Changes in Blood Serum Protein Fractions as Indicators of the Course of Inflammatory Processes

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The nature of the changes in protein fractions of blood serum as indicators of the course of inflammatory processes has not as yet been adequately studied.

Since there are references in the literature to the influence of inflammatory processes on the interrelations of serum protein fractions as revealed by electrophoretic separation [2, 3, 5, 6] this method was adopted for the present study of the proteinograms of those patients in whom a brief exudative inflammatory reaction could be expected to arise in connection with therapeutic measures. With this aim in view a survey was made of patients with pulmonary tuberculosis; these were subdivided into the following two groups, depending on the therapy received:

1. Patients who had been subjected to surgical intervention accompanied by inflammatory reaction of traumatic origin.
2. Patients treated with tuberculin which can cause focal reaction.

Experimental Methods

The total amount of protein was determined by an immersion refractometer; the ratio of protein fractions by paper electrophoresis. Separation of the serum was carried out in the A. E. Gurvich [1] electrophoretic chamber over a period of 16 hours, on paper soaked in Veronal-Medinal buffer (pH 8.6, ionic strength 0.1) at constant current of 250 v and 0.1 mA per 1 cm of paper width. The paper strips were stained with bromophenol blue. Measurements of the electrophoregram were made in the specially constructed apparatus for direct photometry [4].

Table 1.

Percentage Content of Protein Fractions in the Blood Serum of Healthy Subjects

<table>
<thead>
<tr>
<th></th>
<th>γ</th>
<th>α1</th>
<th>α2</th>
<th>Albumins</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>16.5</td>
<td>13.0</td>
<td>8.5</td>
<td>4.3</td>
</tr>
<tr>
<td>±/±</td>
<td>±2.1</td>
<td>±1.8</td>
<td>±1.0</td>
<td>±0.9</td>
</tr>
</tbody>
</table>

Studies on the blood serum protein fractions in the patients were preceded by similar studies on 20 healthy subjects. The following data were obtained as the result of these studies; calculations were performed by the variation method (Table 1).
These data served as a certain standard with which the changes in protein composition of blood serum in the patients could be compared.

**EXPERIMENTAL RESULTS**

The first group of patients was made up of 21 persons aged 16 to 40 years. They were subdivided according to the form of illness as follows: infiltrative pulmonary tuberculosis — 5 patients, focal — 3, chronic hematogenic-disseminated — 2 and chronic fibrous-cavernous — 11. Four patients had been subjected to thoracocauterization, 13 to extrapleural pneumolysis, one to conservative resection of the pulmonary lesion and three to lobectomy.

Blood for investigation was taken 3 times: prior to operation, on the 4th postoperative day and after disappearance of postoperative inflammatory changes. Development of unfavorable postoperative complications occurred in 2 patients. In one of them the last proteinogram determination was carried out shortly before death.

Table 2 reflects the dynamics of the protein composition of blood serum in all the patients under observation.

Data from 4 and 5 graphs enabled us to summarize the obtained material as follows (Table 3).

As Tables 2 and 3 show, in 17 patients there was a decrease in the amount of total protein as compared to preoperative values; in 3 patients it remained unchanged and in one there was an increase. In 16 of the 21 patients studied diminution of γ-globulin content occurred and only in five this fraction showed a slight rise. Concurrently with this there was an increase of total α-globulin in all patients, of α2-globulin in 20 and α1-globulin in 16. Concentration of albumin was decreased in all 21 patients. Changes in the β-globulin content varied: increases and decreases of this fraction were noted in an equal number of cases.

Thus the changes in protein values of blood serum in patients with pulmonary tuberculosis following operative intervention were characterized by a certain decrease in the concentration of total protein and of its γ-globulin and albumin fractions and an increase in α-globulins at the expense of α2-globulin first of all.

Examination of the differences in the changes of the protein composition of serum associated with different operations revealed the following:

a) the least marked changes were seen after cauterization of pleural adhesions complicated by transient mild pneumopleurisy, and after segmental resection and lobectomy without postoperative complications. The average increase in the α2-globulin level in this group of patients was 2.2% and the average reduction of albumins — 3.5%.

b) the most pronounced changes in the protein composition of the blood were seen in operated patients whose postoperative period following lobectomy was stormy and characterized by deterioration of the general condition, progressive course of the pulmonary process, development of empyema.

Clinical deterioration was accompanied by hypoproteinemia and a sharp fall in the albumin and γ-globulins levels with concurrent considerable increase in α-globulin content and moderate increase of β-globulin. The average increase in α2-globulin in this group of patients was 6.6% and the average decrease in albumins — 9.4%.

c) the changes in the protein composition of the blood following extrapleural pneumolysis were of the same character but not so pronounced, occupying an intermediate position between the two degrees mentioned above. The average increase in α2-globulin in this group was 4.2%, and the average reduction in albumins — 4.5%.

Changes in protein fractions were accompanied by formation of exudate in the extrapleural cavity, serous-hemorrhagic at first, then serous. These inflammatory changes resolved favorably.

The data obtained showed that various operative procedures on the thorax caused changes in the protein composition of the blood whose degree depended on the presence and extent of postoperative exudative inflammation of the tissues. The persistence of such changes with respect to the individual serum fractions as well as subsequent dynamics of these changes usually reflected the intensity and duration of the inflammatory reaction in the postoperative period. As the postoperative inflammatory manifestations settled down the changes in the protein composition of the blood associated with them also disappeared; the amount of α-globulins decreased while that of albumins and γ-globulin increased.