Serum Cholinesterase in Analbuminemia

A. A. Dietz, H. M. Rubinstein, and T. Lubrano

Serum cholinesterase activity was found to be normal in persons with analbuminemia. This finding disproves previous speculations that there is some intimate connection between the hepatic biosynthesis of albumin and serum cholinesterase.

Several suggestions have been made to explain the parallelism between serum cholinesterase and serum albumin levels in chronic liver disease—first recognized by Faber (1), and since, by many others—and the moderate fall in serum cholinesterase found to occur in normal persons after the infusion of albumin (2). Kunkel and Ward (3) suggested that a normal serum albumin level was needed for the synthesis of cholinesterase to proceed normally. Vorhaus and Kark (2) concluded that there was an intimate relationship between the biosyntheses of both proteins.

An obvious test of these explanations is offered by analbuminemia. Bennhold et al. (4) mention in passing that their first patient with analbuminemia had a normal serum cholinesterase level. We have had the opportunity to measure serum cholinesterase activity in 2 additional patients with this hereditary disorder, and we also find the levels to be normal.

In J. L., the patient described by Shetlar et al. (5) and by Waldmann et al. (6), the serum specimen was drawn when the albumin concentration was less than 0.1 gm./100 ml. by paper electrophoresis (5), although at other times values as high as 0.3 gm./100 ml. were noted (6). In G. M., the patient described by Gordon et al. (7) and by Bartter et al. (8), the serum sample was drawn after treatment with intravenous albumin, when the distribution of serum proteins was normal by paper electrophoresis.

The results of serum cholinesterase determinations are shown in Table 1. Both samples had normal cholinesterase activity with acetyl-
Table 1. Serum Cholinesterase Activity (Acetylcholinesterase) of Analbuminemia Serums (μ mole/ml/hr.)

<table>
<thead>
<tr>
<th>Patient</th>
<th>Activity</th>
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<tr>
<td>Normal</td>
<td>149 ± 33</td>
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<tr>
<td>J. L.</td>
<td>153</td>
</tr>
<tr>
<td>G. M.</td>
<td>127</td>
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The method used was that of Rubinstein and Dietz (11).

choline as substrate. In Fig. 1, the protein and cholinesterase patterns on acrylamide gel electrophoresis are shown with those of a normal serum. The serum samples were stained for cholinesterase by the method of Bernsohn et al. (9). The distribution of the cholinesterase isozymes was normal in both cases. J. L.'s serum showed a small amount of protein in the albumin region, in a doublet configuration. The distribution of the other serum protein components seems to be normal.

The protein distribution pattern of G. M.'s serum was normal except for a larger-than-normal postalbumin fraction migrating at the same rate as Cholinesterase Isozyme 1. The bulk of the albumin present must be attributed to the intravenously administered albumin. Since albumin used in therapy does not contain cholinesterase, the cholinesterase in this patient's serum must have been produced endogenously.

![Fig 1. Results of disc electrophoresis of serum samples stained for cholinesterase and for protein. In each case, sample stained for protein is on left; for cholinesterase, on right.](image-url)
The demonstration that patients with analbuminemia can have normal serum cholinesterase activity proves that the biosynthetic mechanisms for the two proteins are entirely distinct and that normal serum albumin levels are not necessary for synthesis of cholinesterase. The parallelism between albumin and cholinesterase serum levels said to exist in liver disease must be attributed entirely to damage of the hepatic parenchymal cells with impairment of the synthesis of both proteins. In this connection, Wetstone and LaMotta (10) have recently reported an extensive statistical study of this supposed relation, and find the correlation to be much poorer than heretofore supposed.

Addendum

Another check of the relation between biosynthesis of these two proteins is offered by patients with hereditary absence of serum cholinesterase. We recently encountered such a patient (L.C.), and found that her serum albumin was normal (Dietz, A. A., Lubrano, T., and Rubinstein, H. M., Four families segregating for the silent gene for serum cholinesterase. Acta Genet. Stat. Med. In press.). She had a serum cholinesterase level of 3 μ mole/ml./hr., and her serum albumin was 4.2 gm./100 ml. These results reinforce the conclusion reached above that the synthesis of serum albumin and serum cholinesterase are unrelated.

References