Insulin resistance and clinical outcomes after acute ischemic stroke

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Introduction & Objective

Poor glycemic control before stroke onset was associated with unfavorable functional outcomes independent of blood glucose levels in patients with acute ischemic stroke. However, it is unknown which mechanisms contribute to this association. This study aimed to determine **whether homeostasis model assessment of insulin resistance (HOMA-IR), a marker for insulin resistance, is associated with clinical outcomes after acute ischemic stroke.**

The Fukuoka Stroke Registry

Methods

<Participants>

Participants were **4655 patients** with acute ischemic stroke (age 70.3 ± 12.5 years; 63.5% men) who had been independent before admission, were registered from April 2009 to March 2015, and did not receive insulin therapy during hospitalization.

<HOMA-IR score> $\frac{\text{fasting glucose (mU/L)} \times \text{fasting insulin (mg/dl)}}{405}$

<Study outcomes>

Neurologic improvement:

≥ 4-point decrease in the NIHSS score during hospitalization or an NIHSS score of 0 at discharge.

Neurologic worsening:

≥2-point increase in NIHSS score hospitalization compared with the NIHSS score on admission.

Poor functional outcome at 3 months:

functional dependency (mRS score of 3–5) or death (mRS score of 6) at 3 months.

Results

Table. Baseline characteristics of patients according to HOMA-IR score

	Q1 (≤0.94) n=939	Q2 (0.95–1.39) n=930	Q3 (1.40–2.00) n=938	Q4 (2.01–3.13) n=922	Q5 (≥3.14) n=926	P for trend
Age, years	72.7±11.7	71.0±12.0	69.1±12.9	69.3±12.6	69.4±12.6	<0.001
Men, n (%)	628 (66.9)	588 (63.2)	584 (62.3)	579 (62.8)	575 (62.1)	0.04
Risk factors, n (%)						
Hypertension	702 (74.8)	712 (76.6)	710 (75.7)	760 (82.4)	762 (82.3)	<0.001
Dyslipidemia	376 (40.0)	486 (52.3)	503 (53.6)	541 (58.7)	560 (60.5)	<0.001
Diabetes mellitus	108 (11.5)	134 (14.4)	157 (16.8)	188 (20.4)	251 (27.1)	<0.001
Atrial fibrillation	285 (30.4)	217 (23.3)	189 (20.2)	168 (18.2)	221 (23.9)	<0.001
Previous stroke, n (%)	108 (11.5)	118 (12.7)	101 (10.8)	110 (11.9)	110 (11.9)	1.00
Cardioembolic stroke, n (%)	244 (26.0)	192 (20.7)	181 (19.3)	153 (16.6)	191 (20.6)	<0.001
NIHSS score on admission	3 (1–5)	2 (1–4)	2 (1–4)	2 (1–4)	3 (1–7)	0.03
Reperfusion therapy, n (%)	100 (10.7)	69 (7.4)	70 (7.5)	74 (8.0)	87 (9.4)	0.50
Glucose metabolism						
Body mass index, kg/m ²	21.0±2.8	22.5±2.9	23.4±3.3	24.1±3.3	24.7±4.1	<0.001
Obesity, n (%)	73 (7.8)	171 (18.4)	259 (27.6)	336 (36.4)	413 (44.6)	<0.001
Fasting blood glucose, mg/dL	91.7±12.5	98.1±13.6	102.9±16.9	108.0±19.1	129.7±33.2	<0.001
Immunoreactive insulin, mU/L	3.06±1.18	4.91±0.77	6.77±1.15	9.60±1.76	21.03±18.37	<0.001

Figure. HOMA-IR score and clinical outcomes

Discussion

Insulin resistance

- prevent recovery from the ischemic insult and subsequently worsens the functional outcome after acute ischemic stroke.

- ✓ Pro-inflammatory cytokines may enhance local inflammatory and prothrombotic responses.
- ✓ Insulin resistance may lead to impaired circulation in the ischemic penumbra.
- ✓ Insufficient insulin action can cause catabolism in muscles, including paralyzed muscles.

Conclusion

Insulin resistance is associated with poor functional outcome in patients with acute ischemic stroke. These findings shed new light on insulin resistance as a therapeutic target in improving functional outcomes after acute ischemic stroke.

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