



High Sensitivity C-Reactive Protein Level in First-Ever Acute Ischemic Stroke and Its Short Term Outcome

Goutom Chandra Bhowmik¹, Harun Ur Rashid², Amiruzzaman³, Haripada Roy⁴, Monish Saha Roy⁵, Sudip Barua⁶, Tausif Amim Shadly⁷, Sushanta Barua⁸, Abu Md. Towab⁹, A.K.M Fazlul Kader¹⁰

Abstract

Background: Stroke is the second leading cause of death and the leading cause of adult disability worldwide. A better understanding of stroke risk factors and outcome may help guide efforts at reducing the community burden of stroke.

Objective: To observe the relationship of hs C-Reactive Protein level in first ever ischemic stroke.

Methodology: This cross-sectional descriptive study was conducted in the Department of Medicine, Sir Salimullah Medical College and Mitford Hospital during the period of 6 months to find out the relationship of hs C-Reactive Protein level in first ever ischemic stroke. For this purpose 100 patients with acute ischemic stroke were selected. All acute stroke patient were included as per inclusion and exclusion criteria. Then marker of stroke High Sensitivity CRP were done. Data were collected by using a preformed data sheet and statistical analysis was done in detailed and by using SPSS 20.

Results: This study shows the average age was 62.12 years. Male predominance than female. CI was the most common subtype stroke (38%). The most common risk factor were hypertension (72%), then smoking (44%), hyperlipidemia (28%) and atrial fibrillation (26%). Majority (63%) were hs CRP level >3 mg/L. It was observed that hyperlipidemia and ischemic heart disease were associated with higher CRP level.

Conclusion: In conclusion this study demonstrated that high CRP level is associated with stroke severity at admission and is an independent predictor of early seven-day mortality after ischemic stroke.

Keywords: C-Reactive Protein Level; Acute Ischemic Stroke; Short Term Outcome.

Introduction

Stroke is the third most common cause of death and the first leading cause disability in developed and developing country [1]. The incidence rises steeply with age, and in many lower-and middle- income countries it is association with less healthy lifestyles. About one-fifth of patients with an acute stroke die within a month of the event and at least half of those who survive are left with physical disability [2]. In Bangladesh adequate and complete data on the incidence and mortality of stroke is not available. In one study in Dhaka medical college hospital, stroke is found to be the second commonest cause of emergency admission in the medicine ward and constituted about 20% of the total patient in this ward. One study in BIRDEM Hospital, Dhaka

Affiliation:

¹Assistant Registrar (Cardiology), National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh

²Professor, Department of Medicine, Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh

³Associate Professor, Department of Medicine, Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh

⁴Junior Consultant (Cardiology), Kotalipara Upazila Health Complex, Kotalipara, Gopalganj, Bangladesh

⁵Junior Consultant (Medicine), UHC, Fatikchhari, Bangladesh

⁶Assistant Professor (Medicine), Southern Medical College, East Nasirabad, Kulshi, Chittagong, Bangladesh

⁷Medical Officer (Cardiology), National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh

⁸Assistant Registrar, Department of Cardiology, Dhaka Medical College Hospital, Dhaka, Bangladesh

⁹Junior Consultant (Cardiology), National Institute of Cardiovascular Diseases, Dhaka, Bangladesh

¹⁰Junior Consultant (Cardiology), Belabo Upazila Health Complex, Belabo, Narasingdi, Bangladesh

*Corresponding author:

Goutom Chandra Bhowmik, Assistant Registrar (Cardiology), National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh.

Citation: Goutom Chandra, Harun Ur Rashid, Amiruzzaman, Haripada Roy, Monish Saha Roy, Sudip Barua, Tausif Amim Shadly, Sushanta Barua, Abu Md. Towab, A.K.M Fazlul Kader. High Sensitivity C-Reactive Protein Level in First-Ever Acute Ischemic Stroke and Its Short Term Out Come. Cardiology and Cardiovascular Medicine. 9 (2025): 167-172.

Received: May 01, 2025

Accepted: May 08, 2025

Published: May 18, 2025

5.8 % of admitted patients diagnosed as stroke [3]. Acute stroke is characterized by the rapid appearance of a focal deficit of brain function (e.g.hemiplegia) with or without sign of focal higher cerebral dysfunction (e.g.aphasia), hemisensory loss, visual field defect or brain stem defect, in which symptom last for more than 24 hours. Of all the causes of cardiovascular disease, arterothrombosis is by far most important. C-Reactive protein is a glycoprotein produced by the liver which is normally absent from blood. The presence of acute inflammation with tissue destruction within the body stimulates its production. The CRP typically rises within 6 hours of the start of inflammation allowing the inflammation to be confirmed. It is considered as amarker of low grade vascular inflammation, which is a key factor in the development and rupture of athermathous plaque. High sensitivity CRP test which is more sensitive and specific than standard CRP test [4]. But high sensitivity CRP test is not available in District or upazilla level in our country. Recent data suggests that CRP is an inflammatory potent marker in coronary artery disease and as well as potent and strongest peredictor of cardiovascular disease in both sexes [5,6]. Although in a few study, high level of CRP has been used for determining acute ischemic stroke. Elevated serum levels of CRP are found in three quarters of patients with ischemic stroke [7]. The role of CRP as a marker during and after stroke is less extensively studied in comparison to coronary artery disease disease. The Rotterdam study shows, although high CRP is associated with the risk for future stroke, it is not useful for individual stroke prediction [8]. On the other hand, the Framingham study shows, high CRP is associated with a greater risk for ischemic stroke or TIA [9]. The Bergen stroke study shows, admission CRP is associated with stroke severity and long term mortality when measured at least 24 hours after onset [10]. The Fukuoka stroke Registry shows, patients with cardio-embolic ischemic stroke, age and C-reactive protein are independent risk factors for recurrence in the first year after onset [11]. Several studies have assessed the value of CRP in the very early phases of stroke as a prognostic factor of functional out come. The findings were inconclusive, some found a positive association but other's did not [12]. In search for further clarification of its role in cerebrovascular stroke, I want to evaluate serum high sensitive C-reactive protein level as a biomarker in acute ischemic stroke.

Materials and Methods

Study design: This study was Cross sectional, descriptive study.

Place of study: The study was carried out in the Department of Medicine, Sir Salimullah Medical College and Mitford Hospital, Dhaka, Bangladesh.

Study period: Study period was about 6 months from the date of approval of protocol or until required number of cases are obtained.

Study population: All patients of both sexes between 45-75 years of age will be admitted into indoor patient department of Sir Salimullah Medical College and Mitford Hospital, Dhaka, Bangladesh.

Sample size: Total of 100 cases will be enrolled in the study.

Inclusion criteria:

- Age between 45-75 years
- Both sexes
- First time stroke
- Admission into the hospital within 48 hours of onset of stroke
- Patient or attendant gives consent to participate in the study

Exclusion criteria:

- Age <45 years and >75 years
- Transient ischemic attack
- Recurrent stroke
- Subarachnoid hemoimmunomodulatory drugs, oral contraceptive and angiotensin – converting enzyme inhibitors, liver and renal disorder
- Patient with recent inflammatory conditions, such as major trauma, surgery
- Patients with obvious acute infectious disease
- Patients with clinical symptoms and signs of active infection including fever, cough, burning micturation
- Asymptomatic subjects with evidence of infection on investigations such as leucocytosis on peripheral smear, pus cells in urine, infiltrates on chest radiograph
- Those who do not give consent to participate in the study
- Asymptomatic subjects with evidence of infection on investigations such leucocytosis on peripheral smear, pus cells in urine, infiltrates on chest radiograph those who do not give consent to participate in the study

Data analysis: Data were processed manually and analyzed with the help of SPSS (Statistical package for social sciences) Version 21.0.

Operational definitions:

Stroke: The World Health Organization (WHO) defines stroke as a clinical syndrome characterized by “rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or leading death, with no apparent cause other than of vascular in orgin in my study, stroke is define the presence at of all the follwoing 3 criteria: 1. Sudden onaset of focal neurological

deficit, ie. Hemiparalysis, cranial nerve palsy, 2. Persist for more than 24 hours and 3. Evidence of stroke (ischemic) on CT scan of head or MRI of brain.

C-Reactive Protein: In my study hs CRP is measured from serum of the study population. Serum will be sent to laboratory for estimation of hsCRP by using jaffe colorimetric kinetic method. Creatinine reacts with alkaline picric acid to form a red complex. The intensity of the color from will be proportional to concentration in the sample. Test will be done by auto analyzer Dade Behring Dimension RXL, USA. Reagent- Randox (Figure 1-4).

Short term outcome: In my study short term outcome including death, at 7 days from stroke onset.



Figure 1: CT- scan of brain (Acute Ischemic Stroke) Pt's name: Abdur Rahim Age: 45.

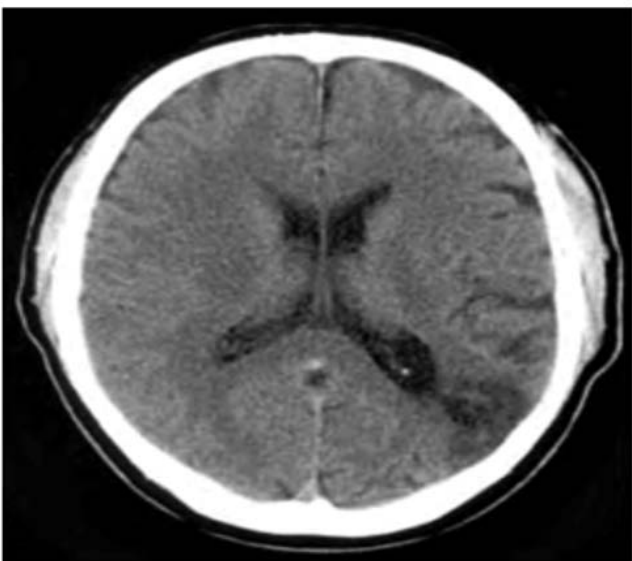


Figure 2: CT- scan of brain (Acute Ischemic Stroke) Pt's name: Mr. Makbul Age: 59.

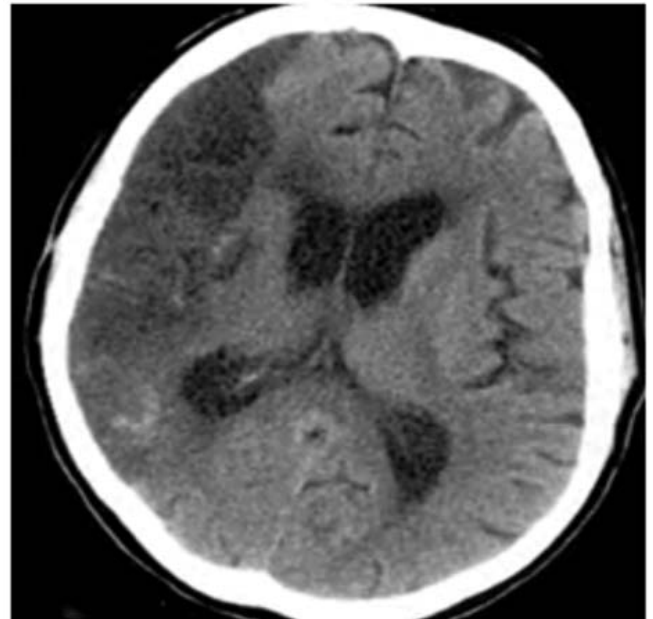


Figure 3: CT- scan of brain (Acute Ischemic Stroke) Pt's name: Mr. Mozibur Age: 52.



Figure 4: CT- scan of brain (Acute Ischemic Stroke) Pt's name: Mrs. Joynab Age: 64.

Results

This Table 1 shows maximum number of stroke patient 70% were above 60 years of age. Female preponderance between 45-75 years age group but in subsequent decades there is male preponderance. majority of patients 62% were from urban area. That businessman, teachers, service holders and house wives were the major 95% of stroke patient. (58%) of the patient were smoker.

Table 2 shows 38% were CI, 15% were SCI, 4% were brain stem, 17% were cerebellum and 28% were un identified.

Table 3 shows majority (63%) were CRP level >3 mg/L.

Table 1: Distribution of Demographic Characteristics of the Respondents (n=100).

Age range (year)	No. of patient	Percentage
45-49	10	10
50-59	20	20
60-70	50	50
70-75	20	20
Sex		
male	76	76
Female	24	24
Residence		
Urban	62	62
Rural	38	38
Occupation		
Executive	0	0
Professional	0	0
Businessman	40	35
Teachers	15	15
Service holder	15	15
Farmer	1	1
Housewife	24	24
Others	5	5
Smoker/Non smoker		
Smoker	58	58
Non-smoker	42	42

Table 2: Distribution of subtype ischaemic stroke (n=100).

Subtype ischaemic stroke	No. of patients	Percentage (%)
CI	38	38
SCI	15	15
Brain stem	4	4
Cerebellum	17	17
Un identified	28	28

Table 3: Distribution of CRP level .

CRP level	No. of patients	Percentage (%)
≤3 mg/L	37	37
>3 mg/L	63	63

Table 4 shows the most common risk factor were hypertension (72.5%), then smoking (44%), Hyperlipidemia (28%), atrial fibrillation (26%) and ischemic heart disease (17%).

Table 4: Risk factor for stroke patients (n=100).

Risk factor	No. of patients	Percentage (%)
Hypertension	72	72
Smoking	44	44
Hyperlipidemia	28	28
Atrial fibrillation	26	26
Ischemic heart disease	17	17

It was observed that hyperlipidemia and ischemic heart disease were associated with higher CRP level. This difference was statistically significant (P<0.05) (Table 5).

Table 6 shows 2. % were died.

Table 5: Relationship between high CRP and low CRP with ischemic stroke patients.

Risk factor	CRP level				P value
	≤3 mg/L		<3 mg/L		
	(n=37)		(n=63)		
	No	%	No	%	
Hypertension	25	67.6	47	74.6	0.325
Smoking	13	35.1	25	39.7	0.617
Hyperlipidemia	9	24.3	29	46	0.001
Atrial fibrillation	2	5.4	5	7.9	0.547
Ischemic heart disease	3	8.1	13	20.6	0.001

Table 6: Outcome (n=100).

Outcome	No. of patients	Percentage (%)
Survived	98	98
Died	2	2

Table 7: Outcome (n=100).

CRP level	No. of patients	Outcome
≥3 mg/L	60	Hemiparesis
>3 mg/L	2	Death
>3 mg/L	10	Recurrent Seizure
<3 μg/L	15	Complete Recovery
<3 μg/L	3	Parkinsonism
≥3 mg/L	3	Aphasia
≤3 mg/L	5	Cerebellar Syndrome

Discussion

A hundred of stroke patients were studied. It was cross sectional, descriptive study. The patients were selected from Department of medicine of Sir Salimullah Medical College and Mitford Hospital, Dhaka. Majority of the patients in this study were of ages above 60 years. In the present study the frequency of stroke increases with increasing age. A study showed 34% patients in the 6th decade and 27% in the 7th decade with an age range of 26-84 years [13]. Bell et al. [14] studied 51 patients with cerebrovascular disease, the age

range of patients were 17 to 84 years with majority of the patient between 50-60 years [14]. In another study highest percentage (37.51%) of patient were in the 6th decade [15]. So these observations are in conformity with that of the present study. In this study 75% of stroke patient were male and 25% were female. The ratio is 3:1. In a study it was found male female ratio as 3.21:1 [16]. Another study showed different finding where male female ratio was 4:1 [17]. In another study it was found male female prevalence 1.24:1. The male female ratio is higher in our country than western countries. In this study majority of patients (62%) came from urban area. This does not signify the preponderance of stroke in urban area because it may reflect the poor communication in the rural area and also superstition about the management of stroke patients in the rural area. In present study 58% of the patients were smoker. It is the third commonest risk factors. In a study of British doctors a significant correlation between smoking and mortality from cerebral thrombosis was evident after 20 years of follow up [18]. In the medical research council trial (1985) placebo group, the risk of stroke was doubled among smokers. Yano et al. and Donnan et al [19]. had shown strong association between cigarette smoking and stroke [19]. In this study shows hypertension (72%) emerges as the most important risk factor in stroke. The result correlates with that of other studies where hypertension was found to be the most important risk factor [20-22]. Smoking (44%) appears as second important risk factor of ischemia stroke in this study, which correlates with Donnan et al. [23], who found smoking as a strong risk factor for SAH and cerebral infarction. Baidya et al. [24] demonstrated that cigarette smoking may modulate stroke risk through a gene-environment interaction. Bhat [25] and Uddin et al. [26] also suggested a strong relationship between cigarette smoking and causation of acute ischemic stroke. In this study shows 38% were CI, 15% were SCI, 5% were brain stem, 17% were cerebellum and 28% were un identified in subtype ischemic stroke. In the original OSCP study, Bamford et al. reported similar findings [27, 28]. In this present prospective study 63% patients with acute ischemic stroke had high hsCRP (> 3 mg/l) levels. Other studies have shown varying prevalence. Rajput et al. [29] had found that among stroke patients from Pakistan, 132 (88%) had elevated CRP (CRP > 10 mg/L) [29]. Moreover, in a study by Di Napoli et al. [30] from Italy, 95 patients (74.2%) with acute ischemic stroke had high CRP levels (> 0.5 mg/dl) at admission [30]. Muir et al. [31] had detected elevated CRP (> 10 mg/L) levels in 96 out of the 228 (42.1%) patients admitted with acute ischemic stroke in the UK. On the other hand, only 22% of stroke patients and 14% of myocardial infarction patients had high CRP (> 7 mg/l) levels in a study from Netherlands [32]. This variance may be explained partly by the different definitions of high CRP in various studies. The high CRP levels are now becoming universally standardised and most centres accept a value above 3 mg/dl as high [33]. In the present study, 2 (2%) patients died in the hospital due to the disease progression.

The Mortality rate was significantly higher in our patients with high CRP. Studies in Nepal, Norway, and China had similar findings [33-35]. Furthermore, the impact of CRP on mortality seems to be long-term. A recent study showed that elevated CRP levels in young patients with ischemic stroke were associated with an increased risk of mortality, even 12 years after the CRP measurements [36].

Conclusion

In conclusion this study demonstrated that high CRP level is associated with stroke severity at admission and is an independent predictor of early seven-day mortality after ischemic stroke. Thus, high CRP levels may be a marker for starting therapy with statins for both primary and secondary prevention. Future large scale studies are required to explore these findings.

Recommendations

To evaluate the short-term outcomes of stroke patient in the community longitudinal study on large sample size should be conducted. Further clinical research is needed to find therapies that reduce the stroke mortality rate associated with diabetes mellitus.

References

1. Feigin VL. Stroke epidemiology in the developing world. *Lancet* 365 (2005): 2160 -61.
2. Langhorne P. Stroke Disease In: Walker BR, Colledge NR, Ralston. SH, Penman, ID, editor, *Davidson's Principles & Practice of Medicine*, 22nd Edition, Churchill Livingstone Elsevier.
3. Latif ZA, Zaman SM, Barua, Ahad A, et al. Study of Stroke between normotensive and hypertensive NIDDM case in BIRDEM, Dkaka. *Bangladesh Journal of Neuroscience* 6 (1990): 52-56b
4. Wakugawa Y, Kiyohara Y, Tanizaki Y, et al. C-reactive protein and risk of first ever ischemic stroke and hemorrhagic stroke in general Japanese population: the Hisayama Study. *Stroke* 37 (2006): 27-32.
5. Curb JD, Abbott RD, Rodriguez BL, et al. C -reactive protein and the future risk of thromboembolic stroke in healthy men. *Circulation* 107 (2003): 2016-20.
6. Kaplan RC, McGinn AP, Barid AE, et al. Inflammation and hemostasis biomarkers for predicting stroke in postmenopausal women: the women's health initiative observational study. *J Stroke Cerebrovascular Disease* 17 (2008): 344-355
7. Smith CJ, Emsley HC, Georgiou RF, et al. Viability of the systemic acute phase response after ischemic stroke. *J. Neuro Science* 251 (2006): 77-81
8. Di Napoli M, Gody DA, Campi V, et al. C-reactive protein in intracerebral hemorrhage time course, tissue

- localization and prognosis. *Neurology* 79 (2012): 690-699.
9. Bos MJ, Schipper CM, Koudstaal PJ, et al. High serum c-reactive protein level is not an independent predictor for stroke; the Rotterdam study.
 10. Rost NS, Wolf PA, Kass CS, et al. plasma concentration of C-reactive protein and risk of ischemic stroke and transient ischemic attack: the Framingham study. *Stroke* 32 (2001): 2575-9.
 11. Montaner J, Fernandez – Cadenas I, Molina CA, et al. Post stroke C-reactive protein is a powerful prognostic tool among candidates for thrombolysis. *Stroke* 37 (2006).
 12. Topakian R, Strasak AM, Nussbaumer K, et al. Prognostic value of admission C-reactive protein in stroke patients undergoing iv thrombolysis. *J Neurol* 255 (2008): 1190–6.
 13. Anwarullah AKM, Habib M, Mohammad QD, et al. Review of risk factor for stroke. Study of 100 cases. *Bangladesh J Neurosci* 9 (1993): 1-20.
 14. Bell DA, William Brien, Vladimar H, et al. Antiphospholipid syndrome. Prevalence among patients with stroke and TIA. *Am J Med* 88 (1990): 593-97.
 15. Sarker CB, Islam MR, Das AB, et al. Risk factors for stroke: a study of eighty cases in two district hospitals in Bangladesh *J Neurosci* 9 (2013): 48-55.
 16. Haque A, Mannan MA, Rahman HZ. Prognosis of acute stroke. *Bangladesh J Neurosci* 3 (2007): 42-47.
 17. Alamgir SM, Mannan MA. Cerebrovascular disease (A report of 53 cases). *Bangladesh Med Res Coun Bull* (2015): 45-50.
 18. Doll R, Peto R. Mortality in relation to smoking. 20 years observation in male British doctors. *BMJ* 2 (2016): 1525-36.
 19. Donnan AG, Meneil JJ, Adena AM, et al. Smoking as a risk factor for cerebral ischemia *Lancet* 16 (2009): 643-47.
 20. Christopher SG, Janice EOC, Hilary L. Diabetes hyperglycemia and recovery from stroke. *Geriatrics and Gerontology International* 1 (2001): 2-7.
 21. Szczudlik A, Slowik A, Turaj W, et al. Transient hyperglycemia in ischemic stroke patients. *J Neurol Sci* 189 (2001): 105-11.
 22. Karapanayiotides T, Piechowski-Jozwiak B, Van Melle G, et al. Stroke patterns, etiology and prognosis in patients with diabetes mellitus. *Neurology* 62 (2004): 1558-62.
 23. Donnan GA, Mcneil JJ, Adena MA. Smoking as a risk factor for cerebral ischaemia. *Lancet* 8664 (1989): 643-647.
 24. Baidya OP, Chaudhuri S, Devi KG. Clinico-epidemiological study of acute ischemic stroke in a tertiary hospital of northeastern state of India. *International Journal of Biomedical and Advance Research. IJBAR* 04 (2013): 420-425.
 25. Bhat VM, Cole JW, Sorkin JD, et al. Dose-response relationship between cigarette smoking and risk of ischemic stroke in young women. *Stroke* 39 (2008): 2439-43.
 26. Uddin MJ, Mondol BA, Ahmed S, et al. Smoking and Ischemic Stroke. *Bang J Neurosci* 24 (2008): 50-54.
 27. Bamford J, Sandercock P, Dennis M, et al. Classification and natural history of clinically identifiable subtypes of cerebral infarction. *Lancet* 337 (1991): 1521-6.
 28. Azra Z, Amir M. Risk factors and subtypes of acute ischemic stroke. A study at King Fahd Hospital of the University. *Neurosciences* 21 (2016): 78-82.
 29. Rajput MR, Lakhair MA, Shaikh MA, et al. C-Reactive Protein (CRP) and other Risk Factors in Acute Ischemic Stroke Patients. *Journal of Liaquat University of Medical and Health Sciences (JLUMHS)* 10 (2011): 131-3.
 30. Di Napoli M, Papa F, Bocola V. C-reactive protein in ischemic stroke: an independent prognostic factor. *Stroke* 32 (2001): 917-24.
 31. Muir KW, Weir CJ, Alwan W, et al. C-reactive protein and outcome after ischemic stroke. *Stroke* 30 (1999): 981-5.
 32. den Hertog HM, van Rossum JA, van der Worp HB, et al. C-reactive protein in the very early phase of acute ischemic stroke: association with poor outcome and death. *J Neurol* 256 (2009): 2003-8.
 33. Huang Y, Jing J, Zhao XQ, et al. High-sensitivity C-reactive protein is a strong risk factor for death after acute ischemic stroke among Chinese. *CNS Neurosci Ther* 18 (2012): 261-6.
 34. Rajeshwar K, Kaul S, Al-Hazzani A, et al. C-reactive protein and nitric oxide levels in ischemic stroke and its subtypes: correlation with clinical outcome. *Inflammation* 35 (2012): 978-84.
 35. Dewan KR, Rana PV. C-reactive protein and early mortality in acute ischemic stroke. *Kathmandu Univ Med J (KUMJ)* 9 (2011): 252-5.
 36. Naess H, Nyland H, Idicula T, et al. C-reactive Protein and Homocysteine Predict Long-term Mortality in Young Ischemic Stroke Patients. *J Stroke Cerebrovasc Dis* (2013).



This article is an open access article distributed under the terms and conditions of the [Creative Commons Attribution \(CC-BY\) license 4.0](https://creativecommons.org/licenses/by/4.0/)