms)	410.8±43.1	412.1±49.5	0.79
CHA_2DS_2-VASc score	2.74±1.38	2.80±1.44	0.64
HAS-BLED score	2.20±1.03	2.15±1.08	0.60
Type of defibrillator			
VVI-ICD, n (%)	111 (75)	132 (52.8)	<0.001
Dual chamber ICD, n (%)	32 (21)	97 (38.8)	<0.001
Cardiac resynchronization therapy, n (%)	5 (3.3)	21 (8.4)	0.082
Elapsed time after ICD implantation (years)	6.94±2.95	5.57±3.24	<0.001
Number of pacemaker control	7.6±4.07	4.9±3.47	<0.001
Number of atrial fibrillation during pacemaker control, n (%)	45 (30.4)	32 (12.8)	<0.001
Medications			
β-blocker, n (%)	126 (85.1)	218 (87.2)	0.82
ACEI/ARB, n (%)	114 (77)	195 (78)	0.75
MRA, n (%)	53 (35.8)	92 (36.8)	0.84
Diuretic, n (%)	62 (41.9)	108 (43.2)	0.80
Laboratory results			
Creatinine (mg/dl)	1.23±0.78	1.11±0.52	0.09
GFR (mL/min/1.73 m²)	73.3±28.5	78.3±29.9	0.10
Hb (g/dl)	13.6±1.9	13.5±2.1	0.56
Platelet (10^3/mm³)	234.5±71.0	228.7±72.3	0.44
Leukocyte (10^3/mm³)	9.01±3.2	8.83±3.6	0.63
Sodium (mEq/L)	138.2±3.9	138.2±4.3	0.88
Potassium (mEq/L)	4.59±0.57	4.58±0.56	0.93

ACEI – angiotensin-converting-enzyme inhibitor; ARB – angiotensin receptor blocker; DM – diabetes mellitus; GFR – glomerular filtration rate; Hb – hemoglobin; LA – left atrium; LVEF – left ventricular ejection fraction; MRA – mineralocorticoid receptor antagonist.

life, and increased mortality.[1,19] To build up on this topic, it has been shown in a recently published meta-analysis that appropriate shock therapy is related to increased mortality, and appropriate or inappropriate ATP therapies do not have such an effect.[20] Therefore, the identification of the predictors of appropriate or inappropriate ICD therapies

Table 2 – Demographic, clinical, and laboratory characteristics of ICD therapy (+) population according to appropriate shock

Variables	Appropriate therapy (n = 118)	Inappropriate therapy (n = 30)	*p* value
Age (years)	63.4±13.1	64.7±16.3	0.62
Sex (female), n (%)	25 (21.1)	6 (20)	0.88
Dyslipidemia, n (%)	43 (36.4)	10 (33.3)	0.75
DM, n (%)	33 (28.0)	7 (24.3)	0.61
Hypertension, n (%)	59 (50.0)	16 (53.3)	0.74
Smoking, n (%)	35 (29.7)	8 (26.7)	0.76
Coronary artery disease, n (%)	71 (60.2)	19 (63.3)	0.75
Valve replacement, n (%)	7 (5.9)	1 (3.3)	0.85
Ischemic stroke, n (%)	9 (7.6)	4 (13.3)	0.32
LVEF (%)	33.9±10.3	37.0±14.3	0.18
LA diameter (mm)	43.2±6.8	44.5±10.0	0.44
LVEDD (mm)	57.9±9.8	58.5±12.7	0.78
LVESD (mm)	43.3±11.4	43.7±14.4	0.88
Systolic PAB (mmHg)	36.8±10.9	39.9±12.3	0.21
Heart rate (bpm)	69.2±14.2	69.6±11.0	0.88
QRS duration(ms)	111.4±38.2	113.9±45.8	0.74
QT duration (ms)	409.9±41.8	415.3±46.5	0.55
CHA_2DS_2-VASc score	2.73±1.30	2.76±1.69	0.89
HAS-BLED score	2.21±1.01	2.17±1.13	0.85
Type of defibrillator			
VVI-ICD, n (%)	89 (75.4)	22 (73.3)	0.642
Dual chamber ICD (n/%)	25 (21.1)	7 (23.3)	0.549
Cardiac resynchronization therapy (n/%)	4 (3.3)	1 (3.3)	0.992
Elapsed time after ICD implantation (years)	6.92±2.96	7.06±3.01	0.82
Number of pacemaker control (n)	7.55±4.06	7.96±4.96	0.620
Number of atrial fibrillation during pacemaker control (n/%)	30 (25.4)	15 (50)	< 0.001
Medications			
β-blocker, n (%)	99 (83.9)	27 (90)	0.40
ACEI/ARB, n (%)	91 (77.1)	23 (76.7)	0.95
MRA, n (%)	40 (33.9)	13 (43.3)	0.34
Diuretic, n (%)	49 (41.5)	13 (43.3)	0.85
Laboratory results			
Creatinine (mg/dl)	1.28±0.85	1.03±0.32	0.11
GFR (mL/min/1.73 m²)	71.2±27.9	82.4±28.9	0.06
Hb (g/dl)	13.7±1.9	13.6±1.7	0.85
Platelet (10^3/mm³)	235.7±72.5	228.6±66.2	0.63
Leukocyte (10^3/mm³)	8.94±3.2	9.13±3.5	0.78
Sodium (mEq/L)	138.0±3.9	139.0±3.6	0.21
Potassium (mEq/L)	4.59±0.57	4.57±0.57	0.88

ACEI – angiotensin-converting-enzyme inhibitor; ARB – angiotensin receptor blocker; DM – diabetes mellitus; GFR – glomerular filtration rate; Hb – hemoglobin; LA – left atrium; LVEF – left ventricular ejection fraction; MRA – mineralocorticoid receptor antagonist.

represents a significant step in selecting and following-up the patients who will have ICD implantation. In the studies conducted, observation of documented VT before ICD implantation, occurrence of VT during myocardial infarction, sedentary lifestyle, kidney failure, ejection fraction ≤35%, emotional stress status, depression, smoking or

Table 3 – Multivariate logistic regression analysis for ICD therapy prediction

	p value	*Exp(B)*	*95% CI for EXP(B)*	
			Lower	*Upper*
Hypertension	0.234	0.831	0.658	1.142
Diabetes mellitus	0.712	0.912	0.556	1.285
LVEF	**0.05**	0.977	0.955	1.000
LA diameter	0.361	1.017	0.981	1.055
GFR	0.161	0.994	0.986	1.002
Betablocker	0.562	0.992	0.860	1.007
CHA_2DS_2-VASc	0.132	0.982	0.943	1.106
HAS-BLED	0.542	0.984	0.931	1.001
VVI-ICD	**<0.001**	0.369	0.229	0.596
Elapsed time after ICD implantation	**<0.001**	1.151	1.072	1.235

GFR – glomerular filtration rate; LA – left atrium; LVEF – left ventricular ejection fraction.

not receiving betablocker treatment of ICD shock therapy have been shown to be predictors for ICD shock therapy.[21–25] Lead fractures of the device, T-wave oversensing status, electrical interference, atrial fibrillation, and supraventricular tachycardia can also be mentioned as the most common causes of inappropriate shocks.[26]

Regarding the comorbid loads of the diseases included in the CHA_2DS_2-VASc scoring, it is expected that the mortality rate or the rate of malignant arrhythmia, and therefore, the incidence probability of the ICD therapy will be high in this patient group. Considering heart failure, which ranks in the first place in this scoring, the presence of heart failure with reduced ejection fraction (EF <35%) is still one of the first indications for ICD implantation across the world. Additionally, when LVEF is <35%, the risk of death has been shown to increase 7 times, this risk increases 16 times when multiple shocks occur. It has been shown that the rates of device-based shock therapy decrease with the improvement of the ejection fraction.[27] In other words, it is obvious that the probability of ICD shock therapy will be high in patients with heart failure and impaired systolic functions (EF <40%) within the CHA_2DS_2-VASc scoring. It should be remembered that this scoring may also lead to obtaining high scores in this scoring system, since there is no indication of ICD implantation in patients with heart failure whose systolic functions have been preserved alone. When evaluating the CHA_2DS_2-VASc scoring as a predictor for ICD therapy, it may also be a logical option to consider this situation. In our study, no change was observed between the ICD therapy and the CHA_2DS_2-VASc relationship when the patients with ejection fraction > 40% were excluded. However, in our study, supporting the previous data, it was put forward once again that low EF is an independent risk factor for ICD therapies. Secondly, it was suggested that hypertension leads to supraventricular and ventricular arrhythmias by causing diastolic dysfunction, changes in left atrium diameter and function, and eventually left ventricular hypertrophy.[28] However, when the previous studies were reviewed, it was observed that hypertension was distributed similarly in groups receiving and not receiving ICD therapy[11], but there are publications reporting that hypertension is predictive for ICD therapy.[29] In our study, no difference was observed in the distribution of hypertension between the patients with any ICD therapy and the patients without it. In our study, the diameter of the left atrium was found higher in the patients receiving shock therapy. This can be explained by paying attention to the extending effect of heart failure and hypertension on the diameter of the left atrium. Thirdly, in the studies conducted on patient's age, it was revealed that advanced age was an independent risk factor for mortality in patients with ICD implantation.[30] It was stated that, among the CHA_2DS_2-VASc scoring components, being above 75 years of age and heart failure were the strongest predictors.[30] In another study, patients who had ICD implantation and received appropriate shocks were seen to be older.[31] On the contrary, it was reported in a published meta-analysis that elderly patients received less shock therapy than young people. This was explained as the effect of higher mortality rates in elderly patients for several reasons.[32] This may be a result from the shorter follow-up time of the patients after ICD implantation in older individuals owing to the high mortality rates mentioned. In our own study, it was observed that age was distributed similarly in the groups receiving and not receiving shock therapy. However, as the ICD implantation time increased, the rate of encounter with shock therapy was found to increase. In this case, it seems as a more realistic approach to think that the period during which the patient kept the device and the incidence rate of the device-based therapies, rather than the age of the person at the time of implantation, have a more linear relationship. The situation is still unclear in patients with diabetes mellitus. Normally, it is known that the presence of diabetes mellitus has a high risk of sudden cardiac death with arrhythmias such as atrial fibrillation and ventricular fibrillation.[33] Some studies have suggested that the first appropriate shock rate is higher in diabetic patients who had ICD implantation whereas others have asserted that being diabetic has no cumulative effect.[34,35] In patients with a history of stroke, inappropriate shock rates were observed higher.[36] This is accepted as the ef-

fect of arrhythmias occurring depending on the development of autonomic dysfunction in such patients.[37] In our study, the presence of diabetes and stroke was found to have no effects on ICD therapy. When evaluated in terms of gender, as in our study, no difference has been observed between both genders in many studies. However, in a recent large-scale study, women have been shown to receive less appropriate shock therapy, but receive inappropriate shock at a rate similar to men.[38] In this study, it is seen that the presence of ischemic heart disease is the most common cause of device implantation (60%). Because the presence of coronary artery disease is known in many patients carrying devices, it can be assumed that the description of the peripheral artery disease in the VASc component has no effects on the prediction of ICD therapy. For the clarification of this situation, prospective studies are needed in more homogeneous patient groups. When the CHA_2DS_2-VASc scoring system is evaluated as a whole, in a study conducted on this subject before, it was shown that ICD therapy rates were higher in individuals with high CHA_2DS_2-VASc scores.[31] This score is expected to be high since it was higher in the patients receiving shock in each subgroup that constituted this scoring in the same study. Considering the indications of ICD implantation in the majority of patients with ICD implantation in our study, it is observed that comorbid conditions such as history of heart failure, diabetes mellitus and hypertension are distributed similarly among the groups receiving and not receiving appropriate shock. Thus, the CHA_2DS_2-VASc score was expected to be in similar ranges. In another study, it was speculated that the CHA_2DS_2-VASc score had a predictive value for all-cause mortality in patients with ICD, however, no information was given about ICD therapies in that study.[39] In addition, when reviewed in our study, the HAS-BLED score did also not have a predictive effect for ICD therapies. Since hypertension, advanced age and stroke exist in both CHA_2DS_2-VASc and HAS-BLED scoring systems, it is not a coincidental but expected result that similar results appear in both scoring systems.

Conclusion

Consequently, according to the data in our study, the predictive value of the CHA_2DS_2-VASc score was not found for device-based therapies in patients who had ICD implantation. More comprehensive and prospective studies are needed on the subject.

Limitations of the study

The study has some limitations. First of all, it stands out that it is a monocentric retrospective observational analysis. Additionally, the absence of mortality data of the patients can be considered as another limitation. Plus, insufficient data on atrial fibrillation is another factor that grabs attention.

Conflict of interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethical statement

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by local ethics committee with 13.09.2019/93/2047 ID number.

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