Research Article

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Effect of anticoagulation on infarct volume and NIHSS score in patients with atrial fibrillation and ischaemic stroke

Atriyal fibrilasyon ve iskemik inme hastalarında antikoagülasyonun infarkt hacmi ve NIHSS skoru üzerine etkisi

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Abstract

Purpose: The aim of this study was to evaluate the use of oral anticoagulation (OAC) in patients with cardioembolic stroke due to non-valvular atrial fibrillation (NVAF). The NIHSS (National Institute of Healt Stroke Scale) score calculated by a neurologist at initial presentation and infarct volume measured semi-automatically in cm3 by Magnetic Resonance Imaging (MRI).

Materials and methods: A total of 101 NVAF patients with acute ischaemic stroke were included in this retrospective study. Patients were divided into 4 groups according to OAC drug use: Non-OAC users (Group 1), subtherapeutic dose warfarin users (under 70 years of age: INR≤2.0; over 70 years of age: INR≤1.6 Group 2), therapeutic dose warfarin users (under 70 years of age: INR≥2.0; over 70 years of age: INR≥1.6 Group 3) and therapeutic dose Non-vitamin K oral anticoagulant (NOAC) users Group 4.

Results: Infarct volume was calculated as 22.20 cm³ median (0.4-235 cm³ lowest-highest) for Group 1; 12.95 cm³ (1.3-129 cm³) for Group 2; 2.25 cm³ (0.3-89 cm³) for Group 3 and 4.40 cm³ (0.2-293 cm³) for Group 4 and the difference was statistically significant (p=0.039). The calculated NIHSS score was 9 (4-23) for the Group 1, 8.5 (3-18) for the Group 2, 6.5 (2-20) for the Group 3, 5 (1-22) for the Group 4 and the effect of anticoagulation use on NIHSS score was statistically significant (p=0.029).

Conclusion: Anticoagulant treatment holds importance in the primary and secondary prevention of stroke and in enhancing the NIHSS score and infarct volumes among stroke patients, as evidenced in the current study.

Keywords: Atrial fibrillation, cardioembolic stroke, ischemic stroke, infarct volume, NIHSS score.

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Öz

Amaç: Bu çalışmada non-valvüler atrial fibrilasyona (NVAF) bağlı kardiyoembolik inme geçiren hastaların oral antikoagülasyon (OAK) kullanımının, ilk başvuruda nöroloji uzmanı tarafından hesaplanan NIHSS (National Institute of Healt Stroke Scale (Ulusal sağlık enstitüleri inme ölçeği) skoru ve çekilen diffüzyon manyetik rezonans görüntüleme (MRG) 'nin cm3 cinsinden semiotomatik olarak ölçülen infarkt volümünün değerlendirilmesi amaçlanmıştır.

Gereç ve yöntem: Akut iskemik inme tanısı alan 101 NVAF hastası retrospektif olarak planlanan bu çalışmaya dahil edildi. Hastalar OAK ilaç kullanımına göre 4 gruba ayrıldı: OAK kullanmayanlar (Grup 1), subterapötik dozda warfarin kullanan (70 yaş altı: INR≤2,0; 70 yaş üzeri: INR≤1,6 Grup 2), terapötik dozda warfarin kullananlar (70 yaş altı: INR≥2,0; 70 yaş üzeri; INR≥1,6 Grup 3) ve terapötik dozda Non-vitamin K oral antikoagülan (NOAK) kullanan Grup 4 olmak üzere 4 gruba ayrıldı.

Bulgular: İnfarkt volümü 1. Grup için 22,20 cm³ medyan: (0,4-235 cm³ en düşük-en yüksek), 2. Grup: 12,95 cm³ (1,3-129 cm³), 3. Grup: 2,25 cm³ 0,3-89 cm³) ve 4. Grup: 4,40 cm³ (0,2-293 cm³) olarak hesaplandı ve aradaki fark istatistiksel olarak anlamlıydı (p=0,039). Hesaplanan NIHSS skoru 1. Grup için 9 (4-23), 2. Grup: 8,5 (3-18), 3. Grup: 6,5 (2-20), 4. Grup 5 (1-22) olarak hesaplandı ve antikoagülasyon kullanımının NIHSS skoru üzerine etkisi istatistiksel olarak anlamlı bulundu (p=0,029).

Sonuç: Antikoagülan tedavi, bu çalışmada gösterildiği gibi inme hastalarında NIHSS skorunu ve enfarktüs hacimlerini iyileştirmenin yanı sıra inmenin birincil ve ikincil önlenmesinde önemlidir.

Anahtar kelimeler: Atrial fibrilasyon, kardioembolik inme, iskemik inme, infarkt volümü, NIHSS skoru.

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Introduction

Cardioembolic stroke is cerebral artery occlusion caused by a cardiac embolism. The rate of ischemic stroke due to cardioembolism is 15-25%, and this rate can reach up to 35% in young patients [1-3]. The presence of atrial fibrillation increases the risk of stroke by approximately five times. At least half of cardioembolic strokes are associated with Atrial fibrilasyon (AF), and NVAF is the most prevalent cardiac arrhythmia [4, 5]. The prevalence of AF increases by aging, and this rate rises to 24% over age of 80. AF is a significant risk factor for strokes in advanced ages [5]. As it is known, OAC agents are used in AF patients due to a possible risk of thromboembolism, and the CHA_2DS_2 (C:Congestive heart failure; H:Hypertension; A_2:Age 75 years or older; D:Diabetes mellitus; S_2:Previous stroke, transient ischemic attack or thromboembolism) and CHA_2DS_2-VAS_C (C:Congestive heart failure; H:Hypertension; A_2:Age 75 years or older; D:Diabetes mellitus; S_2:Previous stroke, transient ischemic attack or thromboembolism; V:Vascular disease; A:Age 65-74 years; S:Sex category (female)) scales are used for thromboembolism risk in patients with NVAF [6-8]. One of the common stroke risk factors is summarized in the CHA_2DS_2-VAS_C score based on the clinical risk factor [9]. Vitamin K antagonists (warfarin) and oral anticoagulants not dependent on vitamin K (NOAC) used as OAC in the treatment highly protect atrial fibrillation patients against stroke [10]. Using warfarin in western countries, the target PT-INR value has been shown as 2.0–3.0 [7, 11]. However, in Japan, which also uses warfarin, it was kept lower in patients over age of 70 years and the ideal PT-INR level was determined as (1.60-2.6). Recently, NOAC have come into use and are now widely used in the treatment of NVAF with strong evidence levels. They have come to the forefront in reducing stroke due to atrial fibrillation in primary prophylaxis with their ability to cause significantly less bleeding compared to warfarin, to prevent stroke at an equal or greater rate, and to be easy to use [12, 13]. In the examination, the NIHSS scale, which evaluates the severity of stroke, is calculated. A high score indicates deteriorating [14].

Measuring the neurological deficit after stroke is very significant to demonstrate the effectiveness of the drug, intervention or surgery used. For this reason, the Modified Rankin Scale (mRS) used is an accepted disability scale [15]. In this context, the objective is to determine the usage of OAC in patients who have had a cardioembolic stroke due to NVAF, with the NIHSS score. The evaluation of infarct volume, measured semi-automatically in cm3 through MRI, is also planned.

Materials and methods

The data of 101 patients with or without OAC (newly diagnosed AF, discontinued or disrupted of using drug) among NVAF patients diagnosed with acute ischemic stroke at a Training and Research Hospital between 2014-2020 were retrospectively analysed. Permission was obtained from Atatürk University Faculty of Medicine Ethics Committee for the study. Patients older than age of 18 years, with diffusion MRI of sufficient quality for volumetric analysis, and with a NIHSS score (calculated by a neurologist) at presentation were included in the study. Exclusion criteria of the study; It was determined as the patient who used OAC for a reason other than AF and had a stroke, but the current neurological examination and death could not be explained by infarction. Within the framework of the current research, demographic data, including age, gender, personal and family medical history of the participants recruited for the study, were collected, vascular risk factors (HT, DM, AF, CAD, CHF, hyperlipidaemia, smoking, etc.), CHA_2DS_2 and CHA_2DS_2-VAS_C scores, systemic and neurological examination findings were analyzed and recorded. Stroke subtypes were determined by Bamford (TACI, PACI, POCI, LACI) classifications [16]. The patients were separated into four groups based on their OAC drug usage. According to this [17].

Group 1: Those who do not use OAC,

Group 2: Patients using subtherapeutic doses of warfarin (INR≤2.0 in patients under age of 70 years, INR≤1.6 in patients over age of 70),

Group 3: Patients using therapeutic doses of warfarin (INR≥2.0 in patients under age of 70 years, INR≥1.6 in patients over age of 70 years),

Group 4: Consisted of patients using NOAC.

An anatomical classification was made by [16, 18] according to the arterial area, in which clinical features were prioritized. This classification was made according to the location of the lesion in terms of treatment; total anterior circulation infarcts (TACI), partial anterior circulation infarcts (PACI), posterior circulation infarcts (POCI), lacunar infarcts (LACI), and developing infarcts according to the usage of OAC status were compared.

The hemorrhagic transformation (HT) may occur as part of the natural history of ischemic stroke or may develop with the using of antiplatelet, anticoagulant or thrombolytic therapy [19], those with HT within the first 24 hours of the patients included in the study were identified and analyzed statistically.

Diffusion MRI imaging

All diffusion magnetic resonance imaging procedures were made by using a 1.5 T MR scanner (Avanto, Siemens Healthcare Services, Erlangen, Germany). For diffusion weight imaging (DWI), echo-planar imaging was made in the transverse plane over the spin-echo sequence, and imaging parameters were used as TR/TE:3100/100; matrix:192x192; NEX:3; section thickness:5 mm; inter-section gap:1.5 mm; examination time:4-5 minutes and FOV:230x230 mm. Diffusion gradients were taken in three planes perpendicular to one another and ADC maps were attained by using 2 different b values (500 and 1.000 sec/mm²).

The semiautomatic technique, which is a quantitative method and takes less time (less than 15 minutes) when compared to the manual technique, was used for the calculation of infarct volumes. Infarct volume in patient groups was evaluated semi-automatically by using DWI on a 3D volume measurement workstation (Figure 1) (Myrian Pro, Intrasense, France).

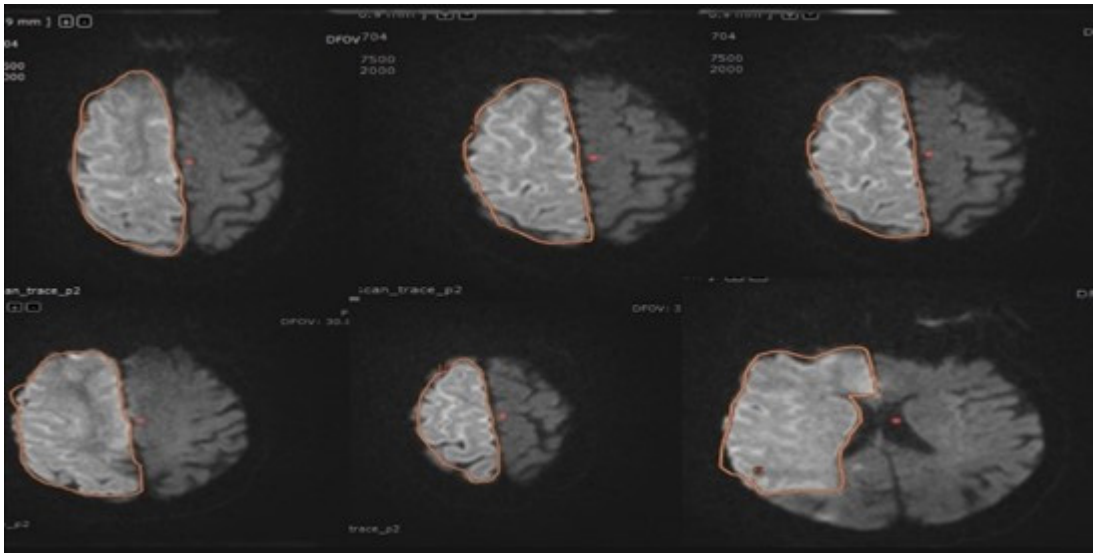

Figure 1. Measuring the infarct volume of a patient with a persistent lesion in the same arterial irrigation area using diffusion-weighted imaging with the Myrian Program

Statistical analysis

Analyses were carried out using IBM SPSS 20 statistical analysis software. Data were presented as mean, standard deviation, median, minimum and maximum percentage. The normal distribution of continuous variables was assessed using the Shapiro-Wilk test when the sample size was less than 50, and with the Kolmogorov-Smirnov test when the sample size exceeded 50. In the comparisons between two independent groups, the Independent Samples t test was used when the normal distribution condition was provided, and the Mann Whitney u test was used if it was not. In the comparison of continuous variables with more than two independent groups, the ANOVA test was used when the normal distribution condition was

provided, and the Kruskal Wallis test was used when it was not. Post-hoc tests after ANOVA test were made by using Tukey test when variances were homogeneous and Tamhane's T2 test when variances were not homogeneous. After Kruskal Wallis test, Kruskal Wallis 1-way ANOVA (k samples) test was used for post-hoc tests. n 2x2 comparisons between categorical variables, the expected value (>5) was calculated by using the Pearson Chi-square test, if the expected value is between (3-5), the Chi-square Yates test, and the expected value (<3) was made by using the Fisher's Exact test. If the comparisons are bigger than 2x2 between categorical variables, Pearson Chi-square test was used when expected value (>5) and Fisher-Freeman-Halton test was used when expected value (<5). Statistical significance level was taken as $p<0.05$.

Results

Within the study's scope, 101 patients who met the inclusion criteria were evaluated and the demographic data such as age and gender of stroke patients with NVAF were examined; 72.92±9.04 years, 64 (63.3%) women, 37 (36.6%) men, median NIHSS score of 8 (min-max 1-23), discharge mRS 3 (0-6.3), the mRS score was measured in third month of discharging 2 (0-6). Generally, 79 (79.7%) patients had AF known, and 22 (22.2%) patients had newly diagnosed AF; The using of VCA was detected in 24 patients (24.2%), of which 5 (25%) were in the therapeutic range, and 55 (55.5%) of them were using NOAC, and 30 (54.5%) of them were using the therapeutic dose. Age, CHA_2DS_2 and CHA_2DS_2-VAS_C score were similar in all four groups. The discharge mRS score did not differ significantly among the groups (p=0.387). In our study group, infarct volumes, measured by basing the reference of 101 NVAF patients and/or MRI imaging mainly with the diffusion, were compared according to the therapeutic status. The median measured infarct volume of patients who did not use OAC was 22.20 cm^3, in patients using subtherapeutic VCA, it was measured at 12.95 cm^3, in patients using VCA at the therapeutic dose, it was measured at 2.25 cm^3, and in those using therapeutic NOAC, it was measured at 4.40 cm^3 (Table1). The infarct volumes measured from patients who did not use OAC were significantly higher than those from other groups (p=0.039, Table 1).

Table 1. Basic and characteristic findings by anticoagulation status

Parameters	Group 1 (n:47)	Group 2 (n:18)	Group 3 (n:6)	NOAC (n:30)	*p* value
Age	73 (49-90)	69 (46-83)	77 (64-86)	71 (53-90)	0.2
Female Gender %	68	50	33	70	0.1
NIHSS score	9 (4-23)	8.5 (3-18)	6.5 (2-20)	5 (1-22)	0.029
Infarct Volume	22 (0.4-235)	12.9 (1.3-129)	2.25 (0.3-89)	4.4 (0.2-293)	0.039
Modified Rankin Scale	3 (0-6)	3 (1-6)	3 (1-6)	2 (0-6)	0.3
INR	1.2 (0.8-2)	1.09 (0.96-1.5)	2.1 (1.76-3.4)	1.3 (1-2.5)	0.00001
Hemorrhagic Transformation %	64.7	17.6	5.8	11.7	0.279
Hypertension %	87	83	83	90	0.8
Diabetes %	38	38	33	35	0.7
Hyperlipidemia %	53	33	50	56	0.4
Coronary Artery %	61	50	33	31	0.5
Chronic Heart Failure %	41	61	50	40	0.4
Carotid Artery Stenosis %	19	5.6	16.7	35.3	0.5
Cigarette %	34	38.9	50	27.8	0.8
Great Vessel Occlusion %	42.6	27.8	33	23	0.3
Disease of White Matter %	45	44	66	56	0.6
CHA_2DS_2 score	3 (1-6)	3 (1-4)	3 (2-4)	3 (1-5)	0.2
CHA_2DS_2-VAS_C score	5 (3-9)	5 (2-7)	4.5 (4-7)	6 (4-8)	0.1

NIHSS score: National Institute of Healt Stroke Scale; INR: Protrombin time
CHA_2DS_2, CHA_2DS_2-VAS_C score: Stroke risk score in patients with atrial fibrillation

Groups 1 and 2 were combined, Groups 3 and 4 were combined and then these two combined groups were compared. Infarct volume of Group 1+2; It was calculated as 16.9 (0.4 -235) cm^3. Group 3+4 infarct volume was measured as 3.5 (0.2-293) cm^3, and the difference between the 2 groups was statistically significant (p=0.005) (Table 2).

Table 2. Basic and characteristic findings by anticoagulation status

Parameters	Group 1+2 (n:65)	Group 3+4 (n:36)	*p* value
Age	74 (46-90)	73 (53-90)	0.503
NIHSS score	9 (3-23)	5 (1-22)	0.004
Infarct Volume	17 (0.4-235)	3.5 (0.2-293)	0.005
Discharging mRS score	3 (0-6)	2 (0-6)	0.122
3rd month mRS score	3 (0-6)	2 (0-6)	0.087

mRS: Modified Rankin Scale, NIHSS score: National Institute of Healt Stroke Scale

The patients in the current study group were classified according to the Bamford system [16] based on Diffusion MRI. The identified risk factors and the using of anticoagulation were compared with the infarct volumes and statistical analysis was performed (Table 3). At the Bamford classification of our patient group, the average age (TACI:74 (54-90), PACI:74 (46-90), POCI:68 (55-81), LACI:72 (53-86) p=0.2) were analyzed as close to each other. In the statistical analysis, CHA_2DS_2 (TACI:3 median (1-5), PACI:3 (1-6), POCI:3.5 (1-5), LACI:3 (1-5)) calculated with the identified risk factors p=0.2) and CHA_2DS_2-VAS_C score (TACI:5 median (3-8), PACI:5 (2-9), POCI:6 (3-8), LACI:5 (2-7) p=0.2) and the involved artery area was not statistically significant. Furthermore, no significant difference was observed between the existing risk factors and the involved artery area. In comparison with the measured infarct volumes; TACI:74 median (0.4-293), PACI:14 (1.7-93), POCI:8.6 (0.2-76), LACI 1.3 (0.2-15), and it was found statistically significant that the infarct volumes measured in TACI infarcts had larger volumes (p=0.0001).

Table 3. Quantitative and qualitative values according to OCSP classification

Group	TACI	PACI	POCI	LACI	*p* value
Group 1 %	30	40	9	21	0.0001
Group 2 %	6	67	6	22	0.6
Group 3 %	17	50	0	33	0.6
Group 4 %	17	30	23	30	0.69
Female %	25	42	9.3	23.4	0.4
Male %	14	43	16	27	0.4
Rate of Mortality %	53.8	30.7	7.6	7.6	0.028
Hemorrhagic Transformation %	47	29.4	17.6	5.8	0.011

TACI: Total anterior circulation infarcts; PACI: Partial anterior circulation infarcts; POCI: Posterior circulation infarcts; LACI: Lacunar infarcts

Group 1 NIHSS score; 9 (4-23) Group 2; 8.5 (3-18), Group 3; 6.5 (2-20), Group 4; (1-22) and the using of OAC showed an improvement in the NIHSS score, and the difference was statistically significant (p=0.029 Tables 1-2). The stroke severity of patients was categorized into three groups based on the NIHSS score: mild (0-7), moderate (7-16), and severe (≥16) [20]. A positive correlation was found between the infarct volume and the NIHSS score, and it was statistically significant (p=0.001) (Table 4). Although the mRS score at the 3rd month after discharge was not statistically significant. Group 1 was found to be higher than the other groups (p=0.239).

Table 4. Qualitative and quantitative values of stroke severity determined by NIHSS score

NIHSS Score	1-7	8-15	≥16	Chi-square	*p* value
Age	74.50 (49-87)	74 (53-86)	74.5 (46-90	1.6	0.4
Infarct Volume	3.40 (0.20-200	14 (0.20-148)	49.4 (0.4-293)	16.4	0.001
PT-INR	1.29 (0.96-3.47)	1.19 (0.76-1.98)	1.08 (0.98-1.76)	8.9	0.001
Discharging mRS Score	2 (0-4)	3 (0-6)	5 (1-6)	14	0.0001
3 rd month mRS Score	2 (0-3)	2 (0-6)	5 (1-6)	14	0.0001
CHA_2DS_2	3 (0-6)	3 (1-5)	3 (1-6	5.1	0.76
CHA_2DS_2-VAS_C	4.50 (1-8)	4 (3-8)	6 (2-8)	5	0.8

NIHSS score: National Institute of Healt Stroke Scale; INR: Protrombin time; mRs: Modified Rankin Scale
CHA_2DS_2, CHA_2DS_2-VAS_C score: Stroke risk score in patients with atrial fibrillation

Statistical analysis was analyzed by considering the anticoagulation status in the Bamford classification: Group 1 TACI was calculated as 30%; PACI:40%; POCI:9%; LACI:21% (*p*=0.0001). TACI and PACI infarction were observed with a high rate in our patient group who did not use anticoagulant agents (Table 3). In female gender, TACI:25%; PACI:42; POCI:9.3; LACI:23.4% were observed, and TACI and PACI infarcts were detected at a high rate in the female group (Table 3 *p*=0.4). When the mortality rate was evaluated, it was observed that TACI:33%; PACI:7.6%; LACI:7.6%. The mortality rate for TACI infarction was determined to be high and statistically significant (*p*=0.0028, Table 3).

Discussion

It has been documented in the literature that AF increases the risk of stroke five times, and this risk varies depending on the presence of certain stroke risk factors [21, 22]. Common stroke risk factors are summarised in the clinical risk factor-based CHA_2DS_2-VAS_C score [9]. The CHA_2DS_2-VAS_C score performs only modestly in predicting high-risk patients in thrombo-embolic events, but low-risk patients (CHA_2DS_2-VAS_C 0 (men) or score 1 (women)) have consistently low rates of ischemic stroke or death (<1%/ year) and do not require prophylactic treatment [23]. In the presence of a non-gender stroke risk factor, women with NVAF have a significantly higher risk of stroke [24, 25].

In this study, the mean age of 101 patients was 72.92±9.04 years, 64 (63.3%) female and 37 (36.6%) male. The fact that a high proportion of the patient population is female showed that female gender is riskier than male gender in the presence of risk factors in AF patients. In the OCSP classification, it was observed that female gender (TACI:25% and PACI:42%, 9.3% *p*=0.469) of the patients who developed POCI. Infarct volume (TACI:median 105 cm^3, PACI:median 14 cm^3, POCI:median 8.6 cm^3) and mortality rate (TACI:53.8%, PACI:30.7%, POCI:7.6% LACI:7.6% *p*=0.028) was analyzed (Table 3). Considering the mortality rate and infarct volume, this rate was found to be high in TACI and PACI infarcts, and it was found to be statistically significant (Table 3). It was observed that TACI and PACI infarcts constituted a large part of the female gender. The mortality and morbidity rates of female patients were high. In another study by [18] which included 1055 patients with ischemic stroke, stroke severity and prognosis at the 3rd and 12th months were evaluated. The findings of this study show that women stay in the hospital longer and have higher CHA_2DS_2 score, NIHSS score, and mRS score. In a study conducted by Giralt Steinhauer et al. [26] on 439 stroke patients with AF, high of CHA_2DS_2-VAS_C scores, female gender and advanced age were found to be associated with increased stroke severity and a poor prognosis [26].

In the EAFT (European Atrial Fibrillation Trial) study conducted in patients with AF for secondary prevention, patients with non-valvular AF who had a stroke or TIA in the last three months were examined. While the annual stroke rate was 10% in the group that used aspirin, it was 4% in the group that received oral anticoagulant therapy [2, 27]. Our study also evaluated 101 NVAF patients with ischaemic stroke according to their use of anticoagulation. The average age of these 4 groups was similar (Group 1:76 (median); Group 2:73; Group 3:78; Group 4:73). The median values of the CHA_2DS_2 score of the 4 groups (Group 1:3

(median); Group 2:3; Group 3:3; Group 4:3) were similar and it was observed that they were a high-risk patient group. The CHA_2DS_2-VAS_C score of the 4 groups was calculated as (Group 1:5 (median); Group 2:5; Group 3:4.5; Group 4:6) and it was observed to be similar.

The NIHSS is used to determine the severity of acute ischaemic stroke [13]. On this scale, a high score indicates deterioration. The NIHSS score is significant in making decisions for treatment or interventional treatment, as well as evaluating the outcome of treatment [14]. When the groups were compared for stroke severity, the NIHSS score (Group 1: 9 (median); Group 2:8.5; Group 3:6.5; Group 4:5; p=0.029), the NIHSS score of the group using OAC was statistically significantly lower. In a study by [28], NVAF patients were grouped according to using of NOAC, and the NIHSS score (10 for those who did not use NOAC, 6; p=0.008 for those who used NOAC) was calculated and found to be statistically significant. The NIHSS score is a clinically significant parameter in measuring stroke severity, and the using of OAC has been shown to improve stroke severity in both studies.

Infarct volumes were measured according to the anticoagulation status of the patients (Group 1: (47) median 22.2 cm^3; Group 2 (18):12.95 cm^3, Group 3 (6):2.25 cm^3, Group 4 (30):4.40 cm^3; p=0.039) and patients using therapeutic dose OAC had significantly lower infarct volumes than the non-using patient population, and the improvement in infarct volume of anticoagulation using was statistically significant. In a similar study by Sakamoto et al. [17]; infarct volumes were compared according to the anticoagulation status and it was shown that the using of OAC resulted in improvements in infarct volume. When analyzed with OCSP classification according to the arterial areas that developed infarct, it was determined that Group 1 TACI 30% and PACI 40% are statistically significant (p=0.00001 Table 3).

In the present study, large vessel occlusion was found to be higher in the group that did not use OAC, which is not statistically significant (Group 1:42.5% p=0.3, Table 1). In a similar study Sakamoto et al. [17], 330 patients were grouped according to using of OAC and it was concluded that major vessel occlusion was observed at a higher rate in the group that did not use OAC. In the present study, the correlation between stroke severity and INR value was examined and the statistics were recorded according to the NIHSS score of the patients (NIHSS score 0-7 INR:1.29 (median), min-max (0.96-3.47); NIHSS score 8-15 between INR:1.19 (median), min-max (0.76-1.98); NIHSS score ≥16 INR:1.08 (median), min-max (0.98-1.76)). It was observed that the severity of stroke decreased as the INR value increased (p=0.012). In a study by [17] it was shown that a high INR value reduces the risk of major vessel occlusion and the severity of stroke (p=0.001).

The mRS score is a disability scale accepted after treatment [12]. In patients with high level stroke according to the NIHSS score, the mRS scores of discharge and of the third month after discharge were found high and statistically significant (p=0.001). There was a significant relationship between NIHSS score and diffusion MRI lesion volume, as seen in previous studies [29, 30], and the results were also similar in our study (infarct volume between NIHSS 0-7:3.4 cm^3 (median); NIHSS Infarct volume between 8-15:14 cm^3 (median); NIHSS ≥16 infarct volume: 49.4 cm^3 (median); p<0.001) and the difference was statistically significant [31].

A number of clinical factors have been associated with HT in stroke patients. Stroke severity and infarct size are the factors that best correlate with HT [31]. To determine the rate of HT in the patient groups in our study, a higher rate of HT developed in Group 1 according to the anticoagulation status (Group 1:64.7%; Group 2:17.6%; Group 3:5.8%; Group 4:11.7%; p=0.161) but the difference was not statistically significant. A study by [20], showed that the use of anticoagulants was effective in reducing the NIHSS score and infarct volume, and that the development of HT was less in the group of patients with an INR≥1.7.

In conclusion, in the management of patients with AF, especially stroke, in the prevention of embolic complications, anticoagulant therapy has a great importance. Anticoagulant therapy is not only important in the primary and secondary prevention of stroke, but also leads to a reduction in stroke severity and infarct volume in patients who have already suffered a stroke, as recent studies have shown. This study showed that stroke severity and infarct volume decreased, and mortality and morbidity rates were improved

under anticoagulant treatment in AF patients presenting with acute ischemic stroke. In conclusion, oral anticoagulant treatment should be perceived as a contemporary necessity in terms of public health, both because it leads to a decrease in the general prevalence of stroke and because the severity of the previous stroke is milder.

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Author contribution

This study is a part of the first author's Ph. D. thesis. G.A. developed the theory and arranged/edited the material and method section, has done the evaluation of the data in the results and Discussion sections. A.E. constructed the main idea and hypothesis of the study, provided editorial advice. All authors reviewed, corrected and approved. In addition, all authors discussed the entire study and approved the final version.