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Research Article

### CORRELATION OF HIGH-SENSITIVITY C-REACTIVE PROTEIN AND CAROTID COLOR ULTRASONOGRAPHY IN DIAGNOSIS OF ATHEROSCLEROTIC CEREBRAL INFARCTION

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**Abstract:**

**Objectives:** The aim of this research work was to identify the association between high-sensitive C-reactive protein, function of neurological function, carotid plaque and thickness of intima-media, and to support the professionals in the identification of ACI (Atherosclerotic Cerebral Infarction).

**Methodology:** A sum of 96 patients with the 1<sup>st</sup> onset of Atherosclerotic Cerebral Infarction were the participants of this research work from May 2017 to June 2020. We carried out the test for high-sensitive C-reactive protein, evaluation of the neurological function and investigation with the help of carotid color US (Ultrasonography) for all the patients of this research work.

**Results:** We divided 96 patients in to groups; plaque group (PG) and non-plaque group (NPG) keeping in view the presence of the carotid plaque after application of carotid artery US. We further subdivided the PG into unstable plaque & stable plaque sub-groups keeping in view the characteristics of the plaque. The age of the patients of both sub-groups was much high as compared to the patients of NPG ( $P < 0.050$ ). Unstable plaque sub-group appeared with high value of intima-media thickness and level of high-sensitive C-reactive protein, followed by the sub-group of stable plaque and NPG ( $P < 0.050$ ). There was increase in the level of high-sensitive C-reactive protein with the increase in the value of nervous damage scale ( $P < 0.050$ ). Additionally, there was a significant association between the scores of NIHSS and high-sensitive C-reactive protein in the patients suffering from Atherosclerotic Cerebral Infarction ( $P < 0.050$ ).

**Conclusion:** There is close association of the high-sensitive C-reactive protein & intima-media thickness with development of carotid plaque, and high-sensitive C-reactive protein can be considered as highly sensitive index in the identification of the prognosis and risk for Atherosclerotic Cerebral Infarction.

**KEY WORDS:** High-sensitive, C-reactive protein, Intima-media thickness, prognosis, NPG, PG, carotid plaque, methodology.

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**INTRODUCTION:**

Stroke with high rate of mortality, disability and morbidity, is main cause of death in whole world. Among all the cases of stroke, thirty percent cases are fatal and seventy percent of the patients have aphasia, hemiplegia and other associated disabilities [1] which can lead to the severe risk to health of humans and it also put out a heavy burden on the security system of society [2]. Most frequent type of stroke is cerebral infarction, which is responsible for 43.0% to 79.0% of all strokes occurring in Pakistan [3]. Atherosclerosis is most vital factor for cerebral infarction according to the professionals of whole world. Many research works have stated that there is much important role of inflammation in pathological and physiological processes of the atherosclerosis and ischemic injury [4], and it is also a key driver in the development of the atherosclerotic plaque [5]. Among all the markers of inflammation, CRP (C - reactive protein) is very important marker which can forecast the vascular events in future.

high-sensitivity - C-reactive protein is the best biomarker for the prediction of the vascular events. Majority of the cerebrovascular incidents result because of the hemodynamic event formed from the carotid plaque [7]. Association between inflammation, progression of atherosclerosis and cerebrovascular incidents have been validated by many research authors [8, 9]. Plaque's examination can be carried out with the use of MRI or CT and carotid US, in which there are many benefits of carotid ultrasonography and it is widely in use as reliable method for the imaging of carotid atherosclerosis [10]. The objective of this prospective research work was to identify the association between high-sensitivity - C-reactive protein, neurological functionality, carotid plaque and intima-media thickness and to examine the traits of these findings.

**METHODOLOGY:**

A sum of 96 patients present with 1<sup>st</sup> onset of Atherosclerotic Cerebral Infarction were the participants of this research work from May 2017 to June 2020. Diagnosis of Atherosclerotic Cerebral Infarction was carried out in accordance with the 4<sup>th</sup> National Academic Conference on CVDs (Cerebrovascular Disease) [11] and after that we used the MRI or CT for the verification of diagnosis. We excluded all the patients present with other serious complications [4]. The course of the disease was not more than 3 days in all the patients of this current research work. We obtained the written consent from all the patients of this research work after explaining them the purpose of this research work. Ethical committee of the hospital gave the permission to

conduct this research work. We performed the test for the high-sensitivity C-reactive protein, carotid color US examination and evaluation of the neurological function for all the patients of this research work.

The utilization of carotid color US was carried out to assess the morphology of atherosclerotic plaque and measure the intima-media thickness. We defined the carotid plaques as focal echogenic thickenings with a nominal intimal with medial thickness of  $\geq 1.20$  mm [12]. We defined the plaque having rough surface as unstable plaque and plaque with smooth surface as stable plaque [13]. We evaluated the neurological functionality of the patients with NIHSS (National Institutes of Health Stroke Scale) [14].

We used the SPSS V.23 for the statistical analysis of the collected information. We performed the comparison of the data as high-sensitivity - C-reactive protein level, scores of NIHSS, age and intima-media thickness with the utilization of the T test. We used the Chi square test to evaluate the difference between the enumeration data of both groups. We use the Spearman correlation for the determination of the correlation between variables. We considered the P value of less than 0.050 as significant.

**RESULTS:**

In this current research work, we included total 96 patients suffering from Atherosclerotic Cerebral Infarction. The samples comprised 57 males and 39 female patients having range of age from 40 to 83 years. We divided the patients in PG and NPG in accordance with the presence of the carotid plaque after ultrasonography of carotid. There were 78 patients in the PG and eighteen patients in NPG. We further subdivided the plaque group in to unstable plaque & stable plaque sub-groups in accordance with the characteristics of the plaque. In 78 patients present with plaques, 47 patients in the stable plaque sub-group and 31 patients in the unstable plaque sub-group. We found no significant disparity in the sex distribution between the sub-groups of stable plaque, unstable plaque sub-group and NPG ( $P > 0.050$ ). We found that age of the 2 sub-groups was much high as compared to the patients of NPG ( $P < 0.050$ ), whereas there was no significant difference between the patients of both sub-groups ( $P > 0.050$ , Table-1). In terms of level of high-sensitivity - C-reactive protein and IMT, the patients of sub-group of unstable plaque appeared with high values, which was followed by sub-group of stable plaque and NPG. We found a significant difference in the levels of high-sensitivity - C-reactive protein and IMT between the patients of both groups ( $P < 0.050$ , Table-1).

**Table-I: The comparison between stable plaque subgroup, unstable plaque subgroup and non-plaque group.**

	Stable plaque subgroup	Unstable plaque subgroup	Non-plaque group	P value
Number	47	31	18	-
Age (year)	68.1±9.2 <sup>b</sup>	69.5±10.2 <sup>b</sup>	56.7±9.8	P<0.05
Gender (M/F)	27/20	19/12	7-Nov	p>0.05
hs-CRP (mg/L)	7.18±2.6 <sup>ab</sup>	11.7±3.3 <sup>b</sup>	2.9±2.1	P<0.05
IMT (mm)	1.19±0.24 <sup>ab</sup>	1.37±0.34 <sup>b</sup>	0.97±0.09	P<0.05

Note: hs-CRP= high-sensitivity C-reactive protein. IMT= intima-media thickness. a indicates p<0.05, compared to unstable plaque subgroup. b indicates p<0.05, compared to non-plaque group.

In terms of the neurological damage, we identified significant increase in the high-sensitivity - C-reactive protein level with the rise in the nervous damage scale (P<0.050), whereas we found no significant disparity in the IMT between the patients present in various grades of nervous damage (P>0.050). In addition, we found a significant association between the scores of NIHSS and level of high-sensitivity - C-reactive protein in the patients suffering from Atherosclerotic Cerebral Infarction (P<0.050) (Table-2).

**Table-II: The Comparison of High-Sensitivity C-Reactive Protein and IMT In Patients with Different Scale of Nervous Damage**

Scale	N	hs-CRP (mg/L)	IMT (mm)
Mild	31	4.05±1.05	1.06±0.16
Moderate	39	6.47±2.14	1.18±0.29
Severe	26	11.28±3.19	1.25±0.34
P values		P<0.05	p>0.05

Note: hs-CRP= high-sensitivity C-reactive protein. IMT= intima-media thickness.

## DISCUSSION:

In this recent research work, we detected the association of high-sensitivity C-reactive protein, intima-media thickness, neural functionality and atherosclerotic plaques in the patients present with Atherosclerotic Cerebral Infarction to facilitate the professionals. We discovered that the patient's age in 2 sub-groups was much high as compared to the patients of NPG, this show that the presence of atherosclerotic plaques may have association with the patient's age. In another research work conducted on more than three thousand patients with utilizing the regression analysis, Yang stated gender, age and burden of carotid plaque can significantly forecast risk of transient ischemic attack of ipsilateral stroke, mortality because of stroke, or mortality from not known reason at an average follow-up period of 2.50 years [15]. In current research work, we did not investigate the association between gender, burden of carotid plaque and stroke, but we discovered that the patients in the NPG were younger, showing that there is high risk of stroke in the elder patients and viewpoints of both research works are similar. Many research works confirmed the association between the

development of atherosclerotic plaque and inflammation [4, 5].

Process of inflammation has association with different risk factors for the development of atherosclerotic plaque and modified pathophysiology of the vessels of blood [16]. In terms of levels of high-sensitivity C-reactive protein and IMT in this research work, plaque sub-groups appeared with much high values as compared to NPG. We also found in this research work that there was increase in the level of highly sensitive CRP with the increase in the level of nervous damage scale and there was confirm association between the high-sensitivity C-reactive protein and scores of NIHSS in the patients present with Atherosclerotic Cerebral Infarction. This shows that increase in the level of high-sensitivity C-reactive protein has the ability to reflect the inflammation scale as well as nervous damage scale.

There is some limitation of this research work as the size of sample of this research work was very small and there is need of research work on a larger scale to consolidate the facts more clearly. The values of the

intima-media thickness identified from carotid color US, while subjective factors and experience of the personal may have influence on the final results of carotid color US. Regardless of these limitations, we can get definite findings from this current research work, facilitating the professionals in the determination of the prognosis and diagnosis of this fatal disease.

### CONCLUSION:

We found a strong association between the high-sensitive CRP & intima-media thickness with the presence of carotid plaque, and high-sensitivity-CRP can be thought as highly sensitive index in the detection of the prognosis and risk for Atherosclerotic Cerebral Infarction.

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