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PLASMA PROTEIN CHANGES IN EXPERIMENTAL CANCER (YOSHIDA ASCITES SARCOMA IN RATS)

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MALIGNANT tumours are known to alter the plasma proteins of the host both qualitatively and quantitatively.[1,2] Many attempts have been made to detect specificity in the pattern of changes to facilitate diagnosis and prognosis of the malignant states. The presence of certain specific proteins have been claimed with certain type of tumours.[3]

The present study relates to the qualitative and quantitative alterations in the serum proteins of rats bearing Yoshida ascites sarcoma. This sarcoma originated in the ascites form in a rat treated with O. amidoazotoluene and Fowler's solution,[4] and has been maintained in ascites form since by serial transplantations in rats. The nature of cancer cell is uncertain. Originally considered to be reticulo-endothelial in nature,[5] recently the tumour is thought to have an epithelial origin.[6]

For our studies the tumour injected rats were obtained from the Indian Cancer Research Centre, Bombay. They have been maintained in highly inbred Wistar strain of rats. This sarcoma—a rapidly developing tumour causes mortality in hundred per cent of the infected animals within ten days of implantation.

Materials and Methods

Male rats weighing 100-120 grams, infected with 100 million cells, were used for the studies.

Heart blood and ascitic fluid were obtained from the transplanted rats on the 8th day when maximal ascites had developed. Separated serum and the supernatant of the ascitic fluid were stored in cold. Normal rat serum served as control.

Total proteins in the sera were estimated by Biuret method[7] after treating with TCA. Analysis of the serum components was carried out by agar-gel electrophoresis[8] at 300 v with constant current of 10–12 mA running for a period of 6 hours. Each stained protein band was estimated by elution method, using cellophane paper technique.[9] The bands were eluted in N/20 NaOH and the color read in Klett-Summerson photoelectric calorimeter using filter 54.

Results are presented in Table I and Figs. 1 and 2.

Table I

Serum proteins in normal and tumour-bearing rats

Sample	% of proteins in grams
Normal rat serum ..	6·2*
Tumour-bearing rat serum ..	4·5*

* Each value represents the average of 3 experiments.

Note : Reduction in protein content of serum from tumour-bearing rats.

Results and Discussion

The results indicate :

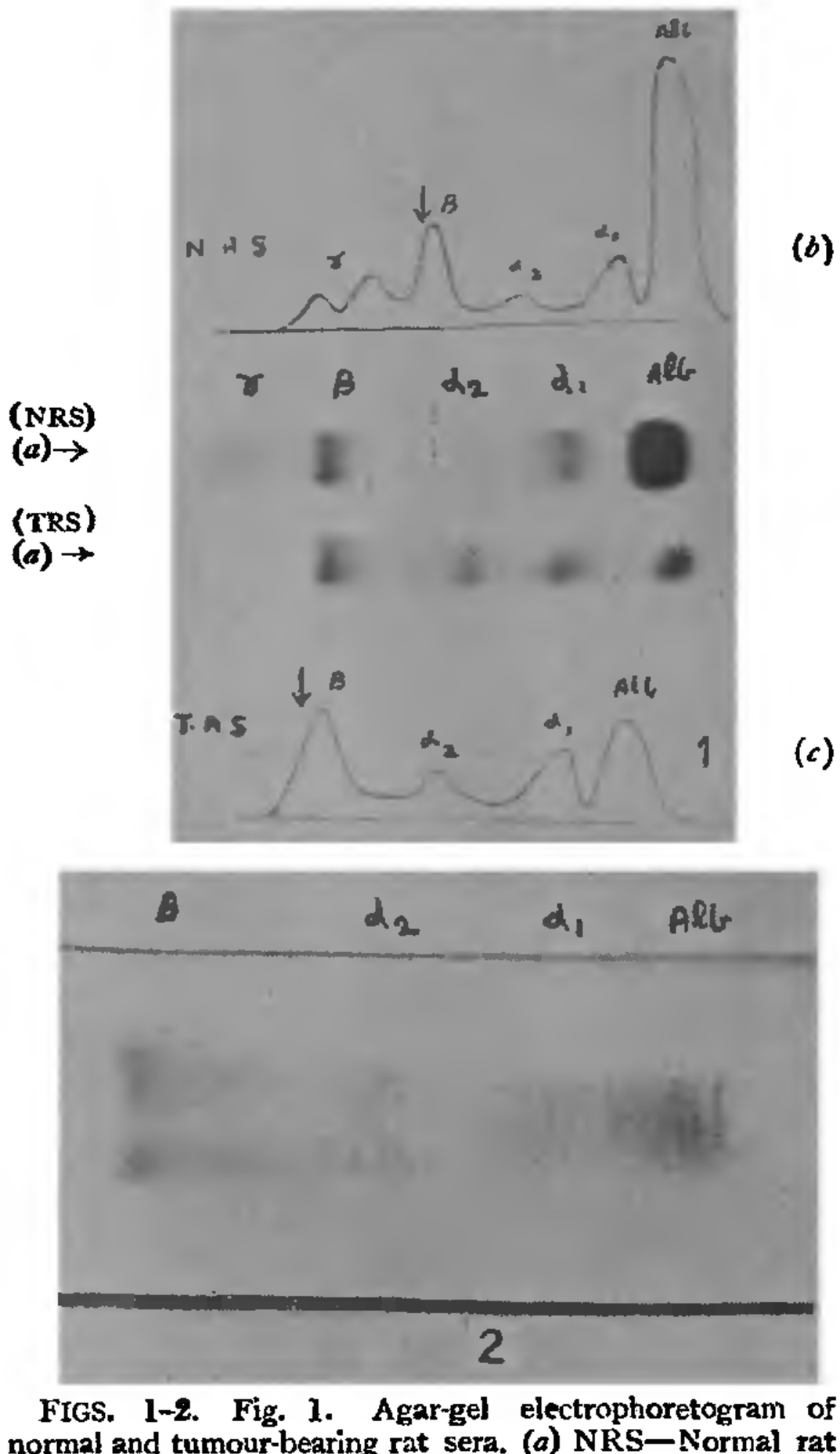
(*i*) reduction in the total protein content,
(*ii*) hypoalbuminemia,
(*iii*) slight elevation of α and β-globulins,
(*iv*) complete absence of γ-globulin in the sera of tumour-bearing animals, and
(*v*) a similar pattern of the components with absence of γ-globulin in the ascitic fluid.

Hypoproteinemia and reduction in albumin can result from malnutrition, but this is usually associated with increased γ-globulin. Similarly, the reduced albumin occurring in many diseases, injury, burns and reactions to stress is invariably accompanied by elevated γ-globulin.[10] Hence, while malnutrition may partly be responsible for the hypoproteinemia and diminished albumin in the sera of Yoshida sarcoma rats due to diminished food intake in the later stages of tumour development, the absence of γ-globulin needs explanation. The reduced protein and albumin in the tumour rat may also result by the depletion from the blood and accumulation of these components in the ascitic fluid exudate.

In the various types of malignancies seen in the human, the changes reported are: hypoproteinemia, albumin reduction, α_1 and α_2 globulin increase, but no significant changes in β and γ-globulin levels.[11]

The low levels and complete absence of γ-globulin seen in Yoshida sarcoma resemble the effects of neoplasms of lymphocyte plasmocyte series, *viz.*, lymphoma, chronic lymphatic leukemia, and thymic tumours. In these tumours the reduction in γ-globulin is attributed to the loss of specialised function in the cancer cell, *i.e.*, the ability to synthesize the immune globulins.[12] Yoshida sarcoma, unlike these malignant cells, is not considered to be a tumour related to immunologically competent cells and develops in the peritonium outside the circulation.

Whether immune globulin synthesis is impaired by the toxins of Yoshida sarcoma cells or suppression of the growth of immunologically competent cells themselves is involved in the causation of hypo and agammaglobulinemia observed in the tumour bearing rats needs elucidation.



FIGS. 1–2. Fig. 1. Agar-gel electrophoretogram of normal and tumour-bearing rat sera. (*a*) NRS—Normal rat serum; TRS—Tumour rat serum, (*b*) Elution of normal rat serum, (*c*) Elution of tumour-bearing rat sera. Note: Absence of γ-globulin and reduction in albumin with slightly elevated α, β globulins in *c*. Fig. 2. Agar-gel electrophoretic pattern of peritonial fluid from tumour-bearing rat. Note: Absence of γ-globulin.

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