Acute Illness with Extreme Hyperglycemia

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Objectives:

To evaluate correlations between plasma glucose to glycated hemoglobin ratio (GAR) and clinical outcomes during acute illness.

Methods:

This is a retrospective, observational cohort study. We enrolled six hundred and sixty-one patients who visited the emergency department of our hospital between July 1, 2008 and September 30, 2010 with a plasma glucose concentration >500 mg/dL. Systolic blood pressure, heart rate, plasma glucose, white blood cell, neutrophil, hematocrit, blood urea nitrogen, serum creatinine, liver function, and plasma glucose concentration were recorded at the initial presentation to the emergency department. Data on glycated hemoglobin over the preceding 6 months were reviewed from our database. Glucose to HbA1C ratio (GAR) was calculated as the plasma glucose concentration divided by glycated hemoglobin.

Factors associated with 90-day all-cause mortality by Cox regression analysis

<table>
<thead>
<tr>
<th>Factor</th>
<th>HR (95% CI) per 1-SD increase</th>
<th>p value</th>
<th>Adjusted HR (95% CI) per 1-SD increase</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAR</td>
<td>1.41 (1.22-1.63)</td>
<td>&lt;0.001</td>
<td>1.29 (1.05-1.57)</td>
<td>0.013</td>
</tr>
<tr>
<td>Age</td>
<td>1.55 (1.20-2.01)</td>
<td>0.001</td>
<td>1.63 (1.20-2.22)</td>
<td>0.002</td>
</tr>
<tr>
<td>Plasma glucose</td>
<td>0.89 (0.70-1.13)</td>
<td>0.328</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>SBP</td>
<td>0.45 (0.28-0.70)</td>
<td>0.001</td>
<td>0.70 (0.44-1.12)</td>
<td>0.132</td>
</tr>
<tr>
<td>Serum creatinine</td>
<td>1.19 (1.05-1.35)</td>
<td>0.005</td>
<td>1.15 (0.93-1.43)</td>
<td>0.206</td>
</tr>
<tr>
<td>Hct</td>
<td>0.63 (0.52-0.77)</td>
<td>&lt;0.001</td>
<td>0.71 (0.56-0.91)</td>
<td>0.006</td>
</tr>
<tr>
<td>Platelet</td>
<td>0.76 (0.60-0.97)</td>
<td>0.003</td>
<td>0.87 (0.69-1.10)</td>
<td>0.251</td>
</tr>
<tr>
<td>ANC</td>
<td>1.29 (1.09-1.53)</td>
<td>0.003</td>
<td>1.05 (0.84-1.30)</td>
<td>0.678</td>
</tr>
<tr>
<td>CRP</td>
<td>1.41 (1.20-1.65)</td>
<td>&lt;0.001</td>
<td>1.31 (1.06-1.62)</td>
<td>0.013</td>
</tr>
</tbody>
</table>

Results:

The GAR of those who died was significantly higher than in the survivors (81.0 ± 25.9 vs. 67.6 ± 25.0, p < 0.001). There was a trend toward a higher 90-day mortality rate in the patients with a higher GAR (log-rank test for trend p < 0.0001). In multivariable Cox regression analysis, GAR was significantly related to 90-day mortality (hazard ratio [HR] 1.41, 95% confidence interval [CI]: 1.22-1.63, p < 0.001), but not plasma glucose (HR: 0.89, 95% CI: 0.70-1.13, p = 0.328). The rates of intensive care unit admission and mechanical ventilator use were also higher in those with a higher GAR.

Conclusions:

GAR independently predicted 90-day mortality, intensive care unit admission, and use of mechanical ventilator. It was a better predictor of patient outcomes than plasma glucose in patients with extremely high glucose levels.

References:

[27] Cohen J, Roth V, Albert E, Chimnath S, Sassen S. The rates of hyperglycemia and oxidative stress in the rise and collapse of the normal oxidative and anti-oxidative mechanisms against vascular endothelial cell dysfunction in diabetes. Arch Physiol Biochem. 2007; 113: 259-267