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ORIGINAL ARTICLE **ÖZGÜN ARAŞTIRMA**

CAN THE PROGNOSIS BE PREDICTED ACCORDING TO THE LOCALIZATION OF CEREBELLAR ISCHEMIC LESIONS?

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ABSTRACT

INTRODUCTION: Damage to different anatomical structures within the cerebellum can lead to a variety of clinical findings. Moreover, these structures have different potentials for recovery from injury. Our objective was to assess the 6th and 12th-month outcomes of cerebellar ischemic stroke patients based on the localization of cerebellar ischemic lesion.
METHODS: Our study included 82 patients who were admitted due to isolated cerebellar ischemic stroke without the involvement of any other brain regions. We recorded outcomes and survival rates for these patients and conducted statistical analyses, including frequency, univariate, and correlation analyses.
RESULTS: More than three-quarters of patients were aged 60 years or older, and the majority of patients were male (57%). Hypertension (68%) and diabetes mellitus (34%) are the most common comorbid conditions. Like previous studies, multiple ischemic lesions (52%) were observed more than single lesions. The patients with the left peduncular region lesions had significantly higher NIHSS and mRS scores at discharge, as well as at 6 and 12 months follow-up compare with other cerebellar ischemic lesion localizations. Additionally, the survival rates at 6 and 12 months were found to be lower for these patients ($p<0.05$).
DISCUSSION AND CONCLUSION: The presence of a left cerebellar peduncular ischemic lesion upon admission was significantly correlated with higher morbidity and mortality rates at discharge, as well as during the 6-12 month follow-up periods. Our results endorse the concept of the left cerebellar peduncles (superior, medial and inferior) causing permanent ambulation problems with poor outcomes in cerebellar lesions.
Keywords: Cerebellum, ischemic stroke, posterior circulation infarctions, cerebrovascular disease, cerebellum diseases.

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SEREBELLAR İSKEMİK LEZYONLARIN LOKALİZASYONUNA GÖRE PROGNOZ ÖNGÖRÜLEBİLİR Mİ?

ÖZ

GİRİŞ ve AMAÇ: Serebellumun farklı anatomik lokalizasyonlarının hasarlanması, değişik şekillerde klinik bulgulara yol açabilir. Ayrıca, bu lokalizasyonların etkilenimi sonrası değişen iyileşme potansiyelleri mevcuttur. Amacımız serebellar iskemik inmeli hastaların 6. ve 12. ay prognozlarının serebellar iskemik infarktların lokalizasyonuna göre değerlendirmekti.
YÖNTEM ve GEREÇLER: Çalışmamıza serebellumdan başka bir santral lokalizasyonda akut iskemisi olmayan izole serebellar infarktla başvuran 82 hasta dahil edildi. Bu hastaların prognozları ve sağ kalım durumları hem yatış hem de takip poliklinik süreçlerinde değerlendirildi ve kaydedilen veriler frekans, tek değişkenli karşılaştırma ve korelasyon analizleriyle değerlendirildi.
BULGULAR: Hastaların dörtte üçünden fazlası 60 yaş ve üzeri olup çoğunluğu erkekti (%57). Hipertansiyon (%69) ve diabetes mellitus (%34) en sık görülen komorbid hastalıklardı. Daha önce yapılan çalışmalardaki gibi, tek sayıda lezyondan çok multipl sayıda islemik lezyonların (%52) olduğu görüldü. Diğer serebellar iskemik lezyon lokalizasyonlar ile karşılaştırıldığında, sol pedinküler bölge lezyonları olan hastalarda taburculukta, 6 ve 12 aylık takiplerde anlamlı olarak daha yüksek NIHSS ve mRS skorları tespit edildi. Ayrıca bu hastalarda 6. ve 12. aylardaki sağ kalım oranları da daha düşük bulundu. ($p<0.05$).
TARTIŞMA ve SONUÇ: Başvuru sırasında sol serebellar pedinküler iskemik lezyonun varlığı, taburculuk sırasındaki ve 6-12 aylık takip süresindeki yüksek morbidite ve mortalite oranları ile anlamlı şekilde koreleydi. Sonuçlar, sol serebellar pedinkül (süperior, orta, inferior) lezyonlarının, serebellar iskemik etkilenimlerde daha belirgin mobilizasyon problemlerine ve azalmış sağ kalıma neden olabileceği fikrini desteklemektedir.

Anahtar Sözcükler: Serebellum, iskemik inme, posterior dolaşım inmeleri, serebrovasküler hastalık, serebellum hastalıkları.

INTRODUCTION

The cerebellum is organized into distinct zones, and the axonal connections within the cerebellar peduncles consist only of afferent and efferent pathways. Consequently, damage to different anatomical structures within the cerebellum can lead to a variety of clinical findings. Moreover, it is suggested that these structures have different potentials for recovery from injury (1-3).

The incidence of cerebellar ischemic stroke vary depending on various factors, such as age, sex, ethnicity, and underlying medical conditions. However, it is estimated that cerebellar ischemic stroke accounts for approximately 3% of all ischemic strokes. Previous studies have suggested that the course and management of cerebellar stroke may differs with acute and subacute period features of patients as affected area, presence of edema that compress the 4th ventricle (2).

In our study, we primarily intended to assess the discharge and 6-month outcomes of the patients based on the localization of the ischemic stroke, specifically whether it occurred in the vermis, hemisphere, or peduncle of the cerebellum. Moreover we also want to describe demographic, clinic, radiologic features of these patients.

METHODS

Our study involved a retrospective evaluation of all patient data from those admitted to the inpatient neurology clinic, stroke unit, and neurointensive care unit at Gazi University Faculty of Medicine with cerebellar ischemic stroke diagnosis between January 2010 and January 2019. Patients whose examination results could not be obtained or whose final diagnosis did not isolate cerebellar lesions were excluded from the study. A total of 4,811 patient with stroke records were reviewed, and 82 patients who had isolated cerebellar ischemic lesions were ultimately included in the study. The Gazi University granted ethical approval for this study (Date: 27.12.2022, No: 1523) and the study was conducted in accordance with the ethical standards of the Declaration of Helsinki.

Age and gender of the patients, clinical characteristics, presence of cerebellar deficits on admission, comorbid conditions (hypertension, diabetes mellitus, hyperlipidemia, recent myocardial infarction within last 6 weeks, atrial fibrillation/ flutter), heart rhythm [according to the electrocardiogram (ECG) and rhythm holter], echocardiogram (left atrial enlargement that measured above 4 cm in diameter, left ventricular akinesia, patent foramen ovale, etc.), presence of malign cerebellar edema, smoking habits, and presence of antithrombotic agent prior to this cerebellovascular accident were defined. Stroke etiologies were specified according to the ASCOD classification (A, atherosclerotic; S, small vessel disease; C, cardioembolic; O, other defined causes; D dissection) (4). Measuring the severity and prognosis of the patients, The National Institute of Health Stroke Scale (NIHSS) at admission (NIHSSa), and discharge (NIHSSd), was calculated as well as the Modified Rankin Score (MRS) at admission (MRSa), discharge (MRSd), and 6-12th (MRS6, MRS12) months. Based on radiological evaluation; infarct lesion type (deep or cortical), size of the lesion (<1.5 cm or ≥1.5 cm), lesion number (single or multiple), and localization (vermian, peduncular, and hemispheric) were determined. Cranial Computarized Tomography (CT; 16 detector General Electronic) and Magnetic Resonance Imagining (MRI; 1.5- 3 Tesla Siemens Magneton Aera) devices were used in our hospital. Also, vascular imaging performed with CT Angiogram, MRI Angiogram, or carotid-vertebral ultrasound (Logic S8 and S9; General Electronic) depends on patients renal functions and other conditions like the presence of a stupor- coma, pacemaker usage, orthopedic implants that are incompatible with MRI, etc. Vascular perfusion areas were classified by using the arterial mapping of the central nervous system review by Tatu et al (5).

Descriptive statistics were used to present the data, with categorical variables expressed as counts and percentages (%). The Mann-Whitney U test was applied to determine the significance of differences between two independent groups for continuous variables, while the Kruskal-Wallis test was used for comparisons among more than two independent groups. Since the data were not normally distributed, Kendall's tau b test for correlation analysis was performed. Data analysis was conducted with the IBM SPSS Statistics 22.0 (IBM Corporation, Armonk, NY, USA) package program. For p<0.05, the results were considered statistically significant.

RESULTS

We found that patients with cerebellar ischemic stroke were most often between the ages of 70 and 79 years, representing 32% of the total case. According to gender, 35 (43%) of the patients were female and 47 (57%) were male.

The etiological classification was made according to the ASCOD system, as follows: A, 45%; S, 6%; C, 34%; D, 15%. The frequencies of the other etiologies were much lower. Table 1 presents detailed demographic, comorbid, radiologic, and cardiac features.

Table 1. Demographic and clinical characters comorbid, imaging, and cardiac features of the patients.

Demographic and Clinical Characteristics		**N (%)**
Female Gender		35(42.7%)
Age (years) median		70.6
HT		56 (68.3%)
DM		28 (34.1%)
Hyperlipidemia		14 (17.1%)
Recent MI		3 (3.7%)
Previous Stroke/TIA		11 (13.4%)
Tobacco use		14 (17.1%)
Prior Antithrombotic Usage		33 (40.2%)
ECG/Rhythm Holter	NSR	65 (79.3%)
	Afib/Aflut	17 (20.7%)
TTE	Normal	44 (53.7%)
	Left Ventricular Akinesia	5 (6.1%)
	Left Atrium> 4 cm	33 (40.2%)
Cerebellar Deficit	Present	76 (92,7%)
Vascular Imaging	Normal	33 (40.2%)
	Vertebral Stenosis (≥50% of the lumen)	34 (41.4%)
	Basilar Stenosis (≥50% of the lumen)	3 (3.7%)
	Vertebral Dissection	10 (12.1%)
	Basilar Dissection	2 (2.4%)
Vascular territory	PICA	37 (45.1%)
	AICA	2 (2.4%)
	SCA	13 (15.9%)
	Watershed	23 (28%)
	PICA+AICA+SCA	7 (8.5%)

HT: Hypertension, DM: Diabetes mellitus, MI: Myocardial infarction, TIA: Transient ischemic attack, ECG: Electrocardiogram, NSR: Normal sinus rhytm, TTE: Transthorasic echocardiography, PICA: Posterior inferior cerebellar artery, AICA: Anterior inferior cerebellar artery, SCA: Superior cerebellar artery.

The localization of cerebellar ischemic stroke in the cases was classified as hemispheric, vermian, and peduncular regions. It should be defined that more than one region as well as right/left or bilateral areas had been affected simultaneously. Figure 1 shows different types of cerebellar ischemic infarct lesions of some patients (Figure 1 and Table 2).

The patients were grouped based on their NIHSS scores into four categories: 0–4, 5–12, 13–25, or > 25. These categories represented stroke severity as mild, mild to moderately severe, severe, and very severe stroke. Upon admission,

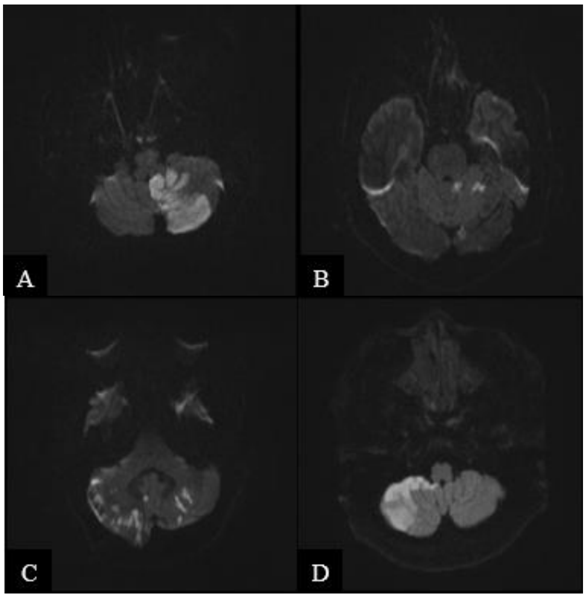

Figure 1. MRI sections of some cerebellar ischemic stroke patients. Different infarct types, patterns on diffusion weighted images (DWI) MRI of some patients. A left cerebellar vermis and hemispheric large medial PICA perfusion territory ischemia (A), left superior cerebellar peduncler and hemispheric small SCA perfusion territory ischemic lesions (B), bilateral vermian, and hemispheric multiple small border zone ischemia (C), a right cerebellar inferior hemispheric and peduncler lateral PICA perfusion territory large ischemic lesion.

Table 2. Cerebellar anatomical localizations of ischemias of patients.

	n (%)
Right	
Vermian	26(31.7%)
Hemispheric	49(59.8%)
Peduncle	10(12.2%)
Left	
Vermian	22 (26.8%)
Hemispheric	33 (40.2%)
Peduncle	9 (11%)
Both (Right and Left)	
Vermian	48 (32,2%)
Hemispheric	82 (55%)
Peduncle	19 (12,7%)

66 (81%) patients had an NIHSS score of 0-4, 13 (16%) patients had a score of 5-12, 3 (4%) had a score of 13-25, and no patients had a score of 25 and higher. At discharge, there were 75 (92%) patients had an NIHSS score of 0-4, 3 (4%) patients had a score of 5-12, no patients had a score of 13-25, and 4 (5%) had a score of 25 and higher. Figure 2 represents the mRS scores and survival data at admission, discharge, and at 6-12th months period post-stroke (Figure 2).

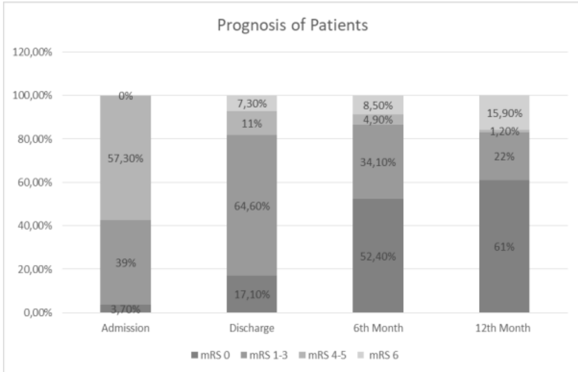

Figure 2. The mRS score data on admission, discharge, and at 6-12th months periods.

Number of infarcts (single/ multiple), infarct pattern (cortical-juxtacortical/deep white matter), Infarct size (small, large), 4th ventricular compression (present/absent), stroke mechanism (atherosclerotic, small vessel disease, cardioembolic, dissection, other), the presence of atrial fibrillation, vertebral and basilar artery stenosis in atherosclerotic patients, and NIHSS at admission to the emergency department, NIHSS at discharge, and mRS at 6 and 12 months were compared. Since the main aim of the study was to correlate the prognosis according to the cerebellar ischemic lesion localization in patients, correlation analysis with the above parameters was not applied. In these comparisons, only multiple cerebellar infarcts and ischemic lesions of 1.5 cm or more created a significant increase in NIHSS and mRS scores at admission ($p<0.05$). In the follow-ups, only the presence of multiple cerebellar ischemic lesions in discharge, 6th and 12th months mRS significantly increased the scores ($p<0.05$).

It was noticed that the localization of the ischemic lesions on the left peduncles of the cerebellum had significant results in terms of increasing the NIHSS and mRS at discharge, 6-12th months follow-up mRS and 6-12th months survival rates. We evaluated these results with the Kruskal Wallis test and correlation analysis. The presence of the left peduncular ischemic lesion on the left peduncles of the cerebellum had significant results in increasing the NIHSS-mRS scores at admission, discharge, and 6-12. month periods compare with other cerebellar regions ($p<0.05$). Significant results were also evaluated in the 6th and, 12th-month mortality rates (Table 3). In the correlation analysis, the presence of a left peduncular ischemic lesion showed a significant correlation with the discharge NIHSS (Correlation coefficient: 0.311, p=0.005), and MRS (Correlation coefficient: 0.432, p<0.001) scores (Table 4). A slightly higher correlation was found in the 6th month MRS (Correlation coefficient: 0.446, p<0.001) and 12th month MRS (Correlation coefficient: 0.561, p<0.001) scores. At 6 months (Correlation coefficient: 0.279, p=0.012) and 12th months (Correlation coefficient: -0.311, p=0.004) mortality rates were also found to have a lower negative correlation. Similarly, the presence of a left cerebellar hemispheric ischemic lesion was found to cause a decrease in 6-month survival rates in both univariate analysis (p=0.36) and correlation analysis (Correlation coefficient:-0.233, p=0.036) (Table 5 and 6).

Table 3. Univariate analysis results of cerebellar ischemic lesion localizations in terms of discharge NIHSS, MRS; 6.-12th month MRS; and 6.-12th month survival.

		Cerebellar Ischemic Lesion Localization[a]					
		VermR	**HemispR**	**PeduncR**	**VermL**	**HemispL**	**PeduncL**
NIHSSd	Chi-Square	1,792	0,217	8,922	1,145	3,982	8,346
	p	0,408	0,897	0,012	0,564	0,137	**0,015**
MRSd	Chi-Square	7,108	6,790	3,990	2,925	5,953	23,914
	p	0,069	0,079	0,263	0,403	0,114	**<0,001**
MRS6	Chi-Square	8,784	8,349	2,886	3,847	3,716	29,008
	p	0,032	0,039	0,409	0,278	0,294	**<0,001**
MRS12	Chi-Square	6,313	6,975	0,550	1,457	2,008	53,004
	p	0,097	0,073	0,908	0,692	0,571	**<0,001**
Survival6	Chi-Square	0,136	0,027	1,216	0,508	4,399	6,305
	p	0,713	0,868	0,270	0,476	**0,036**	**0,012**
Survival12	Chi-Square	0,254	2,807	0,143	0,728	0,091	41,842
	p	0,615	0,094	0,706	0,394	0,763	**<0,001**

a: Kruskal Wallis Test. VermR: Vermis right, Verm L: Vermis left, HemispR: Hemisphere right, HemispL: Hemisphere left, PeduncR: Peduncle right, Peduncle L: Peduncle left, MRSd: Modified Rankin Score at discharged period, NIHSS: National Institute of Health Stroke Scale score at discharged period, MRS6: Modified Rankin Score at 6th month, MRS12: Modified Rankin Score at 12th month, Survival 6/12: Survival rate at the 6/12th month period,

Table 4. Correlation of cerebellar ischemic lesions with discharge NIHSS and mRS scores.

			Correlations							
			VermR	**HemispR**	**PeduncR**	**VermL**	**HemispL**	**PeduncL**	**NIHSSd**	**MRSd**
¶	VermR	*r*	1,000	0,239*	0,227*	0,061	-0,239*	-0,155	-0,067	-0,277**
		p	.	0,032	0,041	0,586	0,032	0,162	0,544	0,009
	HemispR	*r*		1,000	0,154	-0,345**	-0,239*	-0,348**	0,018	0,210*
		p		.	0,166	0,002	0,031	0,002	0,868	0,046
	PeduncR	*r*			1,000	-0,142	-0,230*	-0,012	-0,138	-0,100
		p			.	0,203	0,039	0,917	0,209	0,342
	VermL	*r*				1,000	0,345**	0,140	0,082	-0,169
		p				.	0,002	0,209	0,456	0,108
	HemispL	*r*					1,000	0,030	-0,026	-0,043
		p					.	0,787	0,815	0,681
	PeduncL	*r*						1,000	**0,311****	**0,432****
		p						.	**0,005**	**<0,001**
	NIHSSd	*r*							1,000	0,444**
		p							.	**<0,001**
	MRSd	*r*								1,000
		p								.

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed). ¶: Kendall's tau_b, *r*: Correlation Coefficient. VermR: Vermis right, Verm L: Vermis left, HemispR: Hemisphere right, HemispL: Hemisphere left, PeduncR: Peduncle right, Peduncle L: Peduncle left, MRSd: Modified Rankin Score at discharged period, NIHSS: National Institute of Health Stroke Scale score at discharged period.

When the patients were evaluated as admission, discharge, and 6th and 12th month controls, MRS scores at first were high (MRS>3) due to the fact that the patients were ataxic, but showed a significant improvement in their follow-up. However, with a lesser percentage, an increase was observed in mortality rates after hospitalization periods due to complications such as malignant edema and hemorrhagic transformation as a direct effect of the stroke picture, and more specifically due to conditions such as mobilization problems, infection, etc., and co-morbidities. Mortality rates were 7% at discharge, 9% at 6 months, and 16% at 12 months. Hemorrhagic transformation was observed in only 3 (2%) of 82 patients from the time of admission to the emergency department, hospitalization, discharge, and 6-month outpatient follow-up. These 3 patients had a large cerebellar ischemic lesion with malignant edema and 4th ventricular compression. Decompressive surgical treatment was applied to 2 of 3 patients, and one of them died during hospitalization. The other patients was discharged as mRS 3 and survived for 12 months. In the deceased patient, there is total involvement of PICA+AICA+SCA perfusion areas, and left peduncular involvement is also present.

Table 5. Correlation of cerebellar ischemic lesions with discharge 6th and 12th month mRS scores.

				Correlations						
			VermR	**HemispR**	**PeduncR**	**VermL**	**HemispL**	**PeduncL**	**MRS6**	**MRS12**
¶	VermR	*r*	1,000	0,239*	0,227*	0,061	-0,239*	-0,155	-0,188	-0,092
		p	.	0,032	0,041	0,586	0,032	0,162	0,076	0,388
	HemispR	*r*		1,000	0,154	-0,345**	-0,239*	-0,348**	0,214*	0,249*
		p		.	0,166	0,002	0,031	0,002	0,043	0,019
	PeduncR	*r*			1,000	-0,142	-0,230*	-0,012	0,120	0,072
		p			.	0,203	0,039	0,917	0,255	0,500
	VermL	*r*				1,000	0,345**	0,140	-0,202	-0,090
		p				.	0,002	0,209	0,057	0,397
	HemispL	*r*					1,000	0,030	-0,071	-0,026
		p					.	0,787	0,503	0,807
	PeduncL	*r*						1,000	**0,446****	**0,561****
		p						.	**<0,001**	**<0,001**
	MRS6	*r*							1,000	0,854**
		p							.	**<0,001**
	MRS12	*r*								1,000
		p								.

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed). ¶: Kendall's tau_b, *r* : Correlation Coefficient VermR: Vermis right, Verm L: Vermis left, HemispR: Hemisphere right, HemispL: Hemisphere left, PeduncR: Peduncle right, Peduncle L: Peduncle left, MRS6: Modified Rankin Score at 6th month, MRS12: Modified Rankin Score at 12th month,

Table 6. Correlation of cerebellar ischemic lesions with 6th and 12th months survival rates.

				Correlations						
			VermR	**HemispR**	**PeduncR**	**VermL**	**HemispL**	**PeduncL**	**Survival6**	**Survival12**
¶	VermR	*r*	1,000	0,239*	0,227*	0,061	-0,239*	-0,155	-0,041	-0,068
		p	.	0,032	0,041	0,586	0,032	0,162	0,713	0,522
	HemispR	*r*		1,000	0,154	-0,345**	-0,239*	-0,348**	-0,018	0,084
		p		.	0,166	0,002	0,031	0,002	0,868	0,432
	PeduncR	*r*			1,000	-0,142	-0,230*	-0,012	0,123	-0,054
		p			.	0,203	0,039	0,917	0,270	0,610
	VermL	*r*				1,000	0,345**	0,140	-0,079	0,015
		p				.	0,002	0,209	0,476	0,887
	HemispL	*r*					1,000	0,030	**-0,233***	0,051
		p					.	0,787	**-0,036**	0,631
	PeduncL	*r*						1,000	**-0,279***	**-0,311****
		p						.	**-0,012**	**-0,004**
	Survival6	*r*							1,000	0,226*
		p							.	0,034
	Survival12	*r*								1,000
		p								.

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
¶: Kendall's tau_b, *r* : Correlation Coefficient VermR: Vermis right, Verm L: Vermis left, HemispR: Hemisphere right, HemispL: Hemisphere left, PeduncR: Peduncle right, Peduncle L: Peduncle left, Survival 6/12: Survival rate at the 6/12th month period,

DISCUSSION AND CONCLUSION

In this study, isolated cerebellar ischemic stroke patients data suggested that the presence of a left peduncular ischemic infarction had a notable negative effect on these parameters during follow-up assessments, including discharge NIHSS, mRS scores at 6-12 months, and survival.

More than three-quarters of patients were aged 60 years or older, and the majority of patients were male, similar to the results of other stroke studies (6–8). Hypertension and diabetes mellitus are the most common comorbid conditions (9–13). Similar to previous studies, multiple ischemic lesions were observed more than single lesions, although not significantly. Both unilateral and bilateral lesions were discerned in patients who had multiple ischemia (14–18).

The left cerebellar peduncles ischemic lesions had higher NIHSS and mRS at discharge, 6-12th months mRS. Moreover, it has also affected survival rates in 6-12th months. The presence of a left peduncle ischemic lesion demonstrated a moderate correlation with discharge NIHSS and MRS scores. Besides that presence of left peduncle ischemia showed a moderate correlation with 6th month MRS and a large correlation with 12th month MRS. Furthermore, a moderate negative correlation was also observed in 12th-month survival rates but a small negative correlation with 6th-month survival rates. In the correlation analysis, the evaluation of the correlation level as small, medium, and large was made in accordance with the recommendations according to Cohen. The correlation coefficient of 0.100 is thought to represent a weak or small association; a correlation coefficient of 0.300 is considered a moderate correlation; and a correlation coefficient of 0.500 or larger is thought to represent a strong or large correlation (19).

Similarly, the presence of a left cerebellar hemispheric ischemic lesion was found to cause a decrease in 6th-month survival rates in both univariate and correlation analyses. However, this situation was not considered significant because it was only significant in the 6th month of survival and not in the other similar parameters.

There are a few examples of studies evaluating the clinical progression status of patients according to cerebellar anatomical localizations. These have mostly been studied in patients with multiple sclerosis, and there are examples that include patients with cerebellar tumors (3,20–23). A few evaluations of ischemic stroke have been found (24). In our study, we aimed to determine whether the affected anatomical structure makes a difference in terms of prognosis in ischemic areas of the brain, such as the cerebellum, that cannot be adequately evaluated with NIHSS (25,26). The reason for this goal was that we had the hypothesis that a number of different parameters could be taken into account when making treatment decisions for patients in the acute period, in addition to NIHSS. Also, in our clinical practice, we observed that cerebellar hemispheric involvement, albeit in large sizes, resolves in a shorter time with a better prognosis.

In previous studies, pathologically, this condition has been explained by cytoskeletal and axonal destruction, and decrease of myelinated fibers, and lead to gliosis in peduncles. In addition, the fact that the peduncles are the regions where afferent and efferent fibers pass, and the microcompartment (micro zone) structure as in hemisphere and vermis, is absent in peduncles, suggesting that healing of this afferent-efferent pathway region may be more limited. Moreover, it was a remarkable finding that only left cerebellar peduncle lesions (superior and middle cerebellar peduncle) was shown to have worse prognosis in the results of these previous studies (3,20).

It has been stated that especially the left cerebellar peduncles (superior, middle, inferior) may induce permanent motor and ambulation problems in its effects, because of the fibers that provide proprioceptive control of gait and posture pass through. These data were obtained by performing tractography MR evaluation (3,20,21,24,27,28).

The substantial limitation of our study was the small patient population. However, considering that cerebellar strokes constitute only 2-5% of all strokes and we only included isolated cerebellum ischemia in our sample, we think that this is a significant reason for the limited number. The absence of pre-stroke mRS scores was another limitation, but we know that all of our patients led their lives independently or with minimal support before their stroke. In addition, complications secondary to other comorbid conditions that may affect mortality and do not cause a neurological disease were excluded from the study . Since the data grouped for analysis in the study did not fit the normal distribution in each group, non-parametric tests were preferred and regression analysis could not be performed. An important limitation of the study is that this situation caused the data to be evaluated only by correlation analysis. Although high-level correlation coefficients were not obtained in the correlation analysis, we wanted to emphasize these parameters because there were similar results in the same parameters. Our future aim is to evaluate these results in a larger patient series by applying regression analysis. Finally, another limiting reason for these interpretations based on cerebellar lesion localization in patients is that they are speculative as they are not supported by tractography studies in controlled groups.

In conclusion, the presence of a left cerebellar peduncular ischemic lesions upon admission was significantly correlated with higher morbidity and mortality rates at discharge, as well as during the 6-12 month follow-up period. It was thought that if this situation is evaluated in larger series and found as an independent risk factor, it may affect the decisions to be taken in the selection of the treatment in the initial evaluation of the patients. Also, large series of patients with detailed functional imaging studies are needed to make more grounded comments about these interesting results.

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Ethics

Ethics Committee Approval: The study was approved by Ethics Committee of Gazi University (Date: 27.12.2022, No: 1523).

Informed Consent: The authors declared that it was not considered necessary to get consent from the patients because the study was a retrospective data analysis.

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