Post-mortem Glycosylated Hemoglobin (HbA₁c): Evidence for a History of Diabetes Mellitus*

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ABSTRACT

Glycosylated hemoglobin (HbA₁c) levels on blood obtained from 28 cadavers were compared with that of healthy volunteers and patients with diabetes mellitus. Levels of HbA₁c did not correlate with post-mortem intervals of four to 36 hours, suggesting that HbA₁c is stable under these conditions. All deceased with a history of diabetes mellitus, five cases, had an elevated post-mortem blood HbA₁c. Twenty-three deceased had a negative history for diabetes mellitus and seven of this group had an elevated HbA₁c. These seven cases had diagnosis of malignancies and a history of prolonged exposure to steroids in excess compared to the remaining 16 cases.

Introduction

Post-mortem blood glucose concentrations are affected by glycogen degradation and glycolysis that occurs during the post-mortem interval. Also, complications such as shock subsequent to myocardial infarction and asphyxia may be associated with hyperglycemia. As a result, the post-mortem blood glucose level is not reliable for the diagnosis of a previous history of diabetes mellitus. Glycosylated hemoglobin, HbA₁c, is not subject to rapid fluctuations and is therefore employed in the assessment of diabetic control. Because of this apparent stability of HbA₁c, its use in the diagnosis of diabetes mellitus in post-mortem blood was suggested.

Deceased and Patients

The 28 deceased studied had been inpatients at the University of Chicago Hospital and Clinics. Postmortem dissection was performed four to 36 hrs following death. The time from death to dissection and specimen collection is referred to as the post-mortem interval. Normal healthy volunteers (n, 44) served as controls. Results on 92 diabetic pa-

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Patients are included to serve as a comparison.

**Methods**

Post-mortem blood was obtained from the left subclavian vein. Determinations of HbA1c on healthy volunteers, patients, and deceased were performed by modification of a previously described method. Groups were compared by the Wilcoxon rank sum test.

**Results**

Post-mortem HbA1c levels plotted against the post-mortem interval are shown in figure 1. Levels of HbA1c of healthy volunteers (controls), diabetic patients, and deceased are shown in figure 2. All five deceased with a history of diabetes mellitus had elevated HbA1c levels compared to nondiabetic deceased, (p < 0.05) and included three with the highest values found in the study of deceased. In table I are given details on deceased with a history of diabetes mellitus. There were 23 deceased with no history of diabetes mellitus, and seven of these had HbA1c levels more than two standard deviations above the mean of healthy normal controls. Data on their illnesses are in table II and that on the remaining nondiabetics are in table III.

**Discussion**

The affect of the post-mortem interval on the HbA1c level was not studied with serial post-mortem samples. However, comparing HbA1c levels of deceased with their post-mortem interval showed little correlation (r = −0.143) indicating that a post-mortem interval of four to 36 hrs has little obvious affect on the glycosylation of hemoglobin. All five deceased with a history of diabetes mellitus had an increased HbA1c, three with values that could be expected in patients with poorly controlled diabetes mellitus. The mean HbA1c value of deceased without a his-
Deceased with a History of Diabetes Mellitus

<table>
<thead>
<tr>
<th>Case Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>83</td>
<td>32</td>
<td>49</td>
<td>16</td>
<td>66</td>
</tr>
<tr>
<td>Sex</td>
<td>F</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>F</td>
</tr>
<tr>
<td>HbA\textsubscript{1c}: thiobarbituric acid (TBA) color - A443 nm/10 mg hemolysate hemoglobin</td>
<td>0.201</td>
<td>0.271</td>
<td>0.244</td>
<td>0.206</td>
<td>0.206</td>
</tr>
<tr>
<td>Post-mortem interval (hours)</td>
<td>6.5</td>
<td>16.9</td>
<td>24.5</td>
<td>5.8</td>
<td>21</td>
</tr>
<tr>
<td>Renal involvement</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Cause of death</td>
<td>Cancer</td>
<td>Post-operative cardiac failure</td>
<td>Carcinomatosis</td>
<td>Wegener's granulomatosis</td>
<td>Myocardial infarction + Fungal infection</td>
</tr>
</tbody>
</table>

The ante-mortem blood glucose levels in some were within the normal range whereas in others there was some increase. These findings were not dissimilar from those without documented evidence of treatment with steroids but with an elevated HbA\textsubscript{1c} (table II).

**Conclusions**

A post-mortem interval ranging from four to 36 hrs appears to have little effect on HbA\textsubscript{1c}. Although the number of cases studied is small, the results indicate that a markedly elevated post-mortem HbA\textsubscript{1c} is strong evidence for a history of diabetes mellitus. A moderate increase in the glycosylated hemoglobin concentration was found in some cases with a his-
tory of diabetes mellitus but also in some without. In these latter cases, steroids may have been a contributing factor to a prolonged elevated blood glucose level.

References