International Journal Dental and Medical Sciences Research
Volume 6, Issue 1, Jan-Feb 2024 pp: 416-420 www.ijdmsrjournal.com ISSN: 2582-6018

Serum C-reactive Protein (CRP) levels in Ischemic Stroke cases – A study from SVS Medical College and Hospital, Mahabubnagar, Telangana State INDIA

1. Yashwanth Reddy G* *Assistant Professor, Government Medical College, Mahabubnagar, Telangana State, Former PG Student SVS Medical College, yryashwant2@gmail.com +918328460677*
2. Venkateswarlu Nandyala** - *Professor and HOD, SVS Medical College, Mahabubnagar, Telangana venkatatreya@gmail.com +91-9440203278 – corresponding author*
3. M.G.Umesh**** - *Professor, SVS Medical College, Mahabubnagar, Telangana +91-9885071750 umeshdoc@rediffmail.com*
4. T Nishanth**** - *Professor and HOD, SVS Medical College, Mahabubnagar, Telangana State, India. +919440842619 nishantrao@rediffmail.com*

Serum C-reactive Protein (CRP) levels in Ischemic Stroke cases – A study from SVS Medical College and Hospital, Mahabubnagar, Telangana State INDIA
Yashwanth Reddy G, Venkateswarlu Nandyala, M.G. Umesh Babu, T Nishanth

---

Date of Submission: 08-02-2024 Date of Acceptance: 24-02-2024

ABSTRACT

Background: C-reactive protein (CRP) is nonspecific biomarker of inflammation found to associated with stroke particularly ischemic one. Also, evidence was there to be associated severity, recurrence, and mortality in stroke cases.

Materials and methods: Patients were selected by using non-probability consecutive sampling. Study design was descriptive Cross sectional. Using WHO sample size calculator 50 patients were selected after excluding known risk factors and conditions associated increased CRP. The study was conducted in the SVS Medical College Hospital, Mahabubnagar, Telangana State over two years between 2016 and 2018. Age and gender matched 50 controls were selected for the study. Apart from CT/MRI and routine investigations CRP was estimated in all cases at admission, 7 days after stroke and 30 at days during follow up. Volume of infarction in the imaging and mHISS score calculated daily.

Results: Eighty-four percentage of the cases (42) had elevated CRP levels in this study. There had been good correlation between the size of infarct and CRP levels and also the recovery from the weakness.

Observations: Extensive search had been done to find similar study proved futile but compared this study with earlier studies

Conclusion: Elevated CRP levels is an independent risk factors apart from the routine known conditions

Key words: Stroke, Ischemic, CT scan, MRI scan, CRP levels, mHISS score.

I. INTRODUCTION

Acute ischemic stroke is caused by sudden interruption of cerebral blood flow caused in most patients who have severe symptoms include embolic or thrombotic occlusion (70-80% of patients)[1]. Stroke is the second most common cause of death in the world[2]. There is Evidence that inflammatory processes were involved in cerebral ischemia[3-6]. C-reactive- protein (CRP), is a nonspecific biomarker of inflammation, which is found to be associated with higher risks of stroke recurrence functional damage for stroke survivors and mortality as well[7-9]. Raised CRP also seen in smokers, atherosclerosis, psychological stress, diabetes, obesity, and elderly. The serum CRP and ESR are the earliest acute phase reactants to increase during the inflammatory response. The median circulating concentrations of CRP is 0.8 mg/L. Normal range may be as low as 0.07 mg/L and among apparently healthy individuals 90% have less than 3 mg/L[1]. High sensitive CRP (hs-CRP) is being in many studies; CRP values in the lower range highly correlate with the hs-CRP tests and can therefore replace the costlier hs-CRP measurements[10].

International Journal Dental and Medical Sciences Research
Volume 6, Issue 1, Jan-Feb 2024 pp: 416-420 www.ijdmsrjournal.com ISSN: 2582-6018

II. MATERIALS and METHODS

The present study was conducted on the stroke cases admitted to SVS Medical College and Hospital, Mahabubnagar, Telangana State during August 2015 to July 2018. There were 250 stroke cases admitted in the SVS Hospital. Hemorrhage cases, cardiac embolic cases and known diabetic and Hypertensive collagen and auto-immune diseases were excluded as follows.

Table 1 showing the risk factors associated in 250 cases of stroke in this study.

Diagnosis	Number of cases
Heavy smokers	52
Diabetes + Hypertension	48
Diabetes mellites > 5 YEARS	28
Collagen diseases	22
Valvular lesions	20
Hypertension alone	16
Hemorrhagic stroke	14
Total	200

The present study included 50 cases without known risk factor for the inflammation/ ischemia. Patients were selected by using non-probability consecutive sampling. Study design was descriptive Cross sectional. Using WHO sample size calculator; r = 0.549, Type I error = 5%, Type II error = 10% Confidence level = 95%, Sample size = 50. Hence 50 cases were selected in the present study after excluding the known to raise serum CRP level. 50 age and gender matched healthy individuals served as controls.

III. RESULTS

TABLE 2 SHOWING THE DEMOGRAPHIC DETAILS OF CONTROLS AND ISCHEMIC STROKE WITHOUT ANY ASSOCIATED RISK FACTOR

Parameter	Stroke patients	Control	'p' value
Age [Mean in years]	59.6 ± 15.5	60.4 ± 14.6	0.200
Gender M:F	28:22	28:22	
CRP Mean levels in mg%	6.8 - 62.5	1.8 ± 1.5	< 0.005
Highest CRP level in mg%	268	10.04	<0.0001

mNHISS score is plotted at admission, at 7th day and after 30 days during follow up of survived cases. Study was divided into 3 groups.

TABLE 3 SHOWING THE THREE GROUPS DIVIDED AS PER THE SIZE OF INFARCT AND SIZE OF INFARCT BY MRI IMAGING AND CRP LEVELS.

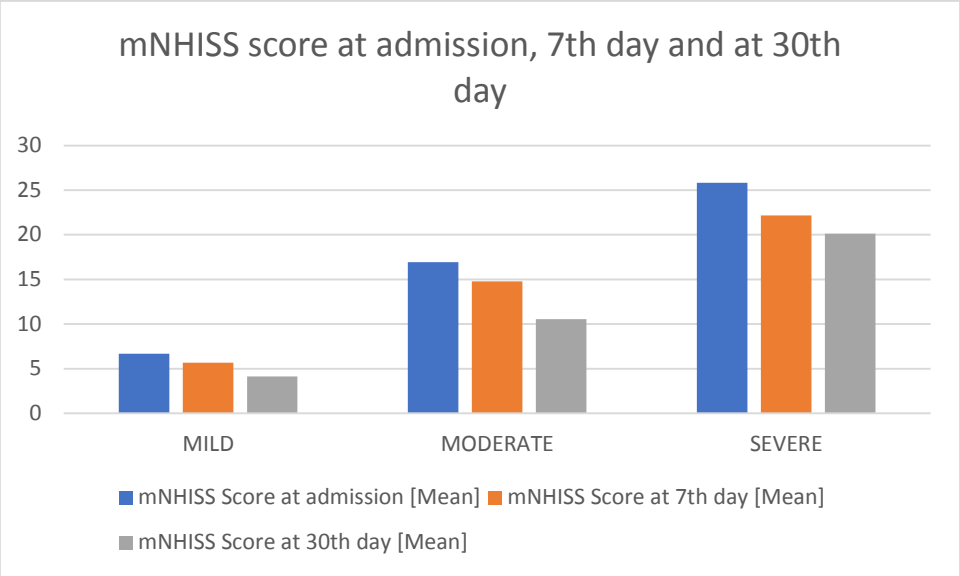
	CEREBRAL INFARCT SIZE	mNHISS score	Plasma CRP levels
MILD	10-50 cc	Up to 10	<3
MODERATE	51-100cc	11-20	3-6 mg%
SEVERE	100-140cc	21-31	>6mg%

6 patients died had infarct size of 118 cc and above and CRP of 68 mg or more.

TABLE 4 SHOWING SERIAL mHISS SCORES IN THIS STUDY

	mNHISS Score at admission [Mean]	mNHISS Score at 7th day [Mean]	mNHISS Score at 30th day [Mean]
MILD	6.68	5.68	2.12
MODERATE	16.92	11.76	8.56
SEVERE	25.82	20.16	18.12

International Journal Dental and Medical Sciences Research
Volume 6, Issue 1, Jan-Feb 2024 pp: 416-420 www.ijdmsrjournal.com ISSN: 2582-6018



6 patients died had infarct size of 118 cc and above and CRP of 68 mg or more.

TABLE 5 SHOWING SERIAL CRP LEVELS IN THIS STUDY

	CRP levels at admission [Mean]	CRP levels at 7th day [Mean]	CRP levels at 30th day [Mean]
MILD	2.26 ± 1.46	1.95 ± 0.95	1.82 ± 0.88
MODERATE	5.94 ± 2.68	3.78 ± 3.04	2.63 ± 1.04
SEVERE	18.34 ± 31.22	8.76 ± 4.24	2.98 ± 2.24

TABLE 6 SHOWING THE SIGNIFICANCE OF CRP LEVELS IN THIS STUDY

GROUP	CRP LEVELS AT ADMISSION [MEAN]	'p' value
SURVIVORS	6.79 ± 35	
NON-SURVIVORS	68.21 ±48.24	0.05 significant

TABLE 7 SHOWING THE SIGNIFICANCE OF INFARCT SIZE IN THIS STUDY

GROUP	INFARCT SIZE	'p' VALUE
SURVIVORS	58.12 ± 38.34	
NON-SURVIVORS	118.24 ± 54.26	0.045

TABLE 8: PROPORTION OF ASSOCIATION OF CRP LEVELS WITH 90 DAY mHISS SCORE MEDIATED BY FOLLOW-UP

VARIABLES	ESTIMATE (95%CI)	'p' VALUE
Log scale of CRP		
Odds Ratio total Effect	2.52 (1.58 – 3.01)	< 0.025
Per SD of log-scale CRP		
Odds Ratio Total Effect	1.52 (1.44 – 1.61)	<0.01

DISCUSSION: In this present prospective study, 42 patients had shown increased levels of CRP. Table is comparison to earlier studies.

Table 9: Percentage of raised CRP in various earlier studies.

Study	Number of ischemic stroke patients with elevated CRP	Remarks
Present study	84%	CRP
Singh and Pradhan[21] 2021	74.19%	CRP

Lal et al[21] 2016	72%	hsCRP
Shoab et al[17] 2014	68%	CRP
Bhaskar et al[26] 2014	59%	hsCRP
Patgiri et al[22] 2014	100%	hsCRP
Chaudhari et al[16] 2013	72%	CRP
Rajput et al[15] 2011	88%	hsCRP
Zacho et al[13] 2009	39%	CRP
Iduculla et al[8] 2009	33%	CRP
den Hertog et al[25] 2009	33%	CRP
Wintech et al[26] 2002	39%	CRP
Di Napoli[24] 2001	74.2%	CRP
Muir et al[11] 1999	42.8%	CRP

This variance may be explained partly by the different ethnic groups in various studies. Age and gender is mainly the same as earlier studies. The present study excluded all the associated and risk factors and the conditions associated raised CRP. Similar studies are not known to the best knowledge of the authors of study. Non-survivors had had been seen to having more higher levels of CRP levels in imaging and more extent infarction area in accordance with earlier studies.

IV. CONCLUSIONS AND SUMMARY

Estimation of CRP for the diagnosis, prediction and prognosis of ischemic stroke should done in all cases as early as possible. This study it had been reported the elevation of CRP in stroke for both diagnosis and prognosis of cases of stroke. Also, it has been concluded the elevation of CRP level is independently a risk factor.

LIMITAIONS and UNIQUENESS of the PRESENT STUDY: Present study was a small, single centre study, the results of which need to be validated in a larger study. Correlation of infarct size on CT/MRI scan and CRP correlate direct pathophysiological basis of rise in CRP. Also, choice of treatment on long term prognosis (e.g., single vs dual antiplatelet) would make estimation of CRP a mandatory. The uniqueness of the study is that known risk factors like hypertension, diabetes, valvular diseases etc and conditions that are associated with raise in CRP were excluded from the study. Extensive internet search could not get any similar study.

ACKNOWLEDGEMENTS: The authors express wholehearted gratitude to the directors and principle and vice-principle for every possible help and co-operation.

ETHICAL CLEARANCE: The Institute's ethical committee had given clearance for study before the start of the study.

COMPETING INTERESTS: Authors have declared that no competing interests exist.

BIBLIOGRPHY

[1]. Yoldas T, Gonen M, Godekmerdan A, Ilhan F, Bayram E. The serum high-sensitive C reactive protein and homocysteine levels to evaluate the prognosis of acute ischaemic stroke. Mediators Inflamm. 2007; 2007: 15929. Doi: 10.1155/2007/15929.

[2]. https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death.

[3]. Kim JS. Cytokines and adhesion molecules in stroke and related diseases. J Neurol Sci. 1996; 137:69 –78.

[4]. Arvin B, Neville LF, Barone FC, Feuerstein GZ. The role of inflammation and cytokines in brain injury. Neurosci Biobehav Rev. 1996; 20: 445–452.

[5]. Dirnagl U, Iadecola C, Moskowitz MA. Pathobiology of ischaemic stroke: an integrated view. Trends Neurosci. 1999; 22: 391–397.

[6]. Li J, Zhao X, Meng X, et al. High-sensitive C-reactive protein predicts recurrent stroke and poor functional outcome: sub-analysis of the clopidogrel in high-risk patients with acute nondisabling cerebrovascular events trial. Stroke. 2016;47(8):2025–2030.

[7]. Cai Z, He W, Zhuang FJ, Chen Y. The role of high high-sensitivity C-reactive protein levels at admission on poor prognosis after acute ischemic stroke. Int J Neurosci. 2019;129(5):423–429.

[8]. Idicula TT, Brogger J, Naess H, Waje-Andreassen U, Thomassen L. Admission C-reactive protein after acute ischemic stroke is associated with stroke severity and mortality: the 'Bergen stroke study'. BMC Neurol. 2009; 9:18.

[9]. Song IU, Kim YD, Kim JS, Lee KS, Chung SW. Can high-sensitivity C-reactive protein and plasma homocysteine levels independently predict the prognosis of patients with functional disability after first-

ever ischemic stroke? Eur Neurol. 2010; 64 (5): 304–310.
[10]. Han E, Fritzer-Szekeres M, Szekeres T, et al.: Comparison of High-Sensitivity C-Reactive Protein vs C-reactive Protein for Cardiovascular Risk Prediction in Chronic Cardiac Disease. J Appl Lab Med. 2022 Oct 29; 7(6): 1259-1271
[11]. Muir KW, Weir CJ, Alwan W, Squire IB, Lees KR. C-reactive protein and outcome after ischemic stroke. Stroke 1999; 30(5): 981-5.
[12]. Ridker PM, Cushman M, Stampfer MJ et al: Inflammation, aspirin, and the risk of cardiovascular disease in apparently healthy men. N Engl J Med 1997; 336(14): 973-979.
[13]. Zacho J, Tybjaerg-Hansen A, Jensen JS Grande P, Sillesen H, Nordestgaard BG. Genetically elevated C-reactive protein and ischemic vascular disease. N Engl J Med 2008; 359(18): 1897-908.
[14]. Mishra PT, Chandra R, Saxena S, Verma S, Jain R, Bhuyan A. High Sensitivity C-reactive Protein (hsCRP) Level in Cerebrovascular Accident (Stroke) JIACM. 2010; 11(3):204–7.
[15]. Rajput MR, Lakhair MA, Shaikh MA, Rind MS, Zafarullah, Bano R. C-Reactive Protein (CRP) and other Risk Factors in Acute Ischemic Stroke Patients. Journal of Liaquat University of Medical and Health Sciences (JLUMHS) 2011; 10(3): 131-3.
[16]. Chaudhuri1 JR, Mridula KR, Umamahesh M, et al High Sensitivity C-reactive Protein Levels in Acute Ischemic Stroke and Subtypes: A study from a Tertiary Care Center Iranian J neurol 2013; 12(3): 92-97
[17]. Shoaib MA, Shehata MA, Taema KM, Hammouda MA. CRP in cerebrovascular stroke: Prognostic implications. Egy j crit care med, 2014; 2(1): 43-52.
[18]. Srinivas U, Nikhilesh Y, Sudhakar K; Correlation of C-Reactive Protein in Acute Ischemic Stroke – An Original Study in a Tertiary Care Hospital: Indian Journal of Applied Research 2019 9 (4): 33-34
[19]. Kumar SR and Vidya TA: High sensitivity C-reactive protein level in cerebrovascular accident. International Journal of Advances in Medicine. 2020; 7(4): 666-672.
[20]. Ardhi MS and Diana; Correlation between HS-CRP in Serum with Neurological Deficit Measured by Nihss in Acute Ischemic Stroke Medico-legal Update, July-September 2021, Vol.21(3): 403-7.
[21]. Lal R, Gupta A, Virmani SK, kumar Tyagi V, Sharma S. High sensitivity C-reactive protein as a prognostic marker in ischaemic and haemorrhagic stroke. Inter J Adv Med. 2016 Apr;3(2):372.
[22]. Patgiri D, Pathak MS, Sharma P, Kutum T, Mattack N. Serum hsCRP: A Novel Marker for Prediction of Cerebrovascular Accidents (Stroke). J Clin Diagn Res. 2014 Dec;8(12) CC08-CC11.
[23]. Subhashish Singh and Rashmita Pradhan, Prognostic Significance of CRP in Ischaemic Stroke Patients; Journal of Clinical and Diagnostic Research. 2021 Oct, Vol-15(10): OC10-OC14
[24]. Di Napoli M, Papa F, Bocola V: C-reactive protein in ischemic stroke: an independent prognostic factor. Stroke 2001, 32:917-924.
[25]. den Hertog HM, van Rossum JA, van der Worp HB, van Gemert HM, de Jonge R, Koudstaal PJ, et al. C-reactive protein in the very early phase of acute ischemic stroke: association with poor outcome and death. J Neurol 2009; 256(12): 2003-8.
[26]. Winbeck K, Poppert H, Etgen T et al. Prognostic Impact of Serial CRP in Acute Stroke; Stroke. 2002; 33: 2459-2464.
[27]. Elkind MS, Tai W, Coates K, Paik MC, Sacco RL: High-sensitivity C reactive protein, lipoprotein-associated phospholipase A2, and outcome after ischemic stroke. Arch Intern Med 2006, 166:2073-2080.
[28]. Maradi V, Anand K, Ashok Kumar. Measurement of cerebral infarct volume by magnetic resonance imaging using ABC/2 method and its correlation with clinical outcome using NIHSS score. International Journal of Contemporary Medicine Surgery and Radiology. 2019;4(2): B144-B149.
[29]. Jayabhaskar C, Ramadevi M and Sreelalitha N; A Study of High Sensitivity C - reactive Protein in Cerebrovascular Accident; British Journal of Medicine & Medical Research 18(4): 1-6, 2016,
[30]. Fatima Y, Mohammed SR, Mohammed Z; A Study of Serum High Sensitivity C-Reactive Protein and Homocysteine Levels in Young Adults with Acute Ischemic Stroke, Mohammed Z: National Journal of Medical Research 10(20): 80-84, 2020
[31]. Banthia B, Shakir SM. Study of prognostic importance of hs-CRP levels in acute stroke patients coming to Theerthanker Mahaveer Medical College, Moradabad Uttar Pradesh, India. Int J Res Med Sci 2020;8: 2877-80.