Clinical Significance of Fucose Level in Glycoprotein Fraction of Serum in Patients with Malignant Tumors

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SUMMARY

Serum fucose content in the glycoprotein fraction was determined in various patients with malignant and benign diseases. The results showed that, in contrast to benign diseases, malignant diseases were characterized by an increased fucose content in the glycoprotein fraction. However, no significant difference was noted in the fucose levels in the mucoprotein fraction. The increased fucose level in glycoprotein in malignant diseases was parallel to the increment in total fucose content in serum, which suggests that the increased levels in total fucose in malignant diseases, reported previously, are primarily due to the increase in fucose-containing glycoprotein.

INTRODUCTION

It has been reported that the protein-bound fucose level in serum is elevated in patients with malignant tumors (1, 11, 12, 16). In our previous study, the results indicated that the elevated fucose level in malignant diseases is probably due to an increase of some glycoprotein in serum (11). Glycoprotein in serum can be roughly classified into 2 groups. The 1st group consists of glycoprotein in the strict sense of the term: that which contains a small amount of carbohydrate and is easily precipitated by common protein precipitants such as trichloroacetic, perchloric, or picric acid. In the 2nd group is mucoprotein (or seromucoid), which contains a large amount of carbohydrate and is soluble in trichloroacetic acid solution.

If the elevation in the serum fucose level in malignant diseases is due to an increase in some specific glycoprotein in serum, a separate measurement of both types of glycoprotein was carried out as follows: 0.05 ml of 70% perchloric acid was added to 0.50 ml of serum. The mixture was strongly agitated, kept on ice for 10 min, and then centrifuged. A portion (0.1 ml) of the supernatant was mixed with 0.90 ml of 0.1 N NaOH. Concentrated sulfuric acid and cysteine were added to this solution as described in the previous report (11). The result, expressed as mg of fucose per 100 ml of serum, was obtained by multiplying the formula used for estimating the total fucose (19) by 1.1.

The fucose content in the g-fraction was obtained by subtracting the fucose content in the m-fraction from the total fucose content.

RESULTS

Charts 1 and 2 show the fucose content of g- and m-fractions in sera of normal individuals and patients with benign or malignant diseases. As seen in the figures, the m-fraction accounted for 45% of total fucose in normal sera [mean value, 3.14 ± 0.14 (S.E.) mg/100 ml] and was slightly elevated in sera of patients with benign and malig-
fied as shown in Chart 3, where the total fucose level is plotted on the ordinate and the amount of fucose in the g-fraction is plotted on the abscissa. The level of fucose in the g-fraction is a linear function of the total fucose level, while no linear relationship between the total and the fucose content in m-fraction was found in sera of normal individuals and patients with benign or malignant diseases (data not shown).

DISCUSSION

Serum contains many types of glyco- and mucoprotein. So-called mucoprotein in serum is comprised mainly of acidic α-globulin (orosomucoid) and haptoglobin, which contain a large amount of carbohydrate, while glycoprotein, in which the carbohydrate content is rather small, includes α1, α2-globulin, transferrin, fibrinogen, etc. (3, 18). Numerous reports indicate changes in the concentration of these glyco- and mucoproteins in response to a variety of diseases, including cancer. Although there is some disagreement, an increase of glycoprotein in cancer patients is generally accepted (1, 2, 8, 11, 16). However, whether this increase is due to an increase in most types of glyco- and mucoprotein or only in certain ones remains unclear. Since hexose and hexosamine are common and major components of glyco- and mucoprotein, while fucose is a rather infrequent and minor component, the increase in glycoprotein as expressed by hexose and hexosamine may not always be parallel to the increase in fucose content in serum. It was reported that the “seromucoid” fraction in serum, which corresponds to the m-fraction in this paper, accounted for about 10% of the total protein-bound hexose in serum (19). In the present investigation, however, it was shown that the m-fraction from normal serum contained approximately 45% of the total fucose. Winzler and Burk (20) first reported that plasma from cancer patients contains
a significantly higher amount of mucoprotein than that in normal individuals. This observation has been further confirmed in a number of reports (4—7, 9, 10, 13—15, 17, 20—22). The present results showed, however, that the level of mucoprotein in normals and in patients with tumors was about the same. The discrepancies are probably due to the fact that the level of the m-fraction was measured by the fucose content in the present investigation; i.e., the sera from cancer patients probably contained a higher level of hexose- and hexosamine-containing mucoprotein but a normal level of fucose-containing mucoprotein.

The present results indicate clearly that the fucose content in the g-fraction of serum increased significantly in cancer patients. Since the fucose content in the g-fractions bore a linear relationship to the total fucose content, it is reasonable to attribute the elevated level of total fucose in sera from cancer patients to the increase in fucose-containing glycoprotein. It is not clear, however, whether the higher level of total fucose in patients with tuberculosis or inflammation, described in the previous report (11), can also be attributed to the increase in the g-fraction. It is likely that the fucose content in the g-fraction is more useful in screening malignant disease than is the total fucose content in serum.

REFERENCES
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