

Assessment of Laboratory Parameters in Acute Stroke Patients who Underwent Decompression Surgery

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ABSTRACT

Objective: Decompression surgery is applied as a life-saving treatment in patients with malignant cerebral edema. We aimed to evaluate the effect of laboratory parameters such as C-reactive protein and albumin ratio in predicting decompression surgery at an early stage in acute stroke patients.

Material and Method: Demographic characteristics, CRP and albumin values, decompression surgery time, NIHSS and mRS scores of 53 stroke patients who underwent decompression surgery were listed. The patients were grouped according to the time of decompression surgery as 0-24th hours, 24th-48th hours, 48th-72th hour and after 72th hours and the laboratory parameters of each group were evaluated.

Results: The mean age of 31 male and 22 female patients was 61±14 (34-91) years. There was no significant difference between the groups in terms of gender, NIHSS, and mRS scores. A statistically significant difference was detected between the first and second groups (p=0.024) when comparing the CRP and albumin ratios.

Conclusion: Markers of inflammation, serum CRP, and albumin ratios were evaluated to determine their usefulness in suggesting the timing of surgical treatment. It was observed that a high CRP and albumin ratio at the time of admission could serve as a predictive factor for surgery within the first 24 hours. Our findings suggest that patients with a high CRP albumin ratio may require surgical treatment within the first 24 hours.

Keywords: Acute stroke, CRP albumin ratio, decompression

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INTRODUCTION

Decompression surgery (DS) is applied to reduce the increased intracranial pressure due to cerebral edema caused by malignant middle cerebral artery infarction, large cortical and lobar hematomas (1). Early DS reduces mortality in stroke patients with increased intracranial pressure (2). C-reactive protein (CRP) is an acute phase protein produced as a response to infection, ischemia, trauma, and other inflammatory processes. It has been reported that increased CRP levels and decreased serum albumin levels are associated with poor prognosis and increased mortality in stroke (3-8). Hence, CRP albumin ratio may be predictive for estimation of prognosis. Likewise, it may be crucial marker for early decompression decision.

CRP albumin ratios of acute stroke patients who underwent decompression surgery at admission were considered. We aimed to emphasize the importance of CRP albumin ratio in the decision of early decompression surgery.

MATERIAL and METHODS

We retrospectively evaluated 53 patients who were followed up with a diagnosis of acute stroke and underwent decompressive craniectomy between 2014 and 2022. Demographic characteristics, comorbid diseases, CRP and albumin values at admission, timing of decompression, admission national institutes of stroke scale (NIHSS) and modified Rankin scale (mRS) scores of the patients were reported. Patients who had had any infectious focus at the time of admission and had elevated CRP due to infection diseases were excluded from the study. Patients with life-threatening brain edema, mass effect and midline shift were consulted to the Neurosurgery clinics. The patients underwent to decompression surgery were followed up postoperatively. According to decompression time, patients were divided into four groups to be 0-24th hours, 24th-48th hours, 48th-72th hours and after 72th hours. In this retrospective study, the admission CRP albumin ratio of each group was evaluated and the relationship between them was examined.

To examine the relationship between independent groups of normally distributed data, ANOVA test was used. Post hoc tests were used for the analysis of significance between groups and $p < 0.05$ was considered statistically significant.

Ethics committee approval was obtained with decision protocol number 2022-05-15 at 07 March 2022.

RESULTS

The mean age of the patients was 61 ± 14 years and 31 patients were male and 22 were female. When comorbid diseases were considered, 34 (81%) patients had hypertension, 18 (42.9%) patients had diabetes mellitus, 12 (28.6%) patients had congestive heart failure, and 11 patients had ischemic cerebrovascular disease in their history. The mean NIHSS of the patients at admission was 15.54 ± 4.64 . The mean mRS at admission was 0.7 ± 0.8 . Thrombolytic therapy was applied to 4 (7%) patients, mechanical thrombectomy to 13 (24%), and both treatments to 27 (50.9%) patients, but no acute recanalization treatment was applied to 9 (16%) patients.

The highest NIHSS score was in the '24th-48th hours' group. The highest CRP and lowest albumin value were in the '0-24th hours' group. According to age, NIHSS, CRP and albumin values, there were no statistically significant differences between the groups (Table 1).

The mean CRP albumin ratio at the time of admission for all patients was calculated as 6.17 ± 8.46 . In the first group, which consisted of 13 patients, the mean CRP albumin ratio was 11.48 ± 12.44 . The second group comprised 22 patients, with a mean CRP albumin ratio of 3.22 ± 5.06 . The mean CRP albumin ratio for 6 patients in the third group was 8.52 ± 8.17 , whereas for 12 patients in the last group, it was 6.17 ± 8.46 (Table 2). In the evaluation of CRP albumin ratios among the groups, a significant difference was observed between the first and second groups ($p = 0.024$) (Table 3).

The mean mRS of the patients at discharge was 5.05 ± 0.66 . There was no statistically significant difference between the groups in terms of gender, NIHSS scores, and type of acute recanalization therapies.

Table 1: Age, NIHSS, CRP and Albumin values and relationships between groups.

	0-24 th hours	24 th -48 th hours	48 th -72 th hours	after 72 th hours	Statistic ^a	p
Age	57.3 ± 10.9	61.1 ± 14.3	57.2 ± 17.4	67.3 ± 16.3	1.178	0.328
NIHSS	15.9 ± 4.3	16.5 ± 4.4	12.7 ± 5.5	14.8 ± 5	1.216	0.314
CRP	40.4 ± 41.2	12.2 ± 18.1	33.2 ± 32	16.1 ± 18.8	2.225	0.124
Albumin	3.8 ± 0.6	4 ± 0.4	4.1 ± 0.4	3.9 ± 0.5	0.503	0.686

a. Asymptotically F distributed.

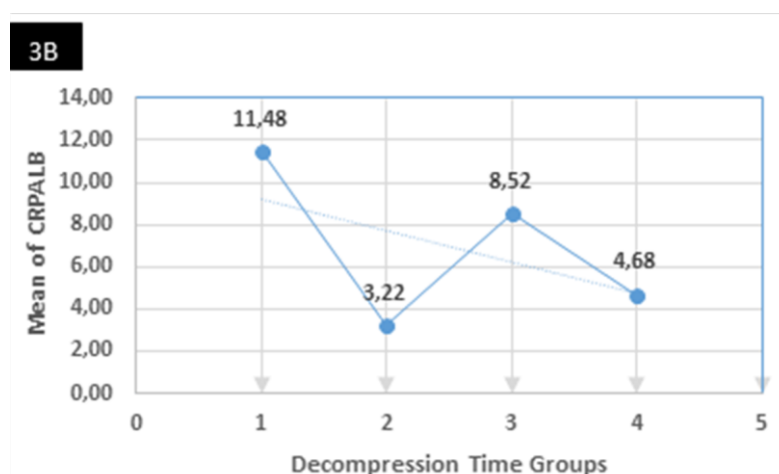
Table 2: Number of groups and mean CRP albumin ratios

Groups	N	Mean	95% Confidence Interval for Mean		F	p
			Lower Bound	Upper Bound		
0-24 th hours	13	11.5 ± 12.4	3.96141	18.99895	3.24	0.03
24 th -48 th hours	22	3.2 ± 5.1	0.980651	5.469173		
48 th -72 th hours	6	8.5 ± 8.2	-0.05415	17.10302		
after 72 th hours	12	4.7 ± 5.9	0.940733	8.422008		
Total	53	6.2 ± 8.5	3.84555	8.513449		

F: Between groups/ANOVA

Table 3: 3A: Comparison of the mean CRP albumin ratio of the groups that classified according to the time of decompression surgery **3B:** Post Hoc test, plot representation of the relationship between CRP albumin ratio and groups

3A	Decompression Time		MeanDifference	Std. Error	p	95% CI	
						LowerBound	UpperBound
Tukey HSD	0-24 th hours	24 th -48 th hours	8.25527*	2.78749	0.024	0.8421	15.6684
		48 th -72 th hours	2.95575	3.93271	0.876	-7.5030	13.4145
		after 72 th hours	6.79881	3.18985	0.158	-1.6844	15.2820
	24 th -48 th hours	0-24 th hours	-8.25527*	2.78749	0.024	-15.6684	-0.8421
		48 th -72 th hours	-5.29952	3.66990	0.479	-15.0594	4.4603
		after 72 th hours	-1.45646	2.85956	0.956	-9.0613	6.1484
	48 th -72 th hours	0-24 th hours	-2.95575	3.93271	0.876	-13.4145	7.5030
		24 th -48 th hours	5.29952	3.66990	0.479	-4.4603	15.0594
		after 72 th hours	3.84306	3.98412	0.770	-6.7525	14.4386
	after 72 th hours	0-24 th hours	-6.79881	3.18985	0.158	-15.2820	1.6844
		24 th -48 th hours	1.45646	2.85956	0.956	-6.1484	9.0613
		48 th -72 th hours	-3.84306	3.98412	0.770	-14.4386	6.7525



DISCUSSION

According to previous studies (9), approximately 10% of ischemic stroke patients experience increased mortality due to excessive vasogenic edema, categorizing them as malignant ischemic stroke. Mortality is reported to be 80% in malignant middle cerebral artery syndrome and the risk for herniation may occur in these patients. DS reduces mortality in ischemic stroke patients who are at risk of herniation (10-12). To determine a marker that will predict the progression to DS is substantial for reducing mortality.

Markers of inflammation such as acute-phase reactants, including CRP have a role in stroke pathophysiology (13). Serum CRP albumin ratio was evaluated as a certain marker of inflammation and can be considered as a predictor for DS. In our study, CRP albumin ratios of the patients who underwent DS within the first 24 hours were significantly higher. Acute stroke patients with a high CRP albumin ratio may need DS in the first 24 hours.

In a meta-analysis, gender, they found that the time of treatment, and size of the infarction area did not affect the outcome of decompressive surgery in patients with malignant middle cerebral artery infarction (14).

In the HAMLET study, no significant differences were found in the outcomes of patients who underwent decompression surgery within the first 48 hours compared to those who had the surgery between 48 and 96 hours. Similarly, in our study, no significant differences were found between the groups in terms of modified Rankin scores. In DESTINY, DECIMAL and HAMLET studies, although DS decreased the mortality, disability rates were higher in patients who applied DC after 48th hour and older than 60 years (15-17). Furthermore, in our study, we found that mortality was not influenced by age or CRP albumin ratio, as there were no significant differences observed between the groups.

The study had certain limitations, including the absence of control groups and the lack of homogeneity between the groups

CONCLUSION

The CRP albumin ratio may be used substantially in predicting the time of decompressive surgery in patients with acute stroke.

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Ethical approval: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and/or with the Helsinki Declaration of 1964 and later versions. Informed consent or a substitute for it was obtained from all patients for being included in the study.

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