Variations in Levels of Transaminases and Lactic Dehydrogenase in Bank Blood

Leonard V. Crowley*

Results of the assay of transaminases and lactic dehydrogenase in blood, proposed as a screening procedure for subclinical hepatitis in blood donors, show that the method of sampling influences the analytic results. Determinations of GOT and GPT may prove useful if made on specimens separated from cells soon after collection. Plasma in contact with cells from blood preserved in acid citrate dextrose solution appears to yield good results up to 21 days. Lactic-dehydrogenase levels are of limited value for this screening.

Attempts have been made to detect asymptomatic carriers of homologous serum jaundice virus by using a variety of liver-function tests on blood collected from donors (1, 2). Levels of glutamic oxal-acetic transaminase (GOT), glutamic pyruvic transaminase (GPT), and lactic dehydrogenase (LDH) are elevated in liver disease, and the determination of GOT levels on donor blood specimens has been proposed recently as a screening test to detect carriers of homologous serum hepatitis. It has been shown that the incidence of homologous serum disease was higher in patients who received blood with high GOT levels than in a control group who received blood with normal levels of this enzyme (3).

In view of the possible usefulness of enzyme determinations as screening tests to detect carriers of homologous serum hepatitis, a study was undertaken to analyze the factors which might influence the levels of GOT, GPT, and LDH in pilot tubes and citrated blood. Colorimetric methods of analysis were employed, since the methodology of such procedures could be adapted to automation techniques applicable to the screening of large numbers of blood specimens.

From the Department of Pathology, College of Medicine, University of Vermont, and The Vermont-New Hampshire Red Cross Regional Blood Center, Burlington, Vt.
Received for publication Sept. 25, 1961.
*Present address: St. Mary's Hospital, 2414 Seventh St. South, Minneapolis 6, Minn.
Materials and Methods

Tests were conducted on 25 U. of blood obtained from healthy volunteer blood-donors from the Red Cross Regional Blood Center; 2 pilot tubes accompanied each unit. All blood was kept under constant refrigeration. The serum was separated from 1 pilot tube within 24 hours after collection; cells and serum remained in contact in the second pilot tube throughout the period of study. Under aseptic conditions, a sample of citrated whole blood was removed from each unit within 24 hours after collection. The plasma was then separated from the cells and used for analysis. Samples of well-mixed citrated blood were also periodically aspirated from each unit under aseptic conditions and the plasma which had been in contact with the cells for variable periods of time was separated from the cells and used for analysis.

GOT, GPT, and LDH levels were determined within 24 hours after collection and at 7, 14, and 21 days on serum from pilot tubes, on acid-citrate-dextrose (ACD) plasma separated from cells within 24 hours, and on serum and ACD plasma allowed to remain in continuous contact with cells. Determinations of the levels of free hemoglobin in serum and plasma in contact with cells were also performed at similar intervals. GOT and GPT levels were determined by the method of Reitman and Frankel (4); LDH levels by the method of Cabaud and Wroblewski (5), and the amount of plasma hemoglobin, by the method of Fielding and Langley (6).

Results

There was a progressive rise in free hemoglobin in both serum and citrated plasma which had remained in contact with cells, and at the end of 21 days the majority of the serum specimens showed visible hemolysis.

No changes were observed in the mean levels of GOT and GPT in serum or plasma which had been separated from the cells within 24 hours after collection. In contrast, the levels of these enzymes in serum which had remained in contact with cells, in the pilot tubes, showed a progressive elevation. The mean levels of both enzymes at 21 days were approximately 5 times the initial mean values. However, no changes were observed in the levels of either GOT or GPT in citrated plasma which had been stored in continuous contact with cells, probably because of the better preservation of red cells in the ACD solution.
Levels of LDH rose progressively in both serum and citrated plasma which had remained in contact with red cells during storage. The degree of elevation was most marked in the serum samples, apparently because of the greater degree of hemolysis in the serum specimens in comparison with the citrated-plasma samples. LDH activity in both serum and plasma specimens which had been separated promptly from the red cells tended to show some decline after prolonged storage, indicating some instability of the enzyme. Mean changes in enzyme levels of GOT, GPT, and LDH in relation to time and method of handling are indicated in Table 1.

Table 1. Mean Changes in GOT, GPT, and LDH Levels in Pilot Tubes and ACD Plasma Under Various Conditions of Storage

<table>
<thead>
<tr>
<th>Enzyme</th>
<th>Level in serum</th>
<th>Level in ACD-plasma</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial 7 days</td>
<td>14 days 21 days</td>
</tr>
<tr>
<td>GOT, cells not separated</td>
<td>17 28 34 99</td>
<td>24 17 19 19</td>
</tr>
<tr>
<td>GOT, cells separated</td>
<td>17 15 19 13</td>
<td>24 16 19 21</td>
</tr>
<tr>
<td>GPT, cells not separated</td>
<td>10 19 28 62</td>
<td>14 11 9 10</td>
</tr>
<tr>
<td>GPT, cells separated</td>
<td>10 9 9 10</td>
<td>14 10 9 15</td>
</tr>
<tr>
<td>LDH, cells not separated</td>
<td>323 371 494 1158</td>
<td>318 479 725 861</td>
</tr>
<tr>
<td>LDH, cells separated</td>
<td>319 333 201 220</td>
<td>318 353 365 285</td>
</tr>
</tbody>
</table>

Discussion

Bang and associates (3), in a study of GOT levels as a screening test for blood donors, noted that 9% of donor blood specimens had abnormal GOT levels when determinations were performed shortly after collection, while abnormally high GOT levels were present in almost 50% of specimens not tested until 2 weeks after collection. In our study, the degree of elevation of GOT appeared to be related directly to the duration of contact between cells and serum prior to analysis. Similar progressive increases were observed in levels of GPT and LDH. The over-all incidence of 23% for abnormally high GOT levels in 13,266 blood specimens reported by Bang and associates was related to the varying ages of the specimens and the manner of handling, rather than indicative of latent liver-disease in the blood donors.

Determination of GOT or GPT may eventually prove useful for evaluating the presence of subclinical liver-disease in prospective blood donors. However, these tests should be performed on serum which has been separated from cells soon after collection, because of
the variation of enzyme levels related to the time that cells and serum remain in contact. Since there is no elevation of enzyme levels in acid-citrate-dextrose plasma stored in contact with cells, the levels of these enzymes in plasma aspirated from the unit at any time up to the date of expiration appear to be comparable to levels in fresh serum.

In contrast to the potential usefulness of transaminase determinations in blood-donor screening, LDH determinations appear of limited value because of the marked changes in enzyme levels resulting from hemolysis, and because of some instability of the enzyme on storage.

References