PROTEIN RELATIONSHIPS IN SERUM AND CAVITY FLUIDS

V. K. G. PILLAY, M.B., CH.B. (NATAL), *King Edward VIII Hospital and Department of Medicine, University of Natal*

Molecules of protein and water appear to move into and out of serous cavities very rapidly. It has been shown for example that approximately 40 - 80% of fluid enters and leaves the peritoneal cavity in an hour in cirrhosis of the liver with ascites.[1] As the serum proteins interchange rapidly with tissue proteins, maintaining a state of dynamic equilibrium,[2] it is reasonable to presume that some relationship exists between the concentration of proteins in the serum and in cavity fluids. A correlation has been found between the protein levels in the serum and in oedema fluid.[3] The present investigation was undertaken to ascertain the relationships of protein concentration in the serum and in inflammatory serous effusions.

Material and Methods

Patients with tuberculous pleural effusions (64 cases) and tuberculous peritonitis with ascites (20 cases) were selected for the study. Blood-stained or cloudy fluid was not accepted. Specimens of blood and of serous fluid were withdrawn from each patient at the same time and subjected to simultaneous electrophoresis as described by Joubert *et al.*[4] The significance of total protein concentrations that were evaluated in the same study has already been reported upon.[5]

Results

As the results are similar in the pleural and ascitic fluids they will be considered together as serous fluid. In the serous fluid, albumin and all the fractions of the globulins are present. The serum albumin is generally low (average 2·0 G. per 100 ml.) and the serum globulin is high (average 5·0 G. per 100 ml.)—observations that have frequently been made in the population group under study.[4,6,7] There is a linear correlation between the concentration of each protein fraction in the serum and serous fluids. This is well reflected in the correlation between each protein fraction in the serum and serous fluids, expressed as a percentage. An example of this correlation is shown in Fig. 1. The linear relationship is also evident in the A/G ratio of the proteins in the serum and serous fluids. Mean values of each protein fraction expressed as a percentage also show a close correlation (Table I). The mean value for the A/G ratio is also shown in the Table.

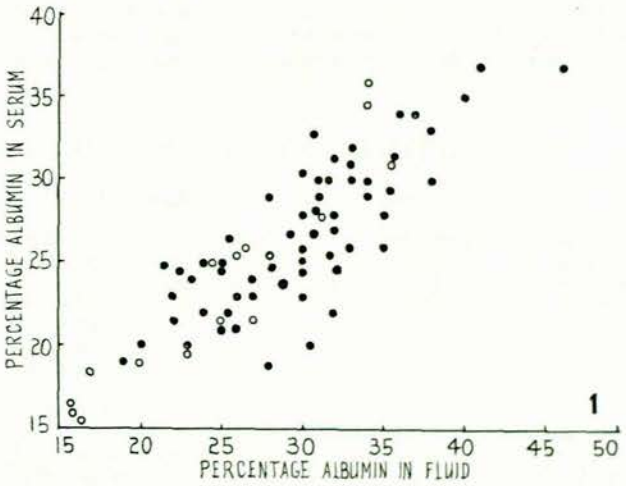

Fig. 1. Correlation between percentage of albumin in serum and in cavity fluids. Black circles=tuberculous pleural effusion. White circles=tuberculous peritonitis.

TABLE I. MEAN VALUES OF THE PERCENTAGE PROTEIN FRACTIONS IN THE SERUM AND SEROUS FLUID

	Serum	*Pleural and ascitic fluid*
Albumin/globulin ratio	0·39 : 1	0·43 : 1
Albumin (%)	28·0	30·0
α_1 Globulin (%)	9·3	9·0
α_2 Globulin (%)	15·7	13·0
β Globulin (%)	17·6	17·0
γ Globulin (%)	29·4	31·0

Discussion

Studies of protein movement between the serum and partition fluids have been made by a number of workers. Antonaci and Macagnino[3] report the results of electrophoretic studies of serum and oedema fluid. Their results indicate, among other things, a parallelism between the serum level of each single protein fraction and their level in the oedema fluid. Freeman and Joekes[8] used paper electrophoresis for a comparative study of protein patterns of serum, urine and oedema fluid in various pathological conditions. They found the albumin percentage of the total protein in the urine and oedema fluid higher than in the serum. Abbas and Tovey[9] used paper electrophoresis to determine the protein pattern in amniotic fluid, maternal serum and umbilical-cord blood in order to trace the possible source, nature and function of the protein in the liquor amnii. They found that the protein pattern in the liquor amnii has the characteristics of a simple protein dialysate. McKie *et al.*[10] demonstrated experimentally the participation of both albumin and globulin in the interchange of total plasma proteins between the blood and ascitic fluid. They present evidence that the movement of albumin across the peritoneal membrane is at least 3 times as fast as that of globulin in terms of weight. The present study confirms the close correlation between the concentration of the various protein fractions in the serum and serous fluids.

SUMMARY

The relationship of the concentration of the protein fractions in the serum and serous fluids was determined in 84 patients by paper electrophoresis. A linear correlation was found for the concentration of all the protein fractions as well as when expressed as a percentage.

I should like to thank Prof. E. B. Adams and Prof. J. V. O. Reid for helpful criticism, and Dr. S. M. Joubert and the Department of Chemical Pathology for the electrophoretic studies; and also the Superintendent of King Edward VIII Hospital, Dr. T. M. Adnams, for permission to publish.

REFERENCES

1. Prentice, T. C., Siri, W. and Joiner, E. E. (1952): Amer. J. Med., **13**, 668.
2. Weil, P. G. (1959): *The Plasma Proteins—Clinical Significance*. Philadelphia: Lippincott.
3. Antonaci, B. L. and Macagnino, G. (1957): Acta med. scand., **159**, 133.
4. Joubert, S. M., Hookins, K. W. and Hunter, W. G. (1959): S. Afr. J. Lab. Clin. Med., **5**, 1.
5. Pillay, V. K. G. (1963): S. Afr. Med. J., **37**, 379.
6. Powell, S. J. (1958): S. Afr. J. Lab. Clin. Med., **4**, 273.
7. Abramson, J. H., Gampel, B., Scotch, N. and Slome, C. (1960): Brit. J. Prev. Soc. Med., **14**, 190.
8. Freeman, T. and Joekes, A. M. (1957): Acta med. scand., **157**, 43.
9. Abbas, T. M. and Tovey, J. E. (1960): Brit. Med. J., **1**, 476.
10. McKie, F. W., Yuile, C. L., Lamson, B. G. and Whipple, G. H. (1952): J. Exp. Med., **95**, 161.