

PAPER ELECTROPHORESIS OF SERUM PROTEINS IN TEN CASES OF DISSEMINATED CANCER

BY

Lieut.-Colonel P. D. STEWART, M.B., Ch.B.(Edin.)

Royal Army Medical Corps

AND

Private I. W. FRENCH

Royal Army Medical Corps

PAPER electrophoresis is a relatively simple method of studying the proportions of the protein fractions in serum or plasma and does not demand the elaborate equipment required for the classical method of Tiselius. Many military laboratories have already acquired or made the necessary apparatus for paper electrophoresis and are using it to study the changes in serum proteins in various diseases. This paper deals with the alterations found in 10 cases of disseminated cancer admitted to Queen Alexandra's Military Hospital, Millbank.

Winzler (1953) has reviewed the extensive literature on all aspects of plasma proteins in cancer and his survey includes a section on electrophoresis, most of which deals with observations made with the classical Tiselius apparatus. Of the papers mentioned, that of Mider, Alling & Morton (1950) contains the most detailed information. The only findings based on paper electrophoresis mentioned by Winzler (1953) are those of Awapara *et al.* (unpublished) who used this method to determine the relative amounts of the serum proteins in normal individuals and cancer patients. Kay (1954) used paper electrophoresis (Flynn & de Mayo, 1951) to study the serum proteins in a series of patients with ascites caused by various conditions including carcinoma.

METHODS

The methods used were those to be described by Hughes & French (in preparation). Total protein was estimated by the method of Kingsley (Hawk, Oser & Summerson, 1947). Paper electrophoresis was carried out in an Eel horizontal tank, bromo-phenol-blue was used as the dye and the resulting strips plotted by means of an Eel scanner built on the principles of the instrument described by Griffiths (1952). The value of each fraction was calculated from the resulting electrophoretic pattern.

A series of sera from 79 individuals has been examined (Hughes & French) by the same method and the mean values and ranges obtained are given for comparison (Table 1).

The diagnosis was established by biopsy or autopsy in nine cases and was evident at laparotomy in the tenth (Case 6).

Table 1

No.	Sex Age	Diagnosis	Total Pro- tein	Albu- min	Globulins				Remarks
					α_1	α_2	β	γ	
1	M. 57	Carcinoma ; Colon with metastases	5.8	2.2	0.6	1.6	0.6	0.8	P.M. Liver extensively involved. No ascites.
2	M. 21	Carcinoma ; Bronchus with metastases	7.3	3.5	0.2	1.1	1.4	1.3	P.M. Liver not in- volved. No ascites.
3	F. 44	Carcinoma ; Breast with metastases	6.6	2.9	0.2	0.7	0.7	1.1	P.M. Liver extensively involved. Ascites (clear fluid).
4	M. 49	Carcinoma ; Bronchus with metastases	5.75	1.4	0.5	1.1	0.85	1.0	P.M. Liver not in- volved but fatty de- generation present. No ascites.
5	F. 38	Carcinoma ; Ovary with ascites	6.0	2.6	0.4	1.0	0.9	1.1	Also developed pleural effusion.
6	M. 33	Carcinomatosis peri- tonei	6.1	2.7	0.5	1.2	1.1	0.6	Ascites present.
7	M. 23	Secondary carcinoma ; Spine	5.8	2.6	0.4	0.9	0.9	1.0	Primary not located. Liver not enlarged clinically.
8	F. 30	Malignant melanoma with metastases	7.0	2.9	0.6	1.5	0.8	1.2	Liver not enlarged clinically. Secondaries in lung.
9	M. 33	Carcinoma ; Oesopha- gus with metastases	6.2	3.4	0.4	1.0	0.7	0.7	Liver found involved at operation. No ascites.
10	M. 41	Seminoma with metastases	7.7	3.4	0.5	1.8	0.8	1.2	Liver not enlarged clinically. Abdominal glands involved.
Mean of 10 cancer cases			6.42	2.76	0.43	1.2	0.87	1.1	} Hughes and French
Mean of 79 normal sera			7.1	4.63	0.1	0.55	0.75	1.05	
Range of 79 normal sera			6.4- 7.8	3.8- 5.7	0.0- 0.4	.1- .9	.3- 1.2	.4- 1.7	

Serum proteins expressed as g/100 ml.

RESULTS

The results, together with brief clinical details, are given in Table 1 and an example of the type of electrophoretic pattern obtained on scanning is shown in Figure 1.

It will be seen from Table 1 that in the 10 cases of disseminated cancer examined there was, when compared with the range of normal sera, a decrease in the total protein (6 cases), a decrease in the albumin (10 cases), an increase in α_1 globulin (5 cases), an increase in α_2 globulin (8 cases), but little alteration in the β and γ globulins.

It is obvious from Table 1 that these changes occur in disseminated cancer irrespective of the primary site and of the presence of metastases in the liver.

DISCUSSION

Our results are in general agreement with those published by Mider *et al.* (1950), Awapara *et al.* (quoted by Winzler, 1953) and Kay (1954). We have not

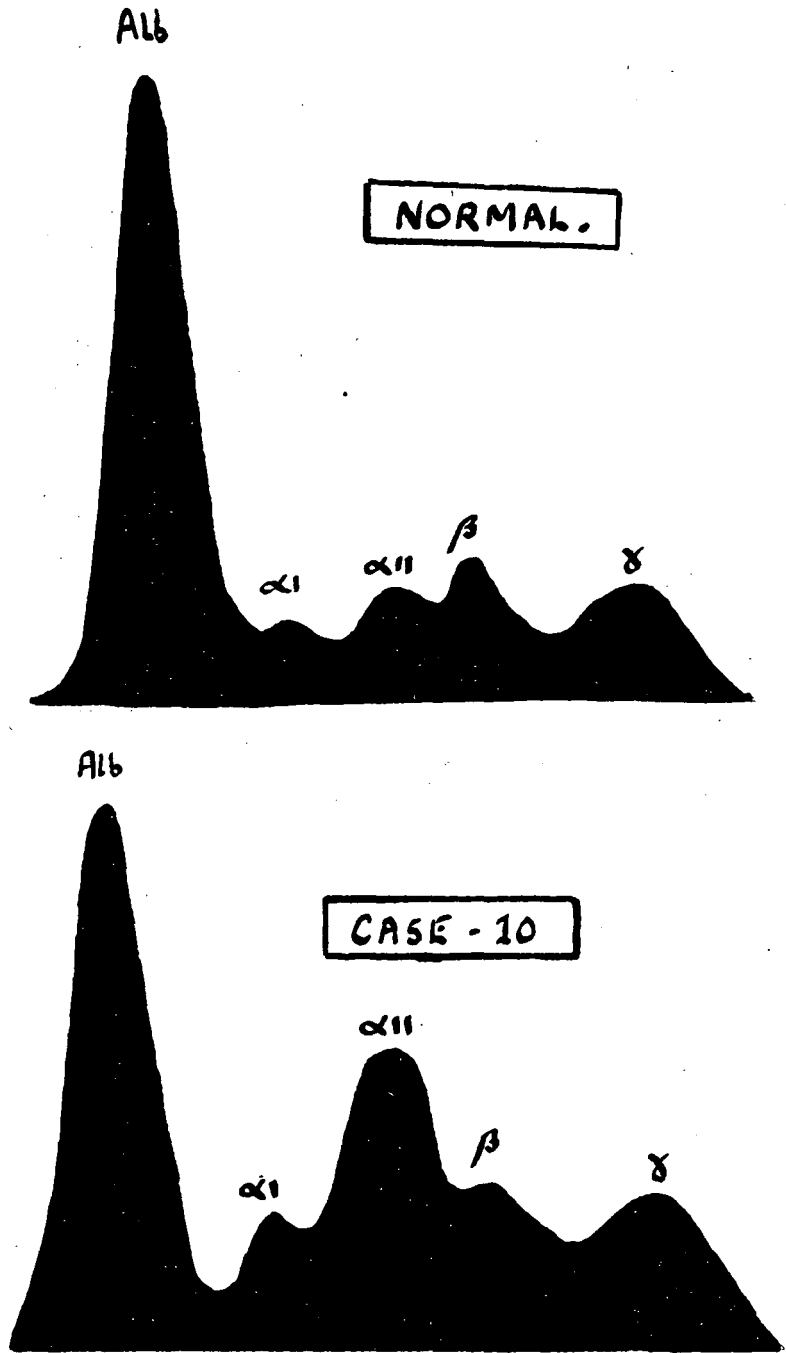


FIG. 1. Electrophoretic pattern.

attempted to make a direct quantitative comparison with the figures given by these authors as there are so many variable technical factors which may influence the results in different laboratories (Martin & Franglen, 1954).

Winzler (1953) in his review concludes that significant abnormalities are associated with cancer, but that they are not specific. For example, increases in alpha globulins are frequently met with in inflammatory conditions and in diseases involving tissue destruction. Nevertheless in certain circumstances a study of the serum proteins may be of diagnostic value. Kay (1954) found electrophoresis of serum protein in ascites revealed distinct and constant patterns in cirrhosis of the liver and carcinomatosis peritonei. If the ascites was due to cirrhosis there was an increase mainly in the γ globulins, whereas if the condition was due to carcinoma the increase was mainly in the α_2 globulin.

The explanation and significance of the changes in serum proteins in cancer is at present largely unknown.

CONCLUSION

1. Sera from 10 cases of disseminated cancer have been examined by paper electrophoresis.
2. The principal alterations found were a decrease in the albumin fraction and an increase in the α globulin.

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