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ROLE OF SERUM FERRITIN AS A SHORT TERM PROGNOSTIC MARKER IN ACUTE ISCHEMIC STROKE: A HOSPITAL BASED STUDY

General Medicine

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ABSTRACT

Introduction: Stroke is a major cause of morbidity and mortality in the world and India. No single prognostic indicator to predict the course of acute ischemic stroke. Serum ferritin considered as an acute phase reactant can also been used for prognosis of stroke. **Purpose:** The purpose of this study was to demonstrate the potential serum ferritin as a surrogate marker for prognosis of stroke. **Materials And Methods:** A study was conducted in the Department of Medicine in Rajah Muthiah Medical College Hospital, Srinagar, where 60 patients with stroke were enrolled for the study. Serum ferritin levels were estimated at the time of admission and National Institute of Health Stroke Scale (NIHSS) was calculated on the 5th day of admission. **Results And Conclusion:** A statistically significant correlation was found between NIHS scores and serum ferritin levels in acute ischemic stroke patients. Further research is needed in this topic in the near future.

KEYWORDS

National Institute of Health Stroke Scale (NIHSS), Serum ferritin, Stroke.

INTRODUCTION

According to the WHO, stroke is defined as "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 h or longer or leading to death, with no apparent cause other than of vascular origin".[1] Stroke is now considered as an important health problem for the society. CVA is the second leading cause of death after heart diseases and also leading cause of hospitalization causing disability. Worldwide there were over 12.2 million new strokes every year and one in four above 25 years of age will have stroke in their lifetime.[2] In India, stroke is the largest contributor to DALY and chief contributor to death among neurological disorders.

With the advent of promising therapies, acute ischemic stroke has a higher expectancy for recovery. The effects of a stroke depend on the site and severity of brain injury. Severity and follow-up of neurological deficit in stroke can be done with scales such as Canadian Stroke Scale (CSS), National Institute of Health Stroke Scale (NIHSS), and Glasgow Coma Scale (GCS)[3]. Although there has been a tremendous progress, poor outcome may still occur because ischemic stroke is influenced by many factors and exact prognostication of stroke is not possible. Several markers such as size the vessel involved, the presenting Glasgow coma scale, the amount of edema surrounding the infarct, and the intracranial pressure have been used to access the severity and to prognosticate acute ischemic stroke. None of these are reliable and therefore there is a ongoing search for reliable prognostic marker in stroke have gained interest in recent years.

The normal Serum ferritin concentration is 15–300 ng/ml. For a longtime, serum ferritin was measured in medicine only to know the iron status. Now it has been suggested that high serum ferritin contributes to the prognosis of ischemic stroke by contributing to deterioration through increasing the infarct size and cerebral edema[4]. Previous studies have suggested that iron overload contributes to the vascular disease by promoting thrombosis and thereby leading to tissue injury[5,6,7]. This study takes up this challenge in the quest for better prognostic indicator of stroke by pitting serum ferritin levels[8] against severity of stroke.

Table 1: NIHSS

Score	Stroke severity
0	No stroke symptoms
1–4	Minor stroke
5–15	Moderate stroke
16–20	Moderate to severe stroke
21–42	Severe stroke

MATERIALS AND METHODS

This was conducted as a prospective observational study 60 patients of acute ischemic stroke admitted in the tertiary care teaching hospital between 2020 and 2022 after getting approval from institutional ethics committee.

Inclusion Criteria

Patients with new onset neurological deficit of both sexes, aged ≥18 years presenting within 48 hours of onset, diagnosed by clinical examination were included in the study. Patients with previous comorbidities such as hypertension, dyslipidemia, diabetes, smoking, and alcohol were included in the study.

Exclusion Criteria

Patients who presented after 48 hours of onset, recent infection, malignancy, anemia, or liver and kidney diseases were excluded; those with intracranial hemorrhage, TIA, RIND, previous history of CVA OR received thrombolysis were excluded from the study.

Data Collection Procedure

All admitted patients were informed of the details of the study and written informed consent was taken. Then, complete relevant medical history, neurological examination, routine blood tests, and CT scan were done, and all data were recorded in a standardized proforma. Estimation of serum ferritin was done using the electrochemiluminescence immunoassay at admission. On the 5th day of admission, the severity of stroke was assessed clinically using NIHS Score. The NIHSS is made up of 11 parameters, each of which scores between 0 and 4. The patients were categorized into THREE groups (table 1) based on the score: Mild, Moderate and Severe. All the data were computed in master chart and statistical data analysis was done. Chi Square test, Mean, Standard deviation, 'p' values were calculated. A 'p' value <0.05 denotes significant relationship. Pearson's r correlation test and scatter plot analysis were also done.

RESULTS

Of the 60 patients enrolled in this study, 38 (63.33%) were males and 22 (36.67%) were females. 14 patients (23.33%) were aged ≤50 years, 46 patients (76.76%) were > 50 years, and 14 patients (28%) were aged >70 years.

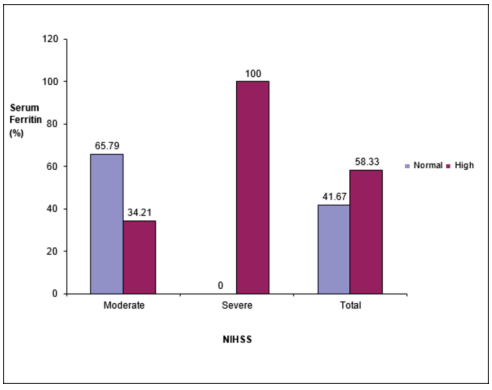


Diagram 1: Serum Ferritin Levels v NIHSS Grading

The maximum and minimum mean values of serum ferritin in the study are 462.12 and 26.48 respectively with an average mean of 241.39. The maximum and minimum mean values for NIHSS scoring system in the study are 23 and 5respectively, with an average mean of 14.42.

Statistical analysis revealed that there was a significant correlation between the values of serum ferritin and NIHSS (P <0.05). With Pearson's R correlation and the scatter plot analysis, a very strong correlation between serum ferritin and NIHSS was found; any increase or decrease in the serum ferritin had a directly proportional change in the values of NIHSS[9,10].

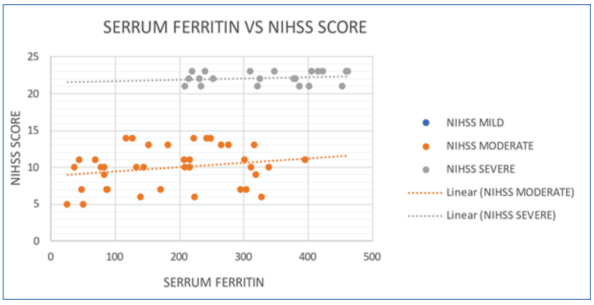
Table 2 Serum Ferritin vs. NIHSS

NIHSS	No. Of Patients	Serum Ferritin		Total
		Normal	High	
MILD	COUNT	0	0	00
	%	0	0	00
MODERATE	COUNT	25	13	38
	%	65.79%	34.21%	100%
SEVERE	COUNT	00	22	22
	%	00	100%	100%
TOTAL	COUNT	25	35	60
	%	41.67%	58.33%	100%

PEARSON'S Correlation: Serum FERRITIN AND NIHSS

		Serum ferritin	NIHSS
Serum ferritin	Pearson Correlation	1	0.613
	P Value		0.000
NIHSS	Pearson Correlation	0.613	1
	P Value	0.000	

Scatter Diagram: Serum FERRITIN And NIHSS



DISCUSSION

The present study was done on 60 patients with acute ischemic stroke and shows that there is a significant correlation between the values of serum ferritin and NIHS score on 5th day of admission. Serum ferritin levels were very high in patients high NIHSS.

Serum ferritin is a representative of the level of iron stores in the cells of the body and consequently might be related to iron present in the brain. Free iron released from the cerebral stores during ischemia catalyzes the conversion of superoxide and hydrogen peroxide into highly reactive hydroxyl radical[11]. Furthermore, Reperfusion caused increased iron release and more free radical generation. Hence, increased iron levels have been associated with more oxidative stress and inflammatory response implicating that increase in body iron stores before stroke onset can aggravate the cytotoxicity of brain ischemia[12]. Another proposed mechanism is that brain cells with higher iron stores release more glutamate when injured during ischemia; the released glutamate in turn causes further tissue injury.

Demerdash et al[14] observed significantly higher serum ferritin in patients with larger lesions (P < 0.01) and deteriorated neurologic condition during follow-up. Cerebrospinal fluid (CSF) and serum ferritin levels were correlated with neurologic deficit (r = 0.50, P <0.001). Increased body iron stores lead to deterioration so chelation therapy[13] with desferroxamine can be tried to improve prognosis. The present as well as the previous studies showed that in patients with acute ischemic stroke, the admission-day serum ferritin was significantly higher in patients who deteriorated after admission, as compared to patients who did not deteriorate.

CONCLUSIONS

Acute ischemic stroke is a significant cause of morbidity and mortality in both developed and developing countries. This study reveals that high values of serum ferritin were associated with high NIHSS, which indicates poor outcome in patients of acute stroke. Patients with higher admission serum ferritin levels tend to deteriorate more compared to those with lower serum ferritin levels. Further research in this topic is required and can help in developing a cost effective surrogate prognostic marker for acute ischemic stroke.

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