Original Articles

SERUM PROTEIN ELECTROPHORESIS IN HEALTHY SUBJECTS AND PATIENTS WITH LIVER DISEASE

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Abstract

Serum protein electrophoresis was done in 82 healthy subjects and 294 patients with acute and chronic liver diseases. Lowest levels of total serum proteins and albumin and highest levels of gamma globulins were found in patients with cirrhosis. No remarkable alterations were observed in other hepatic disorders.

Introduction

Abnormalities in the albumin and globulin levels have been reported in patients with acute and chronic hepatitis and cirrhosis of the liver (Hobbs 1967). This study was planned to determine the normal protein levels in healthy adults and to ascertain its usefulness in the diagnosis of liver diseases.

Material and Method

The subjects for the study came from two groups. One group of 82 healthy adults and another group of 294 patients with acute and chronic liver diseases. Included in the latter group were 177 cases of acute viral hepatitis, 74 cases of cirrhosis, 11 with chronic hepatitis, 32 with obscure hepatopathy (unexplained hepatomegaly), 6 with idiopathic portal hypertension and 48 with miscellaneous hepatic disorders.

Liver function tests were done in all the subjects and the diagnosis of liver disease made on the clinical history and biochemical findings was confirmed by liver biopsy.

Protein electrophoresis was done using Beckman microzone apparatus and electrophoretograms were analysed by densitometery (Beckman 1965).

Results

Table I shows the confidence limits (Mean $\pm$ 2SD) of various protein fractions at 95% levels in 82 healthy adults.

The mean levels $\pm$SD $\pm$SE are shown in Table II. The lowest levels of total serum protein and albumin and the highest levels of gamma globulin were seen in patients with cirrhosis. Slight elevation of gamma globulin was observed in viral hepatitis and moderate elevation in miscellaneous liver disorders. No remarkable variations were seen in $Alpha_1$, $Alpha_2$ and Beta globulins.

Table I: Serum Protein Electrophoresis Confidence Limits

Protein fractions	*Confidence limits at 95% level* g/dl	*to*	g/dl
Total protein	5.950	—	8.810
Serum albumin	3.352	—	5.348
$Alpha_1$ Globulin	0.100	—	0.320
$Alpha_2$ Globulin	0.324	—	0.876
Beta Globulin	0.336	—	1.226
Gamma Globulin	0.750	—	2.110

Table II: Serum Protein Electrophoresis in Health and Disease

Groups studied (n)	*Total Protein Mean* $\pm$*S.D.* $\pm$*S.E.*	*Albumin* (g/dl) *Mean* $\pm$*S.D.* $\pm$*S.E.*	£1-*globulin* (g/dl) *Mean* $\pm$*S.D.* $\pm$*S.E.*	£2-*globulin* (g/dl) *Mean* $\pm$*S.D.* $\pm$*S.E.*	*B-globulin* (g/dl) *Mean* $\pm$*S.D.* $\pm$*S.E.*	8-*globulin* (g/dl) *Mean* $\pm$*S.D* $\pm$*S.E.*
Normal Controls (82)	7.38 0.715 $\pm$ 0.079	4.35 0.499 $\pm$ 0.055	0.21 0.055 $\pm$ 0.006	0.60 0.138 $\pm$ 0.015	0.80 0.232 $\pm$ 0.025	1.43 0.340 $\pm$ 0.037
Viral Hepatitis (177)	7.50 0.26 $\pm$ 0.02	3.88 0.12 $\pm$ 0.01	0.33 0.27 $\pm$ 0.02	0.64 0.26 $\pm$ 0.02	0.86 0.30 $\pm$ 0.22	1.72 0.73 $\pm$ 0.05
Cirrhosis (74)	7.2 0.27 $\pm$ 0.03	3.30 0.17 $\pm$ 0.02	0.29 0.27 $\pm$ 0.03	0.56 0.34 $\pm$ 0.04	0.82 0.37 $\pm$ 0.04	2.45 0.59 $\pm$ 0.07
Chronic Hepatitis (11)	7.81 0.41 $\pm$ 0.12	3.61 0.13 $\pm$ 0.04	0.32 0.50 $\pm$ 0.15	0.74 0.25 $\pm$ 0.08	1.02 0.45 $\pm$ 0.14	2.09 0.68 $\pm$ 0.20
Obscure Hepatopathy (32)	7.90 0.32 $\pm$ 0.06	4.05 0.10 $\pm$ 0.02	0.29 0.65 $\pm$ 0.12	0.69 0.30 $\pm$ 0.05	0.88 0.32 $\pm$ 0.05	1.74 0.43 $\pm$ 0.07
Idiopathic Portal Hypertension (6)	6.80 0.52 $\pm$ 0.21	3.78 0.16 $\pm$ 0.07	0.26 0.25 $\pm$ 0.11	0.61 0.28 $\pm$ 0.11	0.81 0.20 $\pm$ 0.08	1.34 0.37 $\pm$ 0.15
Other Liver Diseases (48)	7.41 0.29 $\pm$ 0.04	3.52 0.19 $\pm$ 0.03	0.33 0.35 $\pm$ 0.05	0.74 0.35 $\pm$ 0.05	0.87 0.33 $\pm$ 0.04	2.00 0.88 $\pm$ 0.13

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Discussion

Liver is the main site of protein synthesis therefore alterations in the electrophoretic analysis of proteins are likely to occur in patients with various hepatic disorders.

Fig. 1 shows the serum protein electrophoretic pattern in a healthy subject and Fig. 2 in a patient with acute viral hepatitis. No characteristic alterations have been observed in the levels of various protein fractions in viral hepatitis except an increase in gamma globulin level one or two weeks after the onset of illness. The increase in gamma globulin is due to slow gamma M globulin so no fusion of Beta and gamma globulins occurs (Hobbs 1967). This type of alterations are also seen in other infective conditions and may explain the elevated gamma globulin levels in patients with miscellaneous disorders which included some patients with cholangitis.

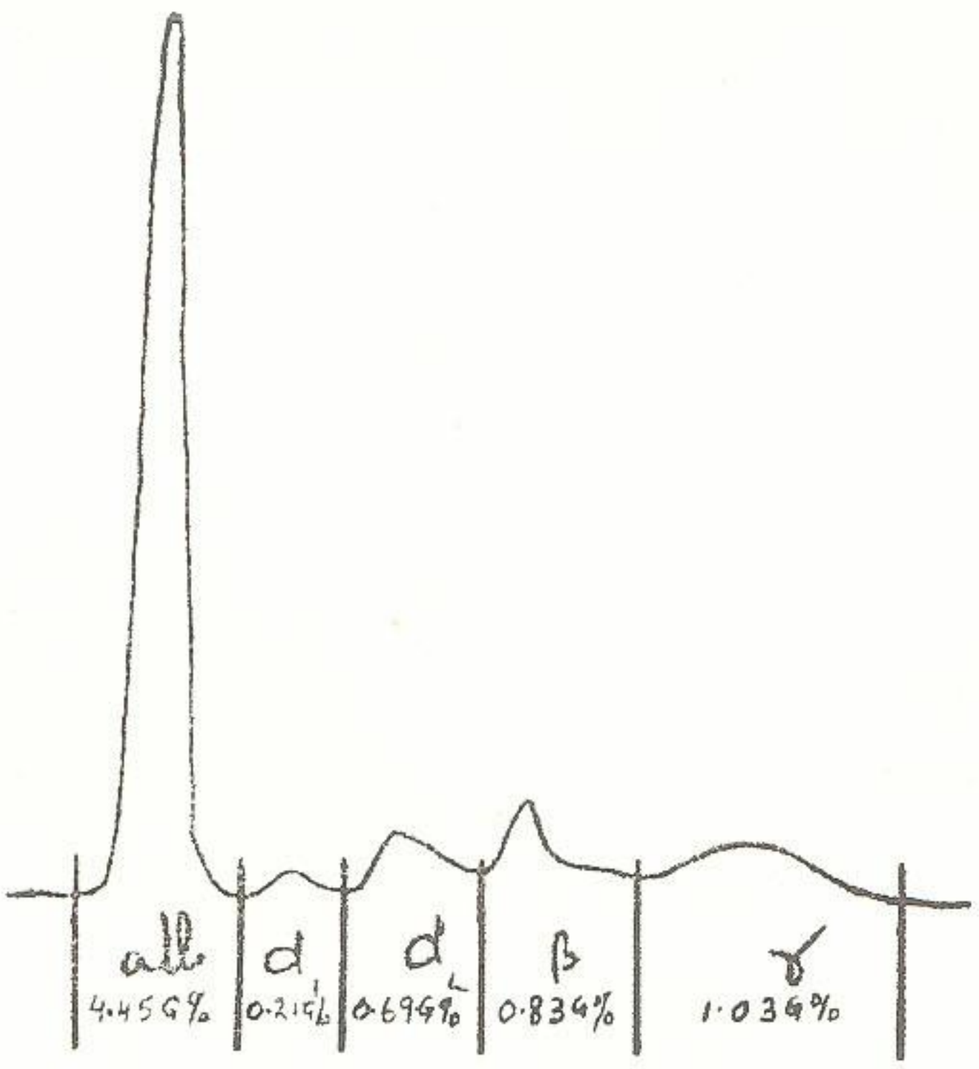

Fig. 1: Normal Electrophoretogram.

The usual findings in patients with cirrhosis are a decreased albumin and increased gamma globulin levels (Rafsky et al., 1950; Ricketts et al., 1949; Franklin et al., 1951). The increase in gamma globulin involves fast $gamma_1$ globulin resulting in the disappearance of gap and thus fusion of Beta and gamma globulin as shown in Fig. 3. This fusion is due to an increase in gamma A which mainly has $gamma_1$ mobility (Hobbs 1967).

The protein electrophoretic pattern may be affected by the stage of liver disease and simultaneous occurrence of other systemic disorders, therefore none of the patterns reported here are absolutely specific. The diagnostic usefulness of this investigation is thus limited and

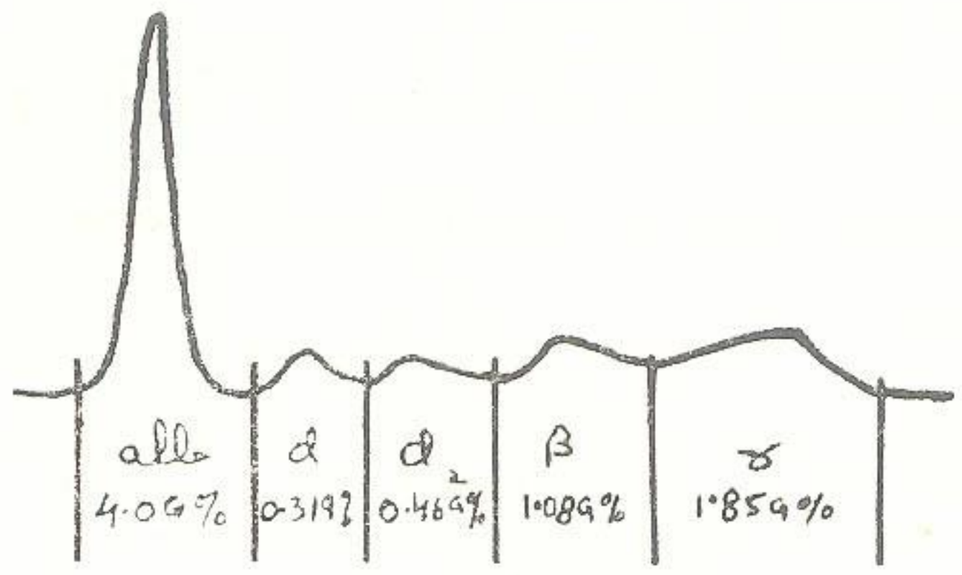

Fig. 2: Acute Viral Hepatitis—Raised $Alpha_1$, $Alpha_2$ and Gammaglobulin. No fusion of Beta and Gamma Globulin.

can only be of value in the follow up to assess the progress and response to therapy in chronic liver disease.

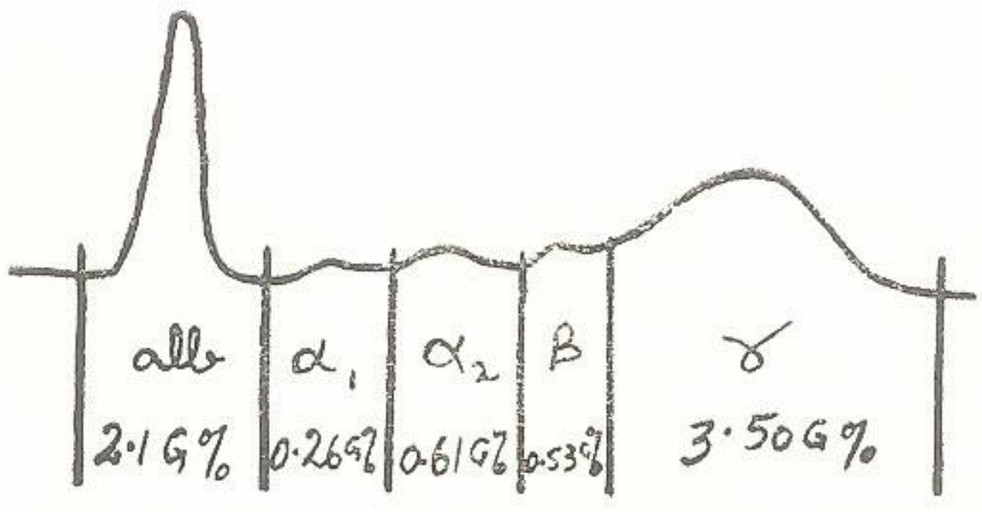

Fig. 3: Cirrhosis of Liver—Reduced Albumin, raised Gammaglobulin and fusion of Beta and Gammaglobulin.

References

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