

## Original Research Article

# Prediabetes, dyslipidemia and c-reactive protein levels among stroke patients: a hospital-based study in north-east India

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### ABSTRACT

**Background:** Stroke is defined as an abrupt onset of a neurologic deficit lasting for more than 24 hours that is attributable to a focal vascular cause. Hyperglycemia and dyslipidemia are often documented in stroke patients. Elevated CRP level is independently associated with the excessive risk of ischemic stroke. Aim and Objectives were to evaluate the glycemic status, lipid profile and c-reactive protein level in stroke patients admitted in a teaching institute of north-east India.

**Methods:** A cross-sectional hospital-based study conducted in the department of medicine, Agartala Government Medical College and GBP hospital, within a period of January 2020 to June 2021. Data were analyzed by SPSS software version 15 using appropriate statistical tests.

**Results:** Among 200 patients of stroke, 50% was found to be pre-diabetic, 40% known diabetic and 10% newly diagnosed diabetic. 60% were hypertensives. Among them, 80% had ischaemic stroke and 20% hemorrhagic stroke. 70% of the patients had hypercholesterolemia, 60% had hypertriglyceridemia. 80% had raised serum LDL and 57% decreased serum HDL. Out of 200 patients, 60% was found to have raised serum CRP level. 55% of ischaemic stroke patients and 5% of hemorrhagic stroke patients had raised CRP level.

**Conclusions:** Prediabetes and newly diagnosed diabetes are highly prevalent in patients with stroke or TIA. As the prevalence of prediabetes is growing rapidly, prediabetes might become one of the most important modifiable therapeutic targets in both primary and secondary prevention. Early detection of dyslipidemia and treatment with drugs along with dietary modifications and lifestyle changes can reduce the risk of stroke. Since, it was a cross-sectional study, these results need to be validated by further long-term prospective studies.

**Keywords:** C-reactive protein, High density lipoprotein, Low density lipoprotein, Prediabetes

### INTRODUCTION

Stroke is the second leading cause of death worldwide. While stroke has grown in incidence worldwide, it is declining among the affluent and rising among those with less access to medical care.<sup>1</sup> Hyperglycemia and dyslipidemia are some of the metabolic abnormalities that are often documented in stroke patients.<sup>2</sup> Zhang et al in their study stated that abnormal glucose regulation, including prediabetes and diabetes doubles the risk of ischemic stroke and worsens survival of patients with

acute stroke. Previous studies showed that about one-third of ischemic stroke patients had prediabetes, and 17.5% to 37.5% of stroke patients without a history of diabetes had unrecognized newly diagnosed diabetes.<sup>3</sup> Susanne Fonville mentioned that the prevalence of prediabetes in previously nondiabetic patients with a recent stroke ranges from 23 to 53%. Prediabetes seems to be a modest predictor for stroke, but doubles the risk for recurrent stroke.<sup>4</sup> Dyslipidemia is a risk factor for atherosclerosis and the main predictor of cardiovascular diseases including stroke. The anti-inflammatory and

antioxidant properties of HDL may reduce the risk of thrombosis by inhibition of LDL oxidation, expression of adhesion molecules, platelet activation and aggregation. Increased TG levels, particularly with low HDL and high LDL level increases the risk of stroke. It was found that carotid intima-media thickness positively associated with increased LDL-C.<sup>5</sup> The prevalence of high CRP level was highest in patients with cardioembolic stroke 83.3%, followed by large artery atherosclerosis 72%, small artery disease 50%, stroke of other determined etiology 40%, stroke of undetermined etiology 49%.<sup>6</sup> A strong and persistent inflammatory response, indicated by raised CRP is associated with a worse outcome. A meta-analysis suggested that elevated baseline CRP levels are independently associated with excessive ischemic stroke risk.<sup>7</sup> Furthermore, the increased levels correlated with larger infarct and bleed, severe neurological deficit, and worse outcome.<sup>8</sup>

**METHODS**

It was a descriptive type of cross sectional hospital-based study.

**Study duration**

This study was completed within two years of time duration (January 2020 to June 2021).

**Study population**

Patients, both male and female, showing clinical and radiological evidence of stroke, both ischemic and hemorrhagic stroke admitted in the department of medicine, Agartala Government Medical College and GBP hospital, subject to the criteria’s mentioned below, were included in the study.

**Sampling technique**

Census sampling was used for the study. As it was decided to include all the stroke patients who were admitted during this period.

**Inclusion criteria**

All the patients with first episode of stroke confirmed by imaging included in the study.

**Exclusion criteria**

Space occupying lesions, cerebral venous thrombosis, transient ischemic attack, patients with recurrent cerebrovascular accident, stroke mimics, acute infection, patients who refuse to give consent.

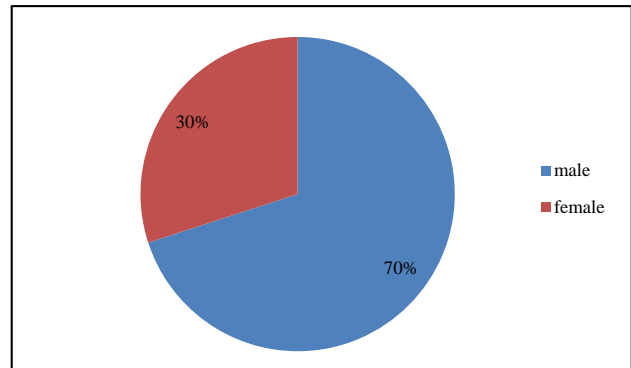
**Method of data collection**

All the patients were personally subjected to detailed history and physical examination. Required investigations

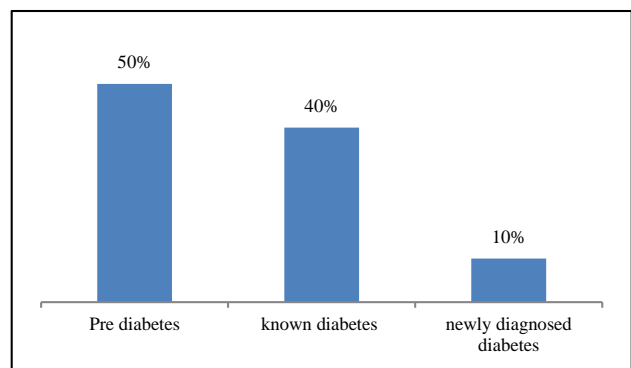
were undertaken immediately after admission. Consent for collecting the required data taken. A pre structured proforma used to record the relevant information from each individual subjects selected for the study.

**RESULTS**

Male preponderance was found (70%) in this study.

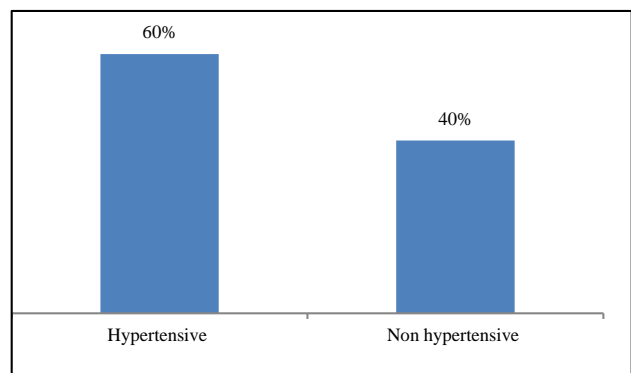


**Figure 1: Gender-wise distribution of stroke patients.**



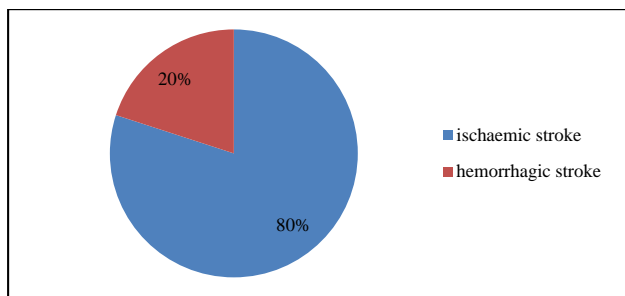
**Figure 2: Glycemic status among stroke patients.**

50% (n=100) was found to be pre-diabetic, 40% (n=80) known diabetic and 10% (n=20) newly diagnosed diabetes.



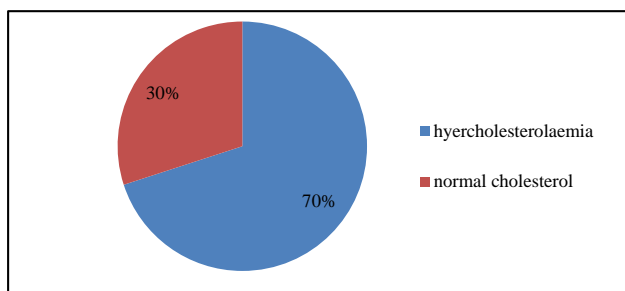
**Figure 3: Distribution of hypertension among stroke patients.**

60% of the patients were hypertensives.



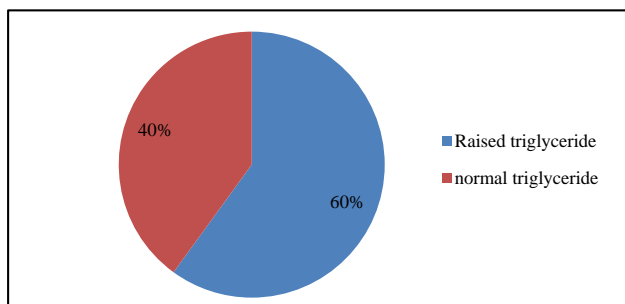
**Figure 4: Distribution of stroke.**

80% (n=160) was found to have ischaemic stroke and 20% (n=40) was found to have hemorrhagic stroke.



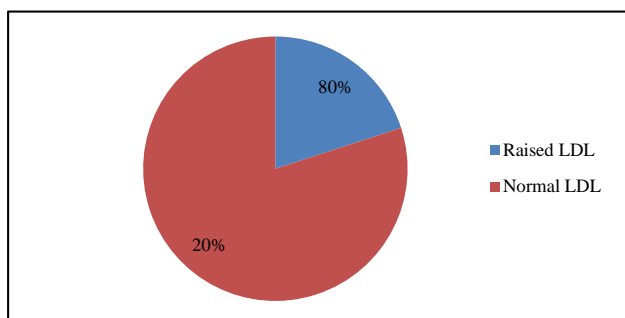
**Figure 5: Distribution of cholesterol level among stroke patients.**

70% (n=140) had hypercholesterolemia.



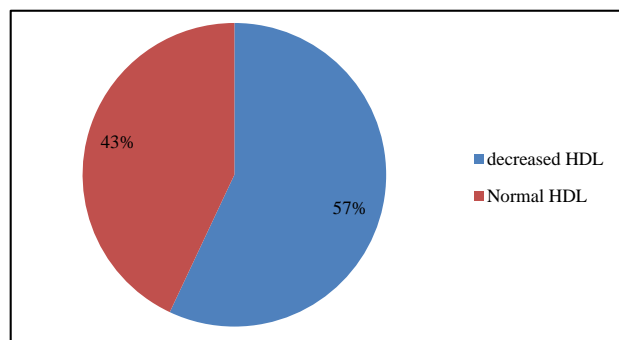
**Figure 6: Distribution of triglyceride level among stroke patients.**

60% of the stroke patients had hypertriglyceridemia



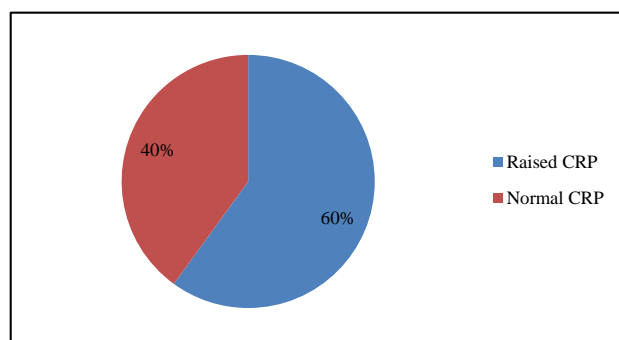
**Figure 7: Distribution of LDL level among stroke patients.**

80% of the patients was found to have raised LDL levels.



**Figure 8: Distribution of HDL-C level among stroke patients.**

43% of the stroke patients was found to have decreased HDL level.



**Figure 9: Distribution of CRP level among stroke patients.**

Among 200 patients of stroke, 60% (n=120) was found to have raised serum CRP and 40% (n=80) was found to be normal. 55% of ischaemic stroke patients had raised CRP and 5% of hemorrhagic stroke patients had raised CRP levels.

**DISCUSSION**

This cross-sectional study was conducted in a tertiary care centre of north-eastern region, to see the glycemic status, proportion of prediabetes and dyslipidemia and c-reactive protein levels among patients admitted with stroke. 200 of such stroke patients were taken as samples for this study. Male preponderance was found, which was

similar to the study conducted by Jeyaraj et al.<sup>9</sup> Among 200 patients, 50% was found to be pre-diabetic, 40% known diabetic and 10% newly diagnosed diabetes. Patients with ischemic stroke had more often prediabetes and newly diagnosed diabetes compared with patients with hemorrhagic stroke. Susanne et al study showed 52% as prediabetics and 27% as having newly diagnosed diabetes.<sup>4</sup> Among 200 patients, 160 had ischaemic stroke and 40 patients were found to have hemorrhagic stroke. 140 patients had hypercholesterolemia and among them 85.7% suffered from ischaemic stroke, whereas 14.3% had hemorrhagic stroke. A statistically positive correlation (0.000) was found between serum total cholesterol and stroke. 120 patients had hypertriglyceridemia, of which 83.3% of cases suffered from ischaemic stroke, whereas 16.7% had hemorrhagic stroke. A statistically positive correlation (0.005) was found between serum triglyceride and stroke. Ayeskanta et al study revealed similar findings.<sup>10</sup> 160 patients had elevated serum LDL, of whom 87.5% cases suffered from ischaemic stroke, where as 12.5% had hemorrhagic stroke. A statistically positive correlation (0.000) was found between serum LDL and stroke. 55% of ischaemic stroke patients and 5% of hemorrhagic stroke patients had raised CRP. A statistically positive correlation (0.005) was found between CRP and stroke. Chaudhuri et al showed that high CRP level is strongly associated with acute ischemic stroke.<sup>11</sup>

In the course of the study, various literatures from different authors across the globe were referred to. Since, it was a cross-sectional study, these results need to be validated by further long-term prospective studies with a larger number of study sample.

## CONCLUSION

Prediabetes and newly diagnosed diabetes are highly prevalent in patients with stroke or TIA.

The most effective prediabetes and diabetes mellitus prevention is based on healthy way of life. Everyone including children are encouraged to perform moderate physical activity and maintain a normal healthy weight. As the prevalence of prediabetes is growing rapidly, prediabetes might become one of the most important modifiable therapeutic targets in both primary and secondary prevention. Therefore, routine screening of prediabetes and newly diagnosed diabetes mellitus is recommended, and the treatment of prediabetes should be included into the future updating of the guidelines for the prevention of stroke. Dyslipidemia is one of the major risk factors for stroke. Thus, early detection of dyslipidemia and treatment with drugs along with dietary modifications and lifestyle changes can reduce the risk of stroke. Guided by personal experience and expert opinions and guidelines, we think that the best approach is personalized medical approach with the emphasis on prevention.

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*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee of Agartala Government Medical College*

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