

Electrophoretic Pattern of Serum Proteins in Leprosy¹

R. K. Gupta, R. D. Mukheja, S. Gupta and K. C. Samuel²

Leprosy is known to have disequilibrium of serum proteins with alterations in serum albumin and globulin fractions (1,4). Various workers (2,4,6,7,8) have described changes in electrophoretically separable fractions of serum proteins in these patients, but their results are at variance. Thus, it was thought worthwhile to take up the study of electrophoretic patterns of serum proteins in various types of leprosy in order to establish a correlation between the type of leprosy and its serum protein electrophoretogram.

MATERIALS AND METHODS

Sixty-five patients having various types of leprosy (lepomatous 20, dimorphous 15, tuberculoid 22, and polyneuritic 8); and 20 healthy subjects of both sexes and similar age groups, belonging to similar geographical areas constituted the subject material for this study. The diagnosis of the type of leprosy was based on the clinical and bacteriologic features of the patients. Histopathologic confirmation was obtained whenever needed.

Serum was collected from these individuals and total serum protein levels were determined by the Biuret method. The sera were also subjected to paper electrophoresis, performed on Whatman filter paper No. 3 using barbitone buffer at pH 8.6. The quantitative measurement of the relative size of various protein fractions was done by elution with 0.01 N sodium hydroxide solution (10). The albumin/globulin ratio was also determined.

RESULTS

The values of total serum protein, concentration of various protein fractions by paper electrophoresis and albumin/globulin ratios on the sera of 20 healthy human subjects and 65 patients suffering from various types of leprosy are shown in Table 1.

Lepomatous leprosy (20 cases). The average duration of illness in these patients was 2.9 years. Thirty percent of these patients showed hyperproteinemia, but the rise was not statistically significant ($p > 0.05$). All except four cases had hypoalbuminemia. Alpha-1 and alpha-2 globulins were raised in seven and eight patients respectively, and four of these showed a rise of both alpha-1 and alpha-2 globulins. Beta globulins were not elevated in any of these patients. Half of these had hypergammaglobulinemia. It was, however, interesting to note that 3 of 20 patients having lepomatous leprosy showed an abnormal protein band between beta and gamma globulin fractions; the concentration of this band was 3.3% to 10.3% of total proteins. The albumin/globulin ratio in these patients showed about twice as much globulin as albumin.

Dimorphous leprosy (15 cases). The average duration of illness in these patients was 2.9 years. Seven of fifteen had some degree of hyperproteinemia, but the rise was not statistically significant ($p > 0.05$). Eight of these patients showed hypoalbuminemia. Alpha-1 globulin was elevated in three and alpha-2 in five. Beta globulin was within normal limits. Six of these patients showed hypergammaglobulinemia. The albumin/globulin ratio was 2:3, approximately.

Tuberculoid leprosy (22 cases). The average duration of illness in these patients was 1.3 years. Total serum proteins were within normal limits and the serum albumin was either within normal limits or slightly reduced. The alpha-1 globulin showed an insignificant rise in six and the alpha-2 globulin was raised in ten. Beta globulin showed a reduction in five. Gamma globulin showed an insignificant rise ($p > 0.05$) in five of these patients. The albumin/globulin ratio was 4:5.

Polyneuritic leprosy (8 cases). Average duration of illness in these patients was 1.8 years. Total serum proteins were within normal range in all. Only two had mild hypoalbuminemia. A slight rise in alpha-1, alpha-2 and gamma globulins was detected in 25%, but these differences were statistically insignificant.

¹ Received for publication 6 May 1975.

² R. K. Gupta, M.D., Reader in Pathology; R. D. Mukheja, M.D., Lecturer in Pathology; S. Gupta, M.D., Lecturer in Pathology; and K. C. Samuel, M.D., Professor of Pathology, M.L.B. Medical College, Jhansi (UP), India. Present address for Dr. Mukheja, B.R.D. Medical College, Gorakhpur (UP), India.

TABLE 1. *The level of total serum protein, concentration of various protein fractions on paper electrophoresis, and albumin/globulin ratio in healthy human subjects and patients of various types of leprosy.*

Group	No. cases	Total serum protein g%	Serum albumin %	Serum alpha-1 globulin %	Serum alpha-2 globulin %	Serum beta globulin %	Serum gamma globulin %	Albumin/globulin ratio (approx.)
Healthy subjects	20	7.95 ± 0.55 (6.8-8.8)	47.55 ± 3.60 (41.9-54.5)	6.24 ± 1.15 (4.8-8.5)	10.52 ± 1.54 (7.8-13.0)	14.15 ± 2.75 (10.2-18.5)	20.81 ± 3.03 (16.9-25.0)	4:5
Lepromatous leprosy ^a	20	8.04 ± 1.11 (6.0-10.0)	36.65* ± 2.67 (32.7-41.9)	7.33* ± 1.49 (3.5-11.4)	12.38* ± 3.33 (6.2-18.8)	13.25 ± 1.52 (8.4-15.0)	26.24* ± 5.08 (18.0-40.1)	4:7
Dimorphous leprosy	15	8.45 ± 1.29 (6.4-10.0)	39.08* ± 4.63 (33.3-53.2)	7.25* ± 1.62 (5.4-10.4)	11.90* ± 2.24 (8.3-15.2)	13.28 ± 1.88 (8.7-16.6)	23.36* ± 3.71 (18.8-37.7)	2:3
Tuberculoid leprosy	22	7.84 ± 1.10 (6.4-9.8)	44.00 ± 5.57 (37.0-52.5)	7.19 ± 2.30 (3.7-11.2)	13.21* ± 3.12 (7.0-18.0)	11.74* ± 2.46 (7.4-16.5)	22.70 ± 3.53 (14.1-28.3)	4:5
Polyneuritic leprosy	8	7.94 ± 0.73 (7.0-8.8)	46.61 ± 6.74 (38.1-55.5)	6.48 ± 2.62 (4.4-10.0)	11.56 ± 2.45 (9.1-15.5)	10.30* ± 2.54 (7.3-14.2)	22.19 ± 3.15 (18.5-27.3)	4:5

^a Three patients showed an abnormal protein.
*Starred figures are statistically significant.
Figures in parentheses give the range of the determinations.

nificant. Beta globulin showed a reduction in 50% of these patients. The albumin/globulin ratio was about 4:5.

DISCUSSION

The findings of the present study revealed that the values of total serum proteins and the concentration of various protein fractions as determined by paper electrophoresis in healthy human subjects are comparable to those found by other workers (2,4,8). The patients suffering from lepromatous leprosy showed an appreciable degree of dysproteinemia. Although a few of them showed apparent hyperproteinemia, the rise was statistically insignificant (p > 0.05). A significant observation in most of these patients was hypoalbuminemia, associated with a rise in serum alpha-1, alpha-2 and gamma globulins; often the rise involved more than one globulin component. Other workers (2,6-9) have also reported the occurrence of hypoalbuminemia and increases in various globulin fractions in such patients. We have, however, not observed any rise in beta globulin in any of these patients. Electrophoretograms of three of the lepromatous leprosy patients also showed an abnormal protein

band which was present between the beta and gamma globulin fractions. This was an unusual observation and has not been reported previously.

Pozzo and Felicite (5) reported variable biochemical changes in patients having dimorphous leprosy. Our studies suggest that the patients suffering from dimorphous leprosy show a definite protein disequilibrium with alterations in serum albumin and globulin fractions similar to that of lepromatous leprosy.

The patients suffering from tuberculoid leprosy do not show any significant changes in their total serum protein, serum albumin, alpha-1 and gamma globulin fractions. These findings are consistent with the observations of other workers (3,9). Some workers (1,4,8) have reported a rise in serum beta globulin without much change in alpha globulins in such patients. However, on the contrary, we have observed a rise in serum alpha-2 and a reduction in beta globulins in some of these patients. The patients suffering from polyneuritic leprosy did not show any significant protein disequilibrium except for a mild reduction in serum beta globulin in a few of them.

From this discussion it would appear that most of the patients suffering from various types of leprosy show some protein disequilibrium. However, these changes are not marked in tuberculoid and polyneuritic types of leprosy, while most of the patients suffering from lepromatous and dimorphous leprosy show a significant dysproteinemia which manifests as hypoalbuminemia together with rises in various globulin fractions. The hypoalbuminemia may be the result of impaired liver functions in these patients. The occurrence of hyperglobulinemia and presence of an abnormal protein band in three lepromatous patients may be attributed to the overactivity of the reticuloendothelial system in these patients associated with diminished cell-mediated immunity.

SUMMARY

Sera collected from 65 patients having various types of leprosy and 20 healthy human beings were studied for the determination of total serum proteins, paper electrophoresis for protein types and albumin/globulin ratios. Significant changes in protein equilibrium with the presence of hypoalbuminemia and increases in various globulin fractions (except beta globulin) were observed in patients having lepromatous and dimorphous leprosy. An abnormal protein band was also detected in 3 of 20 cases of lepromatous leprosy. The patients suffering from tuberculoid and polyneuritic leprosy did not show much protein disequilibrium except for mild rises in serum alpha-2 and reductions in serum beta globulins.

RESUMEN

En los sueros obtenidos de 65 pacientes con varios tipos de lepra y de 20 personas sanas, se determinaron la concentración de proteínas totales, el perfil electroforético de las diversas fracciones séricas, y se calculó la relación albúmina/globulina. Se encontraron alteraciones importantes en los sueros de los pacientes con lepra lepromatosa y dimorfa, con aumento en varias fracciones globulínicas (excepto en las beta globulinas) y presencia de hypoalbuminemia. En 3 de los 20 casos de lepra lepromatosa se observó además una banda protéica anormal. Los pacientes con lepra tuberculoide y polineurítica no presentaron alteraciones protéicas importantes, excepto por

un moderado aumento en la fracción de las alfa-2 globulinas y una reducción, también moderada, de las beta globulinas.

RÉSUMÉ

En vue de déterminer le contenu total en protéines sériques, ainsi que les profils électrophorétiques sur papier des différents types de protéines et les rapports albumine/globuline, on a récolté du sérum chez 65 malades atteints de divers types de lèpre et chez 20 personnes saines. Des modifications significatives dans l'équilibre protéinique, de même que la présence d'hypoalbuminémie et des augmentations de diverses fractions de globulines (sauf de la bêta-globuline) ont été relevées chez les malades souffrant de lèpre lépromateuse ou dimorphe. Une bande signalant la présence d'une protéine anormale a également été détectée chez 3 des 20 cas de lèpre lépromateuse. Les malades atteints de lèpre tuberculoïde ou polynévritique n'ont pas révélé de tels déséquilibres protéiniques, si ce n'est une légère augmentation de la protéine alpha-2 du sérum, et une réduction des globulines bêta.

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