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Original Research Article

Role of C - reactive protein among Acute Ischemic Stroke patients: Comparison of mortality outcomes at a tertiary care center in Tamil Nadu

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Abstract

Introduction: Stroke is an important cause of mortality in elderly and increased rate of morbidity in elderly patients. During the acute phase of cerebrovascular disorders, biochemical markers of inflammation, including C-reactive protein (CRP), may serve as indicators of stroke severity. The present study was undertaken to determine the association of C - reactive protein (CRP) levels and its association with the mortality outcomes among acute ischemic stroke patients**.**

Materials and Methods: This current hospital based observational study undertaken at the Department of General Medicine, Coimbatore Medical College, and Coimbatore. The study included 100 patients diagnosed with acute ischemic stroke. Patients diagnosed with acute ischemic stroke (< 72 hrs) from both genders were included in the study.

Results: In the present study, majority of participants were male and belonged to the 61–70 years age group. Lacunar infarcts were the most common (24%), the overall mortality rate in our study was 28%. Patients with elevated erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) levels were significantly associated with increased mortality.

Conclusion: Inflammatory markers (ESR and CRP), renal parameter (urea), and lipid profile components (total cholesterol, HDL, and triglycerides) showed significant associations with mortality, indicating their potential utility as prognostic indicators in the study population.

Keywords: C-reactive Protein, Ischemic Stroke, Erythrocyte Sedimentation Rate, Mortality Outcomes.

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Introduction

Stroke is a serious global public health issue. It is often associated with increased mortality and morbidity in the low- and middle-income countries (LMICs). Seventy percent of strokes happen in LMICs, and the disease burden that follows is higher than in high-income nations. The average life expectancy in India has gone up to around 60 years recently. This has caused a rise in age-related, non-communicable diseases, such as stroke. In India, stroke is the fourth most prevalent cause of death and the fifth most common cause of disability. [1-8]

After both ischemic and hemorrhagic strokes, there is a nonspecific systemic inflammatory response. T his can happen as part of the brain damage process or as a reaction to problems such deep venous thro mbosis. There is mounting evidence that inflammation significantly contributes to acute ischemic stroke (AIS), highlighting critical linkages between the neurological and immune systems. Cerebral ischemia triggers a vigorous inflammatory response encompassing various cell types. Numerous recent studies have concentrated on the inflammatory response following the ischemia event, elucidating the functions of key inflammatory signaling molecules. [9-11]

A stroke can leave a lot of people with long-term problems. An accurate approach to forecast how a patient's condition will develop over time (prognosis) would help doctors take care of their patients and help patients and their families deal with their new situation. [12-13] The present study

was undertaken to study the association of C - reactive protein (CRP) level and ESR levels and their role in adverse outcomes among patients of acute ischemic stroke.

Materials and Methods

This current hospital based observational study undertaken at the Department of General Medicine, Coimbatore Medical College, and Coimbatore. The study included 100 patients diagnosed with acute ischemic stroke. Ethical committee approval was obtained from the Institutional Ethical Committee, Coimbatore Medical College, and Coimbatore. Individual informed consent was obtained from the patient or the legal guardian prior to recruitment in the study. Patients diagnosed with acute ischemic stroke (< 72 hrs) from both genders were included in the study. A detailed clinical history was elicited and biochemical parameters including complete blood counts, renal profile, urine routine and C-reactive protein levels were performed. CT scan was done at the time of the admission to hospital and were done on admission.

For the estimation of C-reactive protein levels, 5 ml of venous blood was obtained from the study participants. The measurement was done using VITRIOS CRP slides, and VITRIOS 5600 integrated system text. We studied the relation between CRP values and mortality and morbidity outcomes were assessed and analyzed. The outcomes were categorized as alive and deceased. The data was then entered and analyzed using SPSS version 16. The t-test was done for the differences of the means of independent samples for the relationship between various biochemical parameters and mortality parameters was performed. A p value of less than 0.05 was considered to be statistically significant.

Results

In the present study, Majority of the study participants were male as compared to females (m:f – 2:1). The commonly affected patients were aged between 61 to 70 years (37%), and 51–60 years (23%). The participants aged between 71 to 80 years and those between 41–50 years and >80 years constituted groups comprised 12% and 16% each respectively.

Our results showed that the most commonly affected regions were the lacunar (24%), frontal (22%) and occipital (14%) regions. The distribution of lesions in the other areas included the frontotemporal (11%), parietal (10%), temporal (9%), internal capsule (4%), temporo-parietal (4%), and watershed areas (2%). In terms of outcome, the majority of participants were alive (72%), whereas 28% of the patients died, indicating a high mortality rate among the study participants. We observed that the haemoglobin levels did not show a statistically significant difference between the two groups ($p = 0.096$). However, erythrocyte sedimentation rate (ESR) was significantly higher among deceased participants compared to those who were alive ($p = 0.004$), indicating an association between elevated inflammatory response and mortality. Similar observations were also made with respect to the C-reactive protein (CRP) levels where the levels were significantly elevated in the deceased group ($p = 0.003$). Renal function parameters showed that increased urea levels were significantly associated with increased mortality while the elevated creatinine levels were not significantly associated with increased mortality though numerical variations were observed between both groups. Assessment of the lipid profile values showed that, total cholesterol levels Triglyceride (TGL) levels were significantly higher in deceased participants ($p = 0.01$). In contrast, high-density lipoprotein (HDL) levels were significantly lower in the deceased group ($p = 0.001$), suggesting a protective role of HDL. We also observed no statistically significant association between the low-density lipoprotein (LDL) among both the groups.

Table 1: Characteristics among the study participants (n=100)

Parameters	Frequency (n=100)	Percentage (%)
Male	67	12
Female	33	23
Age		
41-50	12	12
51-60	23	23
61-70	37	37
71-80	16	16
>80	12	12
Region involved		
Lacunar	24	24
Frontal	22	22
Occipital	14	14
Frontotemporal	11	11
Parietal	10	10

Temporal	9	9
Internal capsule	4	4
Temporo-parietal	4	4
Watershed	2	2
Outcome		
Alive	72	72
Deceased	28	28

Table 2: Comparison of the Biochemical Parameters and outcome among the study participants (n=100)

Biochemical Parameters	Alive	Deceased	p value
	Mean ± SD	Mean ± SD	
Hb	15.46 ± 6.14	13.68 ± 5.26	0.096
ESR	45.1 ± 5.2	56.46 ± 8.2	**0.004***
C reactive Protein	9.37 ± 2.1	10.01 ± 1.2	**0.003***
Urea	44.4 ± 5.1	59.46 ± 7.5	**0.017***
Creatinine	1.78 ± 0.5	2.38 ± 0.74	0.454
Cholesterol	222.22 ± 85.5	247.93 ± 98.7	**0.01***
HDL	59.49 ± 24.1	42.89 ± 30.2	**0.001***
LDL	157.64 ± 25.2	159.93 ± 30.4	0.644
TGL	165.56 ± 35.8	187.93 ± 54.6	**0.001***

*** p value of < 0.05 was considered to be statistically significant**

Discussion:

The present study evaluated the prognostic significance of C-reactive protein (CRP) and other biochemical parameters in terms of mortality outcomes among patients with acute ischemic stroke (AIS).

In our study, the majority of patients were males (67%), and the commonly affected age group was 61–70 years (37%). Donkor et al [14] have attributed the higher prevalence of stroke among elderly males to increased incidence of risk factors like hypertension, diabetes, and smoking. Age-related vascular changes and cumulative exposure to risk factors contribute significantly to stroke occurrence, these findings are in line with our observations. Similar age and gender distributions have been reported in studies by Feigin et al [15] and Elkind et al. [16] The most common subtype of infarction observed in our study was lacunar infarction (24%), followed by frontal and occipital lobe involvement. This pattern is comparable to the observations made by Bamford et al [17] who reported that lacunar strokes are frequently associated with small vessel disease and chronic hypertension. The predominance of lacunar infarcts in our study population suggests a significant burden of microvascular pathology. Similar patterns have been reported by Pantoni et al. [18]

The overall mortality rate in our study was 28%, indicating a considerable disease burden. This finding is slightly higher compared to some previous studies but may be attributed to differences in patient population, severity at presentation, and healthcare access. [19-20] Identifying reliable prognostic markers is therefore crucial for improving outcomes in such settings. We observed a statistically significant association between elevated CRP levels and increased mortality ($p = 0.003$). Di Napoli et al [21] demonstrated that elevated CRP levels are independently associated with increased mortality among stroke patients. Similarly, Muir et al have also documented that CRP levels measured within 72 hours of stroke onset were predictive of both short-term and long-term outcomes. [22]

In our study we observed that the ESR values were significantly elevated among the deceased ($p = 0.004$), further supporting the role of systemic inflammation in stroke outcomes. Kwon et al., had observed that elevated inflammatory markers were significantly associated with poor neurological recovery and increased mortality. [23] Yahalom et al have documented that renal impairment is an independent predictor of mortality in stroke patients. [24] Elevated urea levels may indicate underlying renal dysfunction or systemic metabolic stress, both of which are known to adversely affect stroke outcomes. In our study also we had observed that the urea levels were significantly elevated in the deceased group ($p = 0.017$).

Amarenco et al [25] based on their systematic review and meta-analysis inferred that Dyslipidemia plays a key role in both the development and progression of ischemic stroke. In our study also we observed that total cholesterol and triglyceride levels were significantly higher among non-survivors, while HDL levels were significantly lower ($p = 0.001$). Low HDL levels, in particular, reduce the protective anti-inflammatory and anti-atherogenic effects, thereby contributing to worse outcomes.

Conclusion

Based on our observations we conclude that inflammatory markers (ESR and CRP), renal parameter (urea), and lipid profile components (total cholesterol, HDL, and triglycerides) showed significant associations with mortality, indicating their potential utility as prognostic indicators in the study population.

Limitations

The cross-sectional design of the present study cannot determine the causality and the study being a single center study carried out in a tertiary care facility may limit the generalizability of the observations. Additionally, long-term follow-up may contribute to the assessment of various impacts on the quality of life and survival. Subsequent research with bigger sample sizes and extended follow-up are advised to corroborate these findings.

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