

## Original Research Article

# A clinical study of factors predicting prognosis in acute ischemic stroke in a tertiary care center in north Kerala

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### ABSTRACT

**Background:** Stroke is the second most common cause of death and third most common cause of disability in the world. Knowledge of prognostic factors is necessary for the clinician to make a reasonable prediction of outcome for individual patients, to provide rational approach to management and to help patients and their families understand course of the disease. Hence, this study to determine the prognostic factors in acute ischemic stroke with special emphasis on atrial fibrillation, hyperglycemia and fever was undertaken.

**Methods:** This is a prospective and hospital based observational study of 70 patients with acute ischemic stroke. The diagnosis of acute ischemic stroke was based on history, physical examination and CT imaging. The severity was assessed based on Scandinavian Stroke Scale (SSS). The prognostic factors with special emphasis on atrial fibrillation, hyperglycemia and fever were studied based on the standard diagnostic criteria.

**Results:** Prevalence of Atrial Fibrillation was 20% in present study. Mortality and dependency rates were significantly higher in AF group. Fever during the first few days of acute ischemic stroke was a statistically significant predictor of poor outcome. Neuronal damage in brain is directly proportional to its temperature. The results of the study confirm that hyperglycemia at stroke onset is an adverse prognostic factor with 33.33% mortality in hyperglycemic stroke.

**Conclusions:** Atrial fibrillation, hyperglycemia and fever were found to be poor prognostic factors in acute ischemic stroke. Prompt recognition and correction of these poor prognostic factors improve the outcome for such patients.

**Keywords:** Acute ischemic stroke

### INTRODUCTION

Stroke or cerebrovascular accident is the abrupt onset of a neurologic deficit that is attributable to a focal vascular cause.<sup>1</sup> Acute ischemic stroke, a major subtype of acute stroke, occurs due to loss of blood supply to a part of the brain which initiates ischemic cascade due to free radical production and damage to endothelial lining. The high variability of the clinical presentation of stroke is because of the complex anatomy of the brain and its vasculature.

Stroke is the second most common cause of death and third most common cause of disability in the world. All over the world, the annual number of deaths due to stroke

has been estimated as 5.54 million.<sup>2</sup> Almost two thirds of the global burden of acute ischemic stroke is in developing countries.<sup>3</sup>

Stroke is one of the leading causes of death and disability in India with an incidence rate of 119-145/1,00,000.<sup>4</sup> In the period from 12 hours to seven days after ischemic stroke onset, many patients who are without complications experience moderate but steady improvement in neurologic impairments. The greatest proportion of recovery occurs in the first three to six months after stroke, with lesser improvements thereafter.<sup>5</sup> The estimated 30-day case fatality rate after first ischemic stroke ranges from 16 to 23 percent. Available data

suggest that persistent neurologic deficits observed at six months after stroke include hemiparesis and cognitive deficits in 40 to 50 percent of patients, and hemianopia, aphasia, or sensory deficits in 15 to 20 percent. Disability outcomes at six months after stroke include depression, inability to walk unassisted, and social impairments in approximately 30 percent, and institutional care in approximately 25 percent.

Considering the long-term neurological disabilities which may result from acute stroke and differences in the extent of recovery among stroke survivors, predicting the outcomes of stroke is a very important issue. This prompted attempts to define variables that can be used for prognostication. Therefore, we have assessed the patients at the time of hospitalization with some other prognostic factors besides the preliminary physical and neurological examinations in order to investigate their neurological status in relation to these factors. Information on survival after stroke as well as data on those factors that determine a high or low likelihood of recovery helps to identify those patients who may benefit more than others from specific medical treatment and rehabilitation services.

## METHODS

This study was a prospective hospital based cross sectional study conducted in patients diagnosed with acute ischemic stroke admitted in the ICU of academy of medical sciences, Pariyaram, Kannur, Kerala, India. 70 adult patients were studied during a period of twenty-nine months from January 2009. Patients with history of previous stroke were excluded. This study was conducted after obtaining permission from institutional ethics committee and the identity of the patients were not revealed.

The selected patients were thoroughly examined and were evaluated with Computed tomography (CT) of head, ECG and other relevant investigations. The diagnosis of acute ischemic stroke was based on history, clinical examination and CT imaging of brain. The severity was assessed based on Scandinavian stroke scale (SSS).<sup>6</sup> The prognostic factors with special emphasis on atrial fibrillation, hyperglycemia and fever were studied based on the standard diagnostic criteria. Detailed history, examination and investigation findings were recorded using a pretested questionnaire and data analyzed using statistical software, statistical package for social sciences (SPSS).

## RESULTS

The present analysis focused only on patients with first-ever acute ischemic stroke. Seventy cases have been registered between January 1, 2009 and May 31, 2011. The prognostic factors with special emphasis on atrial fibrillation, hyperglycemia and fever were studied based on the standard diagnostic criteria.

Out of the 70 patients studied whose age ranged from 40 to 79 years, 41 (58.6%) were males and 29 (41.4%) were females. 3 patients (4%) were aged between 40 and 49 years, 18 patients (25.7%) were aged between 50 and 59 years, 26 patients (37%) were aged between 60 and 69 years and 23 patients (33%) were aged between 70 and 79 years. Among the 70 patients, 14 patients had Atrial Fibrillation, 18 had hyperglycemia and 12 patients had fever.

**Table 1: Age distribution of atrial fibrillation.**

Age	Number of patients (n)	Percentage
40-49 years	2	14.4
50-59 years	4	28.8
60-69 years	6	43.2
70-79 years	2	14.4

**Table 2: Outcome of patients with stroke in atrial fibrillation.**

Outcome	Frequency (n)	Percentage
Alive	8	36.36
Expired	6	27.27
Totally disabled	6	27.27
Partially disabled	2	9.09

Out of the 14 patients with atrial fibrillation, 2 patients were in the age group of 40-49, 4 patients in the age group 50-59, 6 patients in the age group 60-69 and 2 patients were in the age group of 70-79. Out of the 14 patients (20%) presented with AF, 10 (71.4%) were known to have AF and 4 (28.5%) were diagnosed with AF during admission.

In comparison to the non-atrial fibrillation group the atrial fibrillation group had poorer survival and disabilities. Of the 14 patients with atrial fibrillation 6, (42.9%) expired in 30 days' time. Ischemic stroke increases the mortality rate in patients with atrial fibrillation. This effect persists well beyond the immediate period post stroke and is strongly associated with disability after stroke.

### Hyperglycemia

The objective of this study was to determine the correlation between hyperglycemia with length of hospital stay and functional outcomes in ischemic stroke patients.

In this study, those patients with admission glucose level of > 200 mg/dL were classified as 'hyperglycaemics'. Among the 70 patients, 18 patients were hyperglycaemic of which 12 (66.66) were men and 6 (33.3%) women.

Of the 18 patients with hyperglycemia it is found 6 patients expired, 6 patients were completely disabled 2 patients partially disabled and 6 patients recovered.

Hyperglycemia is found as an important factor affecting the prognosis of acute ischemic stroke. "Stress" hyperglycemia is associated with increased mortality and poor functional recovery in diabetic and nondiabetic patients after stroke.

**Table 3: Outcome of patients with hyperglycemia.**

Outcome	Frequency (n)	Percentage
Expired	6	18.75
Alive	12	37.5
Completely disabled	6	18.75
Partially disabled	2	6.25
Recovered	6	18.75

The higher cerebrovascular risk profile of subjects with diabetes mellitus emphasizes the importance of secondary prevention strategies with the aim to prevent a substantial number of these disabling strokes among patients with diabetes.

### Fever

Body temperature is found to be an important factor in prognosis of acute ischemic stroke. In this study an A.M. temperature of >37.2 degree Celsius (>98.9-degree Fahrenheit) or a P.M. temperature of >37.7 degree Celsius (> 99.9-degree Fahrenheit) would define a fever. Among the patients with fever there is no particular age correlation. Of the 12 patients with fever, 4 patients (33.33%) expired, 3 patients (25 %) completely disabled and 5 patients (41.7 %) partially disabled.

**Table 4: Outcome of patients with fever.**

Outcome	Frequency (n)	Percentage
Alive	8	66.66
Dead	4	33.3
Partially disabled	5	41.7
Totally disabled	3	25

Fever during the first few days of acute ischemic stroke was a statistically significant predictor of poor outcome. Neuronal damage in brain is directly proportional to its temperature. Thus, although a fever is considered to be a normal physiological defensive response to infection, inflammation, and several other conditions, avoiding fever and controlling the body temperature are necessary to prevent a worse outcome after cerebral ischemia.

## DISCUSSION

Stroke is a worldwide health problem and makes an important contribution to morbidity, mortality and disability in developed as well as developing countries.<sup>7</sup> A WHO Collaborative study in 12 countries showed stroke incidence rates ranged from 0.2 to 2.5 per 1000 population per year. The prevalence rate of stroke in

India is about 1.54 per 1000 and death rate about 0.6 per 1000. Though the prevalence of stroke is comparatively less in India than in developed countries, it is likely to increase proportionally with increase in life expectancy.<sup>8</sup>

The present study was done in the 70 Patients from department of Medicine, Pariyaram Medical College who were admitted to the ICU with acute ischemic stroke during the period from January 2009 to May 2011. There were 14 patients (20%) with atrial fibrillation during the period of study. Compared with patients without atrial fibrillation the atrial fibrillation group had poorer survival and more disabilities. Of the 14 patients with atrial fibrillation 6 expired in 30 days' time. This is in accordance with a similar study, The Copenhagen Stroke Study, where it was found that stroke in patients with AF is generally more severe and outcome markedly poorer than in patients in sinus rhythm.<sup>9</sup> In present study, of the 18 patients with hyperglycemia, it is found that 4 patients expired, 6 patients completely disabled, 2 patients partially disabled and 6 patients recovered in 14 days. Many studies in the past have shown that hyperglycemia is associated with poor prognosis in stroke patients. (Williams, Rotich et al. Baird, Parsons et al. Alvarez-Sabin, Molina et al.).<sup>10</sup>

A study conducted by Sagar Basu Etal which was published in Neurology Asia, revealed that stroke severity is directly related to hyperglycemia. In the above study twenty-one percent of patients who were not known diabetic was found to be hyperglycemic though their HBA1C level was normal. Eighty-nine percent of such patients died.<sup>11</sup> This rate was significantly higher than patients known to be diabetic with raised sugar and HBA1c level (26% patients, 12% mortality).

Acute hyperglycemia predicts increased risk of in-hospital mortality after ischemic stroke in nondiabetic patients and increased risk of poor functional recovery in nondiabetic stroke survivors.<sup>12</sup> In present study, of the 12 patients with fever, 4 patients expired, 3 patients completely disabled and 5 patients partially disabled. A Prospective Study "Fever in Acute Stroke Worsens Prognosis" by Giuseppe Azzimondi et al Concluded that fever in the first 7 days was an independent predictor of poor outcome during the first month after a stroke.<sup>13</sup>

The results of the study "Outcome and Prognosis after Ischemic Stroke" by Hashem S et al of Departments of Neurology, Cairo University revealed that fever had a linear negative correlation with the prognosis. Moreover, maximum temperature of at least 39.9°C was confirmed to be significantly related to a poor outcome, even without consideration of its cause.<sup>14</sup> For each 1°C increase in body temperature the relative risk of poor outcome (death or SSS score on discharge < 30 points) rose by 2.2(95%CL 1.4-3.5((P<0.002).

Fever is a frequent complication early after stroke and in the majority of cases; it can be explained by infection or

chemical aspiration pneumonia. In about half of the infected patients, infection was most probably acquired before stroke. Therefore, in patients with acute ischemic stroke, aggressive measures to prevent and treat fever could improve the clinical outcomes (“Effect of Fever on Prognosis after Acute Ischemic Stroke”: Saini M et al.<sup>15</sup>

WHO Collaborative study showed that both in developed and developing countries nearly 1/3<sup>rd</sup> stroke patients died within 3 weeks and 48 % died within 1 year. In present study the unfavorable prognostic factors were atrial fibrillation, hyperglycemia and fever.

## CONCLUSION

In present study we observed that atrial fibrillation, hyperglycemia and fever were found to be poor prognostic factors in acute ischemic stroke. Prompt recognition and correction of these poor prognostic factors improve the outcome for such patients.

Also, the higher cerebrovascular risk profile of subjects with diabetes mellitus emphasizes the importance of secondary prevention strategies with the aim to prevent a substantial number of these disabling strokes among patients with diabetes. Thus, it also helps formulate secondary prevention strategies.

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