

# Iron Deficiency Anaemia as a Risk Factor for Stroke

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**Abstract:** Cerebrovascular stroke is a leading cause of long term disability and death. There are many established risk factors of stroke like hypertension, diabetes mellitus, hyperlipidemia etc. However in about 30% of cases cause remains undetermined. Anaemia is the most common haematological disorder and had been related to cerebrovascular accidents,sickle cell anaemia being most commonly associated. Very little is known about the association between non sickle cell anaemia and stroke. Considering this, the present study aims to evaluate the association between iron deficiency anaemia(IDA) and cerebrovascular stroke. 50 Cases of acute ischemic stroke of both the sexes and all age group admitted to medicine department were studied.Various haematological parameters were noted as per performa. Majority of patients were found to be anaemic,out of which 42% were having moderate degree of anaemia and 20% of cases were found to be having iron deficiency anaemia. It can be suggested from the study that there is strong association between Iron deficiency anaemia and ischemic stroke.

**Keywords:** Stroke, risk factor, iron deficiency anaemia

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## I. Introduction

Stroke is the loss of brain function due to disturbances in the blood supply of the brain. Cerebrovascular stroke is the third leading cause of death after heart diseases and cancer<sup>1</sup>. It is also a leading cause of long term severe disability<sup>2</sup>. There are many established risk factors of stroke: hypertension, diabetes mellitus, dyslipidemia etc<sup>1,3</sup>. However the cause of stroke in about 30% of the cases remains undetermined, especially in the young adults<sup>4</sup>.

Therefore there is a need to focus on discovering other risk factors. Anaemia is known to be an important risk factor in the development of cerebrovascular and cardiovascular diseases. The focus was mainly on sickle cell anaemia and not on non-sickle anaemia.

Recently iron deficiency anaemia(IDA) has also been proposed as a risk factor for stroke<sup>5,6</sup>.Iron deficiency decreases the amount of haemoglobin which in turn compromise the oxygen carrying capacity of blood .This could be a possible mechanism for stroke<sup>7,8</sup>.If IDA can be established as a risk factor for stroke,many major cerebrovascular episodes can be prevented.Therefore IDA as a possible cause of stroke should be studied. So,the present study is undertaken to establish an association between iron deficiency anaemia and cerebrovascular episodes and to show the relation of severity of anaemia and ischemic stroke.

## II. Methodology

This is a hospital based prospective study. Patients of all age group and both sexes admitted with diagnosis of acute ischemic stroke were included in the study.

Previously diagnosed cases of sickle cell anaemia and other haemoglobinopathies were excluded from the study. Clinical details were taken to know the associated co-morbid conditions like hypertension, Diabetes, Chronic heart disease,Hyperlipidemia etc. Blood samples were collected for various haematological tests to establish the diagnosis of iron deficiency anaemia. Various investigations were, complete blood count: Hb, PCV, MCV, MCH, MCHC, RDW, platelet count, peripheral smear examination for red cell morphology and serum ferritin levels wherever possible.

## III. Observations And Results

Total 50 patients of Ischemic stroke were studied.

Sex-Out of 50, 39 were male and 11 were female.

Age-39 patients were more than 50 years of age while 11 patients were less than 50 years. Mean age was 57.55 years. Youngest patient being 30 years of age.

Co-morbid conditions-Out of 50 cases 10 patients were hypertensive, 8 patients were diabetic.

Haemoglobin levels-

Out of 39 male patients, 9 had Hb% within normal range

30 patients had Hb% below normal range--16 patients with Hb <11gm%

14 patients with Hb between 11-13 gm%

Mean Hb was 11.204gm%

Out of 11 female patients, 4 had Hb within normal range

7 patients had Hb <11.5 gm%-----

2 patients had Hb <11gm%

5 patients had Hb <10gm%

Mean Hb was 10.554gm%

Out of 50 cases of ischemic stroke, 37 patients were anaemic -Hb % less than normal range {Male-13-18gm% and female-11.5-16.5gm% }

Out of 37 anaemic cases, 16 cases had mild anaemia and 21 cases had moderate anaemia.

**MCV**—Normal range—75-100cu microns

Out of 50 cases: 10(20%) had MCV <75 cu microns (Indicating microcytic RBCs )

40 (80%) had MCV within normal range

**MCHC and MCH** —Normal range MCHC—31-38% & MCH-25-35 pgm

20 patients (40%) had decreased MCH & MCHC (indicating hypochromia)

**RDW**—Normal range—11.5-16.5%

16 patients (32%) had RDW>16.5 % (indicating variation in size in favor of iron deficiency anaemia)

**P.S.**- 10 patients(20%) showed microcytic hypochromic RBCs

**Serum Ferritin levels** - In only 32 cases serum ferritin levels were estimated. In only 8 cases it is below normal range From the above observations it can be stated that there is strong association between Iron deficiency anaemia and Ischemic stroke. Further, chances of stroke increases with increasing severity of anaemia.

#### **IV. Discussion**

WHO clinically defines stroke as the rapid development of clinical signs and symptoms of a focal neurological disturbance lasting more than 24 hours or leading to death with no apparent cause other than vascular origin<sup>3</sup>. The effect of stroke depends on the site and severity of brain injury. This severity hampers the quality of life of stroke patients and also affects family and care givers. Global stroke estimates show that 16 million new acute stroke cases are seen every year<sup>3</sup>. In developed countries majority of the stroke cases are seen above the age of 65 years<sup>4</sup>. However it is found that the average age of patients with stroke in developing countries is 15 years younger than that in developed countries<sup>3</sup>. This is found to be consistent with our study in which 22% of cases were below 50 years of age and the youngest patient belong to 30 years of age . Mean age was found to be 57.4 years.

The ICMR estimates in 2004 indicated that stroke contributed 41% of deaths and 72% of disability adjusted life years, amongst the non communicable diseases<sup>3</sup>.

These statistics are abnormally high. It has also been seen worldwide over the last four decades, the annual age standardized stroke incidence rate has decreased by 1.1% in high income countries but has increased by 5.3% in low to middle income countries<sup>3</sup>. This necessitates the need to look for risk factors other than already established risk factors like hypertension, diabetes, cardiovascular diseases, hyperlipidemia etc. This is necessary to bring down the incidence of stroke.

Anaemia is the most common disorder of the blood and was known to be an important risk factor for cardiovascular diseases and cerebrovascular accidents<sup>5</sup>. The sickle cell anaemia was reported to be highly associated with CVA. Despite many theories stating that decrease in haemoglobin might compromise the oxygen carrying ability of blood and subsequently increase the risk of cerebrovascular and cardiovascular diseases, very few studies were available to know the relationship between nonsickle cell anaemia and stroke.

Few cases of stroke have been reported to be associated with IDA in adults. But several reports have revealed that in paediatric population, the IDA seems to be most important contributing factor for stroke. In these studies authors found that children with IDA contributed for more than half of all stroke cases in children without underlying medical illness, suggesting IDA as a significant risk factor for stroke.

IDA is a commonest type of anaemia accounting for nearly half of all anaemia cases worldwide. Most of the patients with anaemia are asymptomatic, so that the true incidence might be higher than reported. Incidence of Iron deficiency anaemia is very high in developing countries .In a study conducted by Ramesh Chellan and Lopamudra Paul, results showed that more than 95% of children, adolescent girls and pregnant women suffer from anaemia<sup>3</sup>. The association of stroke and iron deficiency anaemia has been explained on the basis of three physiological mechanisms.

- 1) A hypercoagulable state
- 2) Thrombocytosis

### 3) Hypoxia

The possible reason for the IDA as a risk factor for stroke could be a decrease in haemoglobin level in the blood would compromise oxygen carrying ability of the blood flow resulting in low oxygen delivery to brain causing hypoxia and subsequently increase the risk of cerebrovascular or cardiovascular diseases.

Another possible mechanism that may explain the association between IDA and stroke is through the secondary thrombocytosis. This mechanism is supported by findings of association of thrombotic and embolic ischemic stroke with IDA. Cases of carotid thrombus associated with iron deficiency anaemia and thrombocytosis have been reported in adults<sup>3</sup>. Anaemic patients need more blood to flow to the brain to compensate for the lack of oxygen. Therefore increase in blood flow can cause endothelial damage, causing a cascade of thrombus formation(4).

In the study done by Dubyk et al, they supported the role of IDA as a risk factor for stroke in elderly patients<sup>7</sup>. In our study of 50 patients of stroke, 37 cases (74%) were anaemic and 21 cases (42%) had moderate degree of anaemia. Indicating that anaemia is also one of the contributing factor for stroke. The haematological parameters like MCV, MCH, MCHC were lower in 10 cases(20%) along with microcytic hypochromic picture on peripheral smear and lower ferritin levels indicating iron deficiency anaemia.

In 20% of cases only hypochromia was there (lower MCHC), indicating depletion of iron stores.

RDW was more than normal range in 32% of cases indicating findings more in favor of non sickle cell anaemia and other haemoglobinopathies.

This study thus suggested an association between IDA and ischemic stroke. Although there are various associated comorbid conditions with stroke, there is significant association between IDA and ischemic stroke particularly in younger age group.

Further, management of existing stroke cases with IDA, with proper correction therapy, will considerably improve the quality of these patients<sup>9,10</sup>.

A study conducted by Ellie Choi et al showed that blood transfusion may be considered as an adjuvant therapy in the treatment of stroke patients<sup>8</sup>. In the case presented by Preem J Mehta et al, the patient of ischemic stroke showed marked improvement after receiving blood transfusion<sup>5</sup>.

## V. Conclusion

From the present study it can be concluded that there is significant association between ischemic stroke and anaemia especially iron deficiency anaemia. However more studies should be conducted with larger sample size to establish a definite relationship between ischemic stroke and iron deficiency anaemia. Further early detection of anaemia will help to decrease the incidence of stroke cases. Patients found to have IDA should be more aggressively screened and managed for the possible underlying bleeding source and /or iron deficiency status, to reduce the risk of subsequent ischemic stroke.

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