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Research

Laboratory Findings in Atrial Fibrillation-related Stroke Patients Underwent Reperfusion Treatment

Reperfüzyon Tedavisi Uygulanan Atrial Fibrilasyon Tanılı İnme Hastalarında Laboratuvar Bulgularının İncelenmesi

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ABSTRACT

Objective: Stroke is a prominent contributor to both mortality and disability worldwide, with most affected individuals suffering from acute ischemic strokes. Atrial fibrillation (AF) is one of the most known cardiac arrhythmias and increases the risk of ischemic stroke fivefold. Studies regarding laboratory findings in patients with acute AF-related stroke are limited. Blood biomarkers and laboratory findings can provide additional information on stroke severity, potential underlying causes, and treatment response. Our aim is to discuss laboratory findings and biomarkers in patients with acute stroke treated with mechanical thrombectomy (MT) and intravenous thrombolysis (IV r-tPA).

Methods: A total of 219 acute stroke patients were treated with IV r-tPA and/or MT. Patients with known AF or those diagnosed during follow-up were classified as AF (+), whereas others were classified as AF (-).

Results: C-reactive protein, monocytes, and neutrophil/lymphocyte ratio values were significantly higher in both groups on day 7. Some laboratory parameters (white blood cell, red blood cell and glomerular filtration rate) showed significant differences between the two groups. Additionally, we found that leukocyte and neutrophil values were elevated only in the AF (+) group on day 7. In the AF (+) group, the left atrial diameter on transthoracic echocardiography was >40 mm, and troponin levels were high.

Conclusion: Laboratory findings in patients with AF receiving acute stroke treatment can provide additional information about many clinical events related to stroke. These findings and biomarkers can provide more details on stroke severity, underlying causes, and treatment effectiveness. Because there is limited research on laboratory findings in strokes related to AF, our study can provide additional contributions to this important area.

Keywords: Stroke, atrial fibrillation, laboratory findings, stroke treatment

ÖZ

Amaç: İnme, dünyada ölüm ve sakatlığın en önemli nedenleriden biridir. İnme hastalarının çoğunluğu akut iskemik inme olgularıdır. Atriyal fibrilasyon (AF) en sık görülen kardiyak aritmilerden biridir ve iskemik inme riskini beş kat artırır. Akut AF ile ilişkili inme hastalarında laboratuvar bulguları ile ilgili çalışmalar sınırlıdır. Kan biyobelirteçleri ve laboratuvar bulguları, inme şiddeti, potansiyel ana nedenler ve tedavi yanıtının değerlendirilmesi hakkında ek bilgiler sağlayabilir. Amacımız, mekanik trombektomi (MT) ve intravenöz tromboliz (IV r-tPA) tedavisi uygulanan akut inme hastalarında laboratuvar bulgularını ve biyobelirteçleri tartışmaktır.

Gereç ve Yöntem: Toplamda 219 hastaya, IV r-tPA ve/veya MT ile akut inme tedavisi uygulandı. AF'yi olan veya takip sırasında tespit edilen hastalar AF (+) olarak değerlendirildi, diğerleri AF (-) olarak sınıflandırıldı.

Bulgular: C-reaktif protein, monositler ve nötrofil/lenfosit oranı değerlerini her iki grupta da 7. günde anlamlı derecede yüksek tespit edildi. Bazı laboratuvar parametleri (beyaz kan hücresi, kırmızı kan hücresi ve glomerül filtrasyon hızı) her iki grup arasında anlamlı farklılık gösteriyordu. Ayrıca, lökosit ve nötrofil değerlerinin sadece AF (+) grubunda 7. günde yüksek olduğunu bulduk. AF (+) grupta sol atriyum çapı transtorasik ekokardiyografide >40 mm ve troponin düzeyi yüksekti.

Sonuç: Akut inme tedavisi alan AF'li hastalarda laboratuvar bulguları inme bağlantılı birçok klinik olay hakkında ek bilgi sağlayabilir. Bu bulgu ve biyobelirteçler inmenin şiddeti, potansiyel temel nedenleri ve tedavinin etkinliğinin değerlendirilmesi hakkında daha fazla detay sunabilir. Ayrıca AF'ye bağlı inmelerde laboratuvar bulguları ilgili sınırlı çalışma olduğundan çalışmamız bu önemli konuda ek katkılar sağlayabilir.

Anahtar Kelimeler: İnme, atriyal fibrilasyon, laboratuvar bulguları, reperfüzyon tedavisi

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INTRODUCTION

Atrial fibrillation (AF) is a prevalent cardiac arrhythmia linked with elevated susceptibility to stroke. Patients with AF who experience an acute stroke often require prompt medical intervention to minimize the extent of neurological damage and improve outcomes (1). In addition to the clinical management of stroke, understanding the laboratory findings in patients with AF undergoing therapy for acute stroke is essential for optimizing patient management and improving outcomes. By evaluating coagulation parameters, markers of inflammation, cardiac biomarkers, and other relevant laboratory tests, clinicians can tailor treatment plans to individual patients, enhance risk stratification, and monitor treatment response. In addition, these findings can contribute to the ongoing research and development of novel diagnostic tools and therapeutic strategies for AF-related stroke.

This study aims to discuss the laboratory findings commonly observed in patients with AF undergoing therapy for acute stroke and provide valuable insights into the comprehensive care of patients with AF and acute stroke, ultimately leading to improved patient outcomes.

METHODS

A total of 219 patients who underwent reperfusion therapies, such as intravenous thrombolysis (IV r-tPA) and/or mechanical thrombectomy (MT), were analyzed. Patients diagnosed with AF during either initial assessment or subsequent follow-up were categorized as AF positive (+), whereas those without such diagnosis were designated as AF negative (-). Patients ineligible for IV r-tPA and MT because of contraindications, and those with valvular AF or undergoing antibiotic treatment, were excluded from the study. The demographic and clinical profiles of patients were assessed. Transthoracic echocardiography (TTE) was performed in all patients. Laboratory results were reported, and those with and without AF were compared. Laboratory values were obtained on admission and on day 7 following acute stroke therapy. Changes in laboratory findings were recorded. University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital Ethics committee approval was obtained (decision no: 2023-15-06, date: 07.08.2023). Patient consent form was not required in this study.

Statistical Analysis

Statistical analyses were conducted using IBM SPSS Statistics. Normality was assessed using the Shapiro-Wilk test. Numerical variables are expressed as mean ± standard deviation or median (minimum-maximum) for normally or non-normally distributed data, respectively. Categorical variables are presented as frequencies and percentages. Student's t-test or Mann-Whitney U test compared numerical variables between the two groups. ANOVA or Kruskal-Wallis H tests were used for three or more groups. Chi-square, Yates correction, and Fisher's Exact tests were used to compare categorical data. Pearson or Spearman correlation analysis examined the numerical variable relationships. A significance level of $p<0.05$ was considered significant.

RESULTS

The average age of the overall population was 68.3 years, whereas the average age of individuals with AF was 73.8 years and that of individuals without AF was 64.8 years. There was a significant difference in age between the AF and non-AF groups ($p<0.001$). The distribution of gender was also significantly different between the two groups, with a higher proportion of women in the AF group (58.9%) than in the non-AF group (29.5%, $p<0.001$). Comorbid diseases such as diabetes mellitus (DM) and coronary artery disease (CAD) showed significant differences between the AF and non-AF groups (Table 1).

The ejection fraction (EF) was evaluated, and no significant difference was found between the AF and non-AF groups ($p=0.100$). However, the left atrial diameter showed a significant difference, with a higher proportion of individuals having a left atrial diameter greater than 40 mm in the AF group than in the non-AF group ($p<0.001$). The acute stroke treatment methods also differed significantly between the two groups, with a higher proportion of individuals in the AF group receiving MT ($p=0.001$) (Table 2).

Several laboratory parameters showed significant differences between the AF and non-AF groups. These included white blood cell count ($p=0.004$), platelet count ($p=0.001$), red blood cell count ($p=0.020$), neutrophil count ($p=0.016$), monocyte count ($p=0.018$), glomerular filtration rate (GFR), and troponin levels ($p=0.025$). Uric acid, C-reactive protein (CRP), albumin, and various other biomarkers did not show significant differences between the two groups (Table 3).

The changes in laboratory findings between the baseline and 7th day measurements for the AF-positive and AF-negative groups was presented Table 4. CRP levels significantly increased in both groups ($p<0.001$), indicating an inflammatory response. Albumin levels significantly decreased in both groups ($p<0.001$), suggesting a decrease in protein synthesis. White blood cell count and neutrophil count significantly increased in AF (+) group on the 7th day.

Table 1. Demographic data of patients

Variables	All population n=219	AF		p-value
		Present n=90	Absent n=129	
Age, year	68.3±15.2	73.8±13.9	64.8±15.6	<0.001*
Gender, n (%)				
Female	91 (41.6)	53 (58.9)	38 (29.5)	<0.001*
Male	128 (58.4)	37 (41.1)	91 (70.5)	
Comorbidities, n (%)				
Absent	40 (18.3)	6 (6.7)	34 (26.4)	<0.001*
Present	179 (81.7)	84 (93.3)	95 (73.6)	
DM	65 (29.1)	34 (37.0)	31(23.7)	0.037*
HT	122 (54.7)	56 (60.9)	66 (50.4)	0.121
HL	16 (7.2)	7 (7.6)	9 (6.9)	0.998
CAD	65 (29.1)	35 (38.0)	30 (22.9)	0.017*
CRF	33 (14.8)	15 (16.3)	18 (13.7)	0.702
CVD	1 (0.4)	1 (1.1)	0	0.859
Malignancy	2 (0.9)	1 (1.1)	1 (0.8)	0.999
Other	67 (30.5)	34 (38.0)	32 (25.2)	0.054
Smoke (pack/year), n (%)				
None	121 (55.2)	61 (67.4)	60 (46.6)	0.002*
Ex-smoker	11 (4.9)	2 (2.2)	9 (6.9)	
Smoker	40 (18.4)	8 (8.7)	32 (25.2)	
Unknown	47 (21.5)	19 (21.7)	28 (21.4)	

Numerical variables were expressed as mean ± standard deviation or median (minimum-maximum). Categorical variables shown as numbers (%).
*p<0.05 indicates statistical significance. AF: Atrial fibrillation, DM: Diabetes mellitus, HT: Hypertension, HL: Hyperlipidemia, CAD: Coronary artery disease, CRF: Chronic renal failure, CVD: Cardiovascular disease.

Table 2. Clinical variables

Variables	All population n=219	AF		p-value
		Present n=90	Absent n=129	
EF, n (%)				
45-60%	131 (59.8)	49 (54.4)	82 (63.5)	0.100
30-45%	24 (10.9)	14 (15.5)	10 (7.7)	
<30%	13 (5.9)	3 (3.3)	10 (7.7)	
Unknown	51 (23.2)	24 (26.6)	27 (20.9)	
Left atrial diameter, n (%)				
<40	79 (36.0)	18 (20.0)	61 (47.2)	<0.001*
>40	72 (32.8)	42 (46.6)	30 (23.2)	
Unknown	68 (31.0)	30 (33.3)	38 (29.4)	
Acute stroke therapies, n (%)				
Thrombolysis (TPA)	82 (37.4)	20 (22.2)	62 (48.0)	0.001*
Thrombectomy	108 (49.3)	56 (62.2)	52 (40.3)	
TPA bolus + thrombectomy	5 (2.2)	3 (3.3)	2 (1.5)	
TPA + thrombectomy	22 (10.0)	10 (11.1)	12 (9.3)	
Thrombectomy + stent	2 (0.9)	1 (1.1)	1 (0.7)	

Numerical variables were expressed as mean ± standard deviation or median (minimum-maximum). Categorical variables shown as numbers (%).
*p<0.05 indicates statistical significance. AF: Atrial fibrillation, EF: Ejection fraction

Table 3. Laboratory findings

Variables	All population n=219	AF		p-value
		Present n=90	Absent n=129	
Admission				
GFR	79.9±24.5	75.8±23.8	82.9±24.6	0.034*
Uric acide	5.9±1.8	6.0±2.0	5.8±1.7	0.315
CRP	6.4 (0-240)	6.9 (0-240)	6.2 (0-237)	0.450
Albumin	37.6±4.8	37.2±4.8	37.8±4.8	0.366
WBC	9.2 (3.4-24.3)	8.7 (4.4-15)	9.6 (3.4-24.3)	0.004*
PLT	239 (97-703)	213 (97-481)	253 (127-703)	0.001*
RBC	4.5±0.6	4.4±0.6	4.6±0.6	0.020*
RDW	14.2±1.6	14.4±1.6	14.0±1.7	0.048*
Neutrophil	6.1 (0.6-22.4)	5.5 (1.8-11.3)	6.4 (0.6-22.4)	0.016*
Lymphocyte	1.9 (0.3-7)	1.9 (0.3-5.1)	1.9 (0.5-7)	0.385
Monocyte	0.7 (0.2-10.5)	0.6 (0.2-10.5)	0.7 (0.2-2.5)	0.018*
Folate	8.5 (3.2-460)	8.1 (3.2-22.4)	8.8 (3.2-23.4)	0.680
Vitamin B12	220 (41-1500)	236 (60-928)	201 (41-1500)	0.142
Troponin	9 (0-11723)	12 (0-10177)	8.5 (0-11723)	0.025*
APTT	32 (17.8-200)	32 (21.6-64.5)	32 (17.8-200)	0.996
INR	1.1 (0.8-10.2)	1.1 (0.9-2.9)	1.1 (0.8-10.2)	0.102
HDL	41.3 (18.8-279)	41.1 (20-78)	42 (18.8-279)	0.907
LDL	121 (35-390)	114 (35-277)	124.6 (36-390)	0.161
TG	104 (28-436)	102 (28-275)	107 (45-436)	0.066
NLR	3.3 (0.3-36.7)	3 (0.8-36.7)	3.6 (0.3-22.7)	0.350
PLR	125.7 (37.3-660)	116.5 (38.9-531.3)	129.2 (37.3-660)	0.381
MLR	0.4 (0.1-2.8)	0.3 (0.2-2.8)	0.4 (0.1-1.7)	0.698
Fibrinogen	354 (0.7-968)	359 (266-968)	346 (0.7-615)	0.189
NSE	15.1 (0.1-77.7)	14.2 (8-43)	15.5 (0.1-77.7)	0.968
D-D	0.7 (0.1-7.1)	0.6 (0.2-2.8)	0.9 (0.1-7.1)	0.373
Seventh day				
CRP	83 (0-512)	78 (0-512)	87.5 (0-387)	0.685
ALB	29.6 (17.2-277)	28.6 (19.8-39)	31.2 (17.2-277)	0.085
WBC	10 (4-32.8)	10.2 (4.2-19.6)	9.8 (4-32.8)	0.879
PLT	245 (10.1-638)	241 (64-524)	2489 (10.1-638)	0.015*
RBC	5.6±16.1	4.0±0.7	4.2±0.7	0.018*
RDW	14.3±2.0	14.5±1.7	14.1±2.2	0.184
Neutrophil	7.4 (2.5-88.7)	7.8 (2.7-16.9)	6.9 (2.5-88.7)	0.610
Lymphocyte	1.4 (0.1-9.7)	1.3 (0.3-4.2)	1.5 (0.1-9.7)	0.075
Monocyte	0.8 (0-3.5)	0.8 (0.1-1.8)	0.8 (0-3.5)	0.551
NLR	4.8 (1-158.4)	6.1 (1-29.7)	4.4 (1.1-158.4)	0.111
PLR	168 (1.2-1601.5)	167.6 (53.4-591.7)	168.9 (1.2-1601.5)	0.807
MLR	0.5 (0.1-5.6)	0.6 (0.2-2.7)	0.5 (0.1-5.6)	0.093
Fibrinogen	322 (147-799)	383.5 (160-544)	310.5 (147-799)	0.104
NSE	14.4 (0.1-125.9)	18.4 (3.3-60.9)	10.5 (0.1-125.9)	0.107
D-D	1 (0.1-7.5)	1 (0.3-5.6)	1.1 (0.1-7.5)	0.802

Numerical variables were expressed as mean ± standard deviation or median (minimum-maximum). Categorical variables shown as numbers (%).
*p<0.05 indicates statistical significance. AF: Atrial fibrillation, GFR: Glomerular filtration rate, CRP: C-reactive protein, WBC: White blood cell, PLT: Platelet, RBC: Red blood cell, RDW: Red Blood Cell distribution width, APTT: Activated partial thromboplastin time, INR: International normalized ratio, HDL: High density lipoprotein, LDL: Low density lipoprotein, TG: Triglycerides, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, MLR: Monocyte-to-lymphocyte ratio, NSE: Neuron-specific enolase, D-D: D-Dimer

Table 4. Changes in laboratory findings at admission and on day seven

Variables	AF (+) n=90		p-value	AF (-) n=129		p-value	Δp
	Admission	7th day		Admission	7th day		
CRP	6.9 (0-240)	78 (0-512)	<0.001*	6.2 (0-237)	87.5 (0-387)	<0.001*	0.507
Albumin	37.2±4.8	28.6 (19.8-39)	<0.001*	37.8±4.8	31.2 (17.2-277)	<0.001*	0.217
WBC	8.7 (4.4-15)	10.2 (4.2-19.6)	<0.001*	9.6 (3.4-24.3)	9.8 (4-32.8)	0.829	0.043*
PLT	213 (97-481)	241 (64-524)	0.097	253 (127-703)	248.5 (10.1-638)	0.994	0.489
RBC	4.4±0.6	4.0±0.7	<0.001*	4.6±0.6	4.2±0.7	<0.001*	0.402
RDW	14.4±1.6	14.5±1.7	0.528	14.0±1.7	14.1±2.2	0.185	0.565
Neutrophil	5.5 (1.8-11.3)	7.8 (2.7-16.9)	<0.001*	6.4 (0.6-22.4)	6.9 (2.5-88.7)	0.581	0.041*
Lymphocyte	1.9 (0.3-5.1)	1.3 (0.3-4.2)	<0.001*	1.9 (0.5-7)	1.5 (0.1-9.7)	0.009*	0.439
Monocyte	0.6 (0.2-10.5)	0.8 (0.1-1.8)	<0.001*	0.7 (0.2-2.5)	0.8 (0-3.5)	0.008*	0.066
NLR	3 (0.8-36.7)	6.1 (1-29.7)	<0.001*	3.6 (0.3-22.7)	4.4 (1.1-158.4)	0.044*	0.915
PLR	116.5 (38.9-531.3)	167.6 (53.4-591.7)	<0.001*	129.2 (37.3-660)	168.9 (1.2-1601.5)	0.008*	0.883
MLR	0.3(0.2-2.8)	0.6 (0.2-2.7)	<0.001*	0.4 (0.1-1.7)	0.5 (0.1-5.6)	<0.001*	0.384

Numerical variables were expressed as mean ± standard deviation or mean ± standard deviation. Categorical variables shown as numbers (%).
*p<0.05 indicates statistical significance.
Δp: Changes in laboratory findings show the difference in terms of the presence of AF. AF: Atrial fibrillation, CRP: C-reactive protein, WBC: White blood cell, PLT: Platelet, RBC: Red blood cell, RDW: Red Blood Cell distribution width, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, MLR: Monocyte-to-lymphocyte ratio

DISCUSSION

AF is the most frequent cardiac arrhythmia and a risk indicator for ischemic stroke, with a prevalence of 1% (2,3). AF may lead to reduced cerebral perfusion, increased stroke severity, and chronic cerebral white matter damage (4). Notably, this arrhythmia is more common in the elderly, females, and people of Caucasian descent (3). Our findings are consistent with those of previous research, with a higher mean age and a higher proportion of female patients in the AF (+) group. Previous studies have reported that comorbid diseases are more frequent in AF (+) patients and that comorbidity negatively affects the prognosis (5). The most common comorbid diseases are hypertension (HT), CAD, chronic renal failure, heart failure, and obesity (6). Consistent with previous studies, comorbid diseases were more common in our AF (+) group. DM and CAD were the most common comorbid diseases in AF (+) patients. However, there was no information about HT between the groups.

TTE allows noninvasive examination of cardiac structures and functions. Therefore, routine TTE examination is recommended in patients with acute ischemic stroke to exclude possible cardioembolic causes (7). AFFIRM and other studies found no correlation between EF and the presence of AF. However, it was found that left atrial enlargement is correlated with AF (8). We performed TTE on all patients. Consistent with the literature, no significant difference was found between the patient groups in terms of EF. However, the diameter of the left atrium showed a significant difference, with a higher proportion of individuals having a left atrium diameter greater than 40 mm in the AF group than in the non-AF group. IV r-tPA and/or MT is recommended for eligible ischemic stroke patients with or without AF in the hyperacute period. Mechanical Embolus Removal in Cerebral Ischemia (MERCI) and Multi MERCI studies revealed that IV r-tPA failed in 50% of patients with strokes related to AF, necessitating the application of MT in these cases (9). Smaal et al. (10) reported that MT was mostly applied to patients with AF. Likewise, we also found that the rate of MT was higher in AF (+) than AF (-) patients. However, the IV r-tPA treatment rate was high in AF (-) patients.

The inflammatory response plays an important role in the pathophysiology of acute ischemic stroke (11). Secretion of inflammatory mediators is limited in normal brain tissue.

Cessation of blood flow after acute ischemia induces secretion of proinflammatory cytokines and immune cells (12). In studies, it was found that an increase in leukocyte and neutrophil counts is correlated with infarct volume and stroke severity (12). However, studies on leukocyte, neutrophil, and other blood biochemistry values in AF-related strokes are limited. Kneihsl et al. (13) did not find any differences between AF-related stroke and other patient groups in terms of blood glucose, platelet count, hemoglobin, and CRP levels. We found that leukocytes, neutrophils, monocytes, platelet levels, and GFR were significantly lower in the AF (+) group at admission. As mentioned above, acute ischemic stroke-induced inflammation and the rate of inflammation are directly related to stroke volume. After acute treatment of stroke and regression of clinical signs, inflammatory biomarker levels will decrease. CRP and erythrocyte sedimentation rate can provide insights into the inflammatory response associated with stroke and AF. Increased levels of these markers may suggest an ongoing inflammatory process that can contribute to stroke severity and poorer outcomes. However, there are also studies reporting that CRP levels may be normal in stroke patients and are not predictive of prognosis (14). We did not detect any significant difference at admission and on 7th day CRP values between the patient groups. However, CRP, monocytes, and neutrophil/lymphocyte ratio values were significantly higher on the 7th day in both groups. In addition, we found that leukocyte and neurophil values were higher only in the AF (+) group on 7th day. We may speculate that the inflammatory response is similar in all acute ischemic stroke patients at admission, but over time, inflammation is more pronounced in AF-related stroke patients. Because cardioembolic strokes related to AF are more severe and the inflammation rate was high in these groups. Follow-up of the level of inflammatory biomarkers at regular intervals may help us to determine inflammation and predict clinical improvement. For this speculation, more randomized controlled studies are needed.

Cardiac biomarkers, including troponin and brain natriuretic peptide (BNP) can help identify myocardial injury and cardiac dysfunction, which may further complicate the management of patients with AF and acute stroke (15). Llombart et al. (16) found higher levels of natriuretic peptides [N-terminal pro-brain natriuretic peptide (NT-proBNP) and BNP] in cardioembolic strokes. Similarly, Kneihsl et al. (13) found high levels of NT-proBNP and D-dimer and low levels of antithrombin-III in AF-related strokes. Isenegger et al. (17) found that high D-dimer levels may predict cardioembolic stroke. We did not detect any differences in D-dimer and fibrinogen levels between both groups at admission and 7th day. In our study, only troponin was evaluated as a cardiac biomarker. At admission, troponin levels were significantly higher in the AF (+) group. This situation indirectly suggests that cardiac pathologies are more common in AF (+) patients. Because of logistical reasons, natriuretic peptide levels and BNP could not be measured in our study.

Considering these findings, we believe that more studies are needed to use blood biomarkers to detect AF-related strokes and to determine the prognosis.

Because our study was retrospective, small, and non-controlled, we did not evaluate laboratory findings in the MT and IV r-tPA groups regardless of AF, and some biomarkers were not included in this study. These issues are the limitations of our study.

CONCLUSION

Laboratory investigations in patients with AF undergoing therapy for acute stroke provide insights into various aspects of the disease and its management. In addition, these findings and biomarkers may provide additional information about stroke severity, potential underlying causes, and evaluation of treatment response. In the literature, studies on laboratory findings in strokes due to AF are limited, and our study may provide an additional contribution to this important topic.

ETHICS

Ethics Committee Approval: University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital Ethics committee approval was obtained (decision no: 2023-15-06, date: 07.08.2023).

Informed Consent: Patient consent form was not required in this study.

Authorship Contributions

Surgical and Medical Practices: H.A.E., Concept: H.A.E., V.Y., Design: H.A.E., V.Y., Data Collection or Processing: İ.A., Analysis or Interpretation: İ.A., Literature Search: İ.A., Writing: H.A.E.

Conflict of Interest: No conflict of interest was declared by the authors.

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