

Serum Glucose Levels as an Independent Predictor of Outcome in Acute Ischemic Stroke

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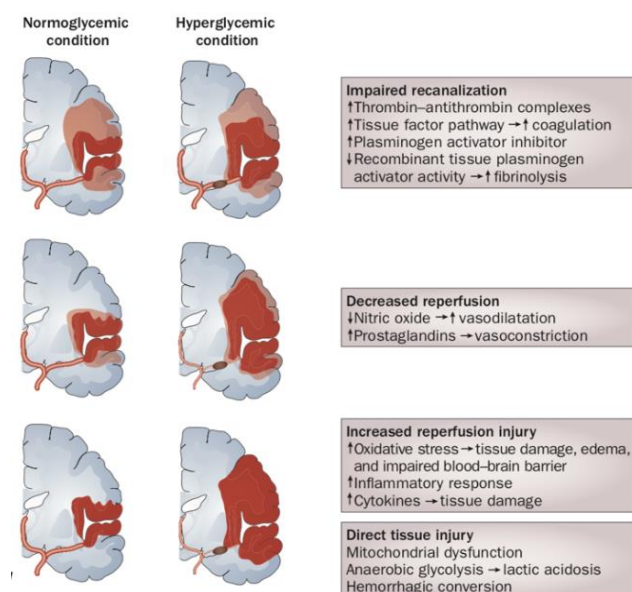
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Abstract: *Diabetes potentiates stroke by favouring thrombosis by increasing prothrombotic factors like fibrinogen and von Willebrand factor, and also increases platelet adhesiveness. There is a decreased fibrinolytic capacity due to increased concentration of plasminogen activator inhibitor type 1. In the present study, we found that hyperglycaemia at the time of presentation with AIS conferred a worse prognosis. Hence Plasma Glucose levels can be used as marker of investigation and helps in management and future therapeutic approaches.*

Keywords: Modified Rankin Scale (MRS), Acute Ischemic Stroke (AIS), Capillary Blood Glucose (CBG)

1. Introduction

World Health Organization defines the clinical syndrome of stroke as rapidly developing clinical signs of focal or global disturbance of cerebral function with symptoms lasting 24 hours or longer, with no apparent cause other than vascular origin. Diabetes potentiates stroke by favouring thrombosis by increasing prothrombotic factors like fibrinogen and von Willebrand factor, and also increases platelet adhesiveness and Increasing Reperfusion injury by increasing oxidative stress and cytokines



Mechanism of Hyperglycaemia aggravating cerebral damage in ischemic stroke

a) **Study Design:** Prospective longitudinal observational study

b) **Sample Size:** 50 patients

c) **Sampling Method:** Convenience sampling

d) **Duration of Study:** From August 2022 to May 2023.

e) **Inclusion Criteria:** Patients who presented with AIS within 24hrs of symptom onset and has blood glucose measured at presentation.

f) **Exclusion Criteria:**

- Haemorrhagic stroke
- Recurrent stroke

g) **Statistical Analysis:** SPSS (Statistical Package for Social Sciences) version 20. (IBM SPASS statistics [IBM corp. released 2011] was used to perform the statistical analysis. Descriptive statistics of the explanatory and outcome variables were calculated.

h) **Study Design:**

- Patients presenting with AIS within 24hrs confirmed by CT/MRI.
- Glycemic status (CBG on admission)
- Neurological status (NIH STROKE SCALE)
- Patients were stratified into normoglycemia (CBG<140mg/dl) and hyperglycemia (CBG>140mg/dl) subdivided into those with and without prior history of diabetes.

Table 3.2. National Institutes of Health Stroke Scale (maximum = 42)

Response	(Score)	Response	(Score)
Level of consciousness		Motor arm (left and right)	
alert	(0)	no drift	(0)
drowsy	(1)	drift before 10 seconds	(1)
stuporous	(2)	falls before 10 seconds	(2)
coma	(3)	no effort against gravity	(3)
		no movement	(4)
Response to level of consciousness questions*		Motor leg (left and right)	
answers both correctly	(0)	no drift	(0)
answers one correctly	(1)	drift before 5-10 seconds	(1)
answers neither correctly	(2)	falls before 5-10 seconds	(2)
		no effort against gravity	(3)
		no movement	(4)
Response to level of consciousness commands†		Ataxia	
obeys both correctly	(0)	absent	(0)
obeys one correctly	(1)	one limb	(1)
obeys neither	(2)	two limbs	(2)
Pupillary response		Sensory	
both reactive	(0)	normal	(0)
one reactive	(1)	mild	(1)
neither reactive	(2)	severe loss	(2)
Gaze		Language	
normal	(0)	normal	(0)
partial gaze palsy	(1)	mild aphasia	(1)
total gaze palsy	(2)	severe aphasia	(2)
		mute or global aphasia	(3)
Visual fields		Facial palsy	
no visual loss	(0)	normal	(0)
partial hemianopsia	(1)	minor paralysis	(1)
complete hemianopsia	(2)	partial paralysis	(2)
bilateral hemianopsia	(3)	complete paralysis	(3)
Dysarthria		Extinction/inattention	
normal	(0)	normal	(0)
mild	(1)	mild	(1)
severe	(2)	severe	(2)

* Level of consciousness questions: "How old are you?" "What month is this?"
 † Level of consciousness commands: "Squeeze my hand" (using nonparetic hand), "Close your eyes."

≤4 = Good prognosis -- No tPA 4-20 = mild to moderate - ideal tPA >20 = severe deficit --No tPA

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

Modified Rankin Scale (MRS)

- 0 No symptoms
- 1 No significant disability, despite symptoms; able to perform all usual duties and activities
- 2 Slight disability; unable to perform all previous activities but able to look after own affairs without assistance
- 3 Moderate disability; requires some help, but able to walk without assistance
- 4 Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
- 5 Severe disability; bedridden, incontinent, and requires constant nursing care and attention
- 6 Death

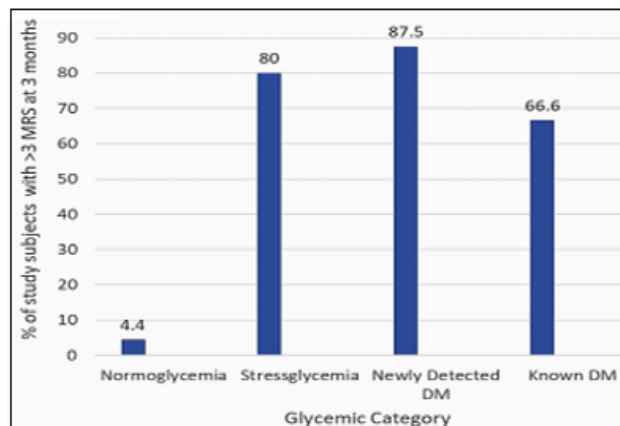
MRS 0 - 3: Good outcome

MRS 4 - 6: Poor outcome

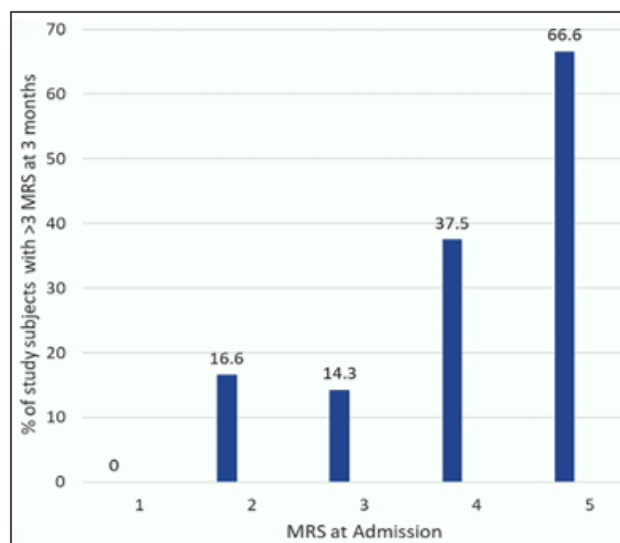
2. Observation and Results

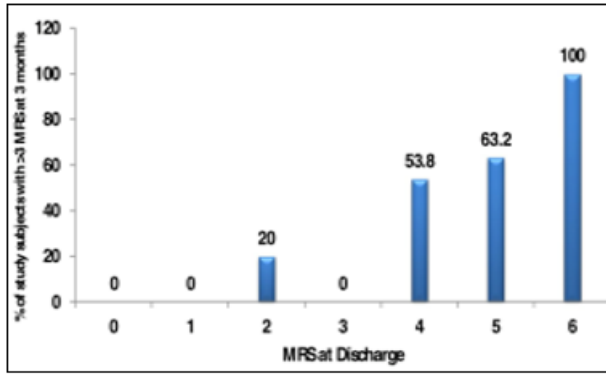
	Stroke severity after 3 months	P value			
		≤3 (27)		>3 (23)	
		n	%	n	%
Glycaemic severity at presentation	≤140	22	95.7	1	4.3
	>140	5	18.5	22	81.5

	Stroke severity after 3 months	P value			
		≤3 (27)		>3 (23)	
		n	%	n	%
Glycaemic category	Normoglycemia	22	95.6	1	4.4
	Stress glycemia	2	20	8	80
	Newly detected DM	1	12.5	7	87.5
	Known DM	3	33.3	6	66.7



	Stroke severity after 3 months	P value			
		≤3 (27)		>3 (23)	
		n	%	n	%
MRS Score at admission	1	2	100	0	0
	2	5	83.3	1	16.6
	3	6	85.7	1	14.3
	4	5	62.5	3	37.5
	5	9	33.3	18	66.6
MRS Score at discharge	0	1	100	0	0
	1	6	100	0	0
	2	4	80	1	20
	3	3	100	0	0
	4	6	46.2	7	53.8
	5	7	36.8	12	63.2
6	0	0	3	100	





3. Discussion

In the present study, we found that hyperglycaemia at the time of presentation with AIS conferred a worse prognosis. In this study the patients with hyperglycaemia had significantly more severe strokes (MRS>3), and the association with increased risk for death persisted even after adjustment for confounding factors. In our study we further subdivided our patients and found that it is the patients with hyperglycaemia without history of DM have relatively worse prognosis. Pre-conditioning by chronic elevated blood sugar levels may offset adverse metabolic effects, which may influence prognosis in non-diabetics. Certain medications that diabetics are frequently prescribed such as statins and antiplatelet agents some way confer a protective effect. Whether early intervention with measures to aggressively control blood glucose levels in these patients may favourably influence their clinical course awaits clarification from randomized clinical trials. However, restoration of normoglycemia as soon as possible should be encouraged, although conclusive evidence of decreased risk with this approach is lacking.

4. Conclusion

A capillary blood glucose concentration above 140mg/dl at acute ischaemic stroke predicts higher mortality and morbidity.

Patients with hyperglycaemia at stroke onset, without prior history of DM have particularly poor prognosis, than that of patients with known diabetes.

5. Future Scope

There are only a few reports on the association of hyperglycaemia with acute ischemic stroke. Ongoing research and interdisciplinary collaboration will be instrumental in improving the management and prevention of Acute Ischemic Stroke.

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