ABNORMAL CARBOHYDRATE METABOLISM IN BRONCHOGENIC CARCINOMA*

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Recently hyper- and hypometabolic states have been described that are related to various neoplasms.[1-4] The first report came from Freund, in 1885,[5] concerning hyperglycaemia in 62 out of 70 patients with neoplasms. His findings were confirmed by Tuffier,[6] and Rebitzer[7] described patients in whom the cancer had preceded the appearance of the diabetes.

By means of the glucose-tolerance test Theis and Stone[8] studied 180 patients with carcinomas and found positive results in 26%. Langston[9] obtained similar results. He stated that there did not seem to be a typical or characteristic curve in cases with carcinoma and suggested that the abnormal carbohydrate metabolism was the result of the overgrowth of tumour cells.

Puchulu *et al.*[1] studied a group of 324 neoplasms of diverse origin and found overt diabetes in 14·2% of the cases; in 127 cases of bronchogenic carcinomas they found 17·5% with overt diabetes. They suggest that bronchogenic cancer acts as a precipitating factor of a genetically determined diabetes.

We studied a group of 35 patients with certified histopathology who had not received specific treatment, and matched them by age and sex with a control group of 35 healthy subjects by means of a modified Conn and Fajans test.

MATERIALS AND METHODS

Two groups of 35 patients of comparable sex and age were studied by means of a modified Conn and Fajans test (by venepuncture). The group with bronchogenic carcinoma comprised 32 males and 3 females, with ages ranging from 45 to 78 years. The control group of normal persons ranged from 49 to 76 years (32 males and 3 females).

Patients for the first group had to fulfil the following criteria:

(*a*) Histopathologically confirmed bronchogenic carcinoma (by means of endoscopic and/or lymph node biopsy) had to be present.

(*b*) Only patients who had not received any specific treatment (surgical, radiotherapy or chemotherapy) were included.

(*c*) They had to be without overt diabetes, liver disease, infection or fever.

*Date received: 3 December 1968.

Technique

The glucose-tolerance test was performed in the following way: a diet of 1,800 - 2,300 calories, containing 300 G of carbohydrates, was administered for 3 days before the test. At 8 p.m. on the evening before the test 10 mg. of prednisone was administered, and a further 10 mg. at 6 a.m. on the morning of the test. Blood samples were obtained immediately before and at 60, 120 and 180 minutes after the intravenous administration of 100 G of anhydrate glucose solution. Determinations of blood sugar were made by the method of Folin and Wu.

In the statistical analysis each point of the curve was considered and was regarded as abnormal when the difference was more than 2 standard deviations of the normal mean.

RESULTS AND DISCUSSION

The results obtained revealed significant differences in the incidence of abnormal GTT between the group of bronchogenic carcinomas and the control group. The percentage incidence of abnormal GTT was 43·9% in the carcinomatous patients and 22·6% in the controls (Fig. 1).

There was a direct relationship between the incidence of latent diabetes and the grade of differentiation of the tumour.

According to the histopathology, 50% of the squamous carcinomas, 32% of the adenocarcinomas and 18% of the oat-cell carcinomas presented abnormalities in the carbohydrate metabolism (Fig. 2). Such a finding is difficult to explain in the light of present knowledge, and several mechanisms such as enzymatic, hormonal or immunological have been postulated (Table I).

Glicksman[4] suggests that the cancer would increase the plasma level of the glucolytic enzymes (phosphohexose-isomerase and others). He found 41% abnormal tests in 39 patients with bronchogenic carcinomas, and only 10% in benign tumours of the lung.

Another physiopathogenic possibility is the production of hormonal-like diabetogenic substances by the tumour tissue, and the abnormal carbohydrate metabolism could

be the reflection of overstimulation of the adrenal gland.

We have recently found greater concentrations of 17-hydroxycorticoids in the urine of patients with bronchogenic carcinoma,[10] and abnormal carbohydrate metabolism.

Recently Hecker *et al.*[11] demonstrated sustained hyperglycaemia during a glucose-galactose tolerance test in patients with lung carcinoma while they were studying the lactose absorption.

It has also been postulated[1] that the tumour produces an insulin-antagonistic substance specifically affecting the peripheral action of this hormone.

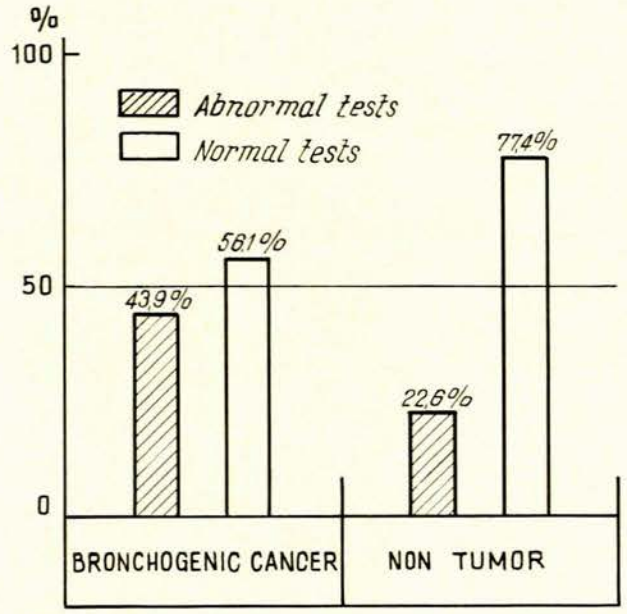


Fig. 1. Incidence of diabetogenic curves in patients with bronchogenic carcinoma and control group.

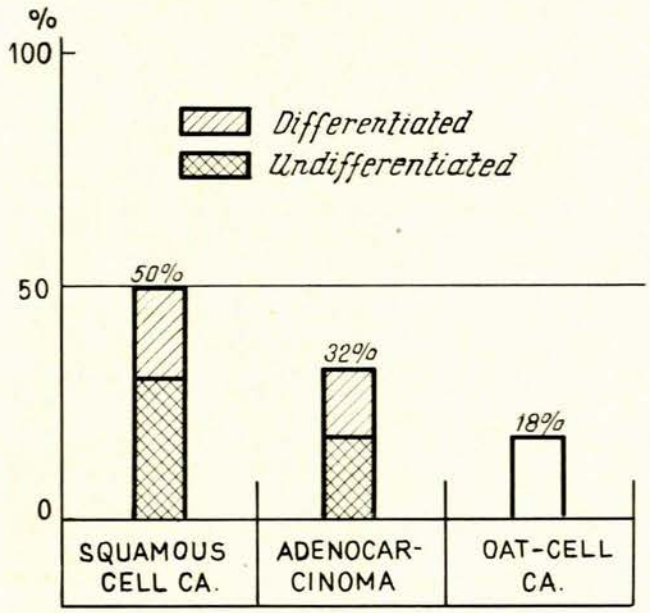
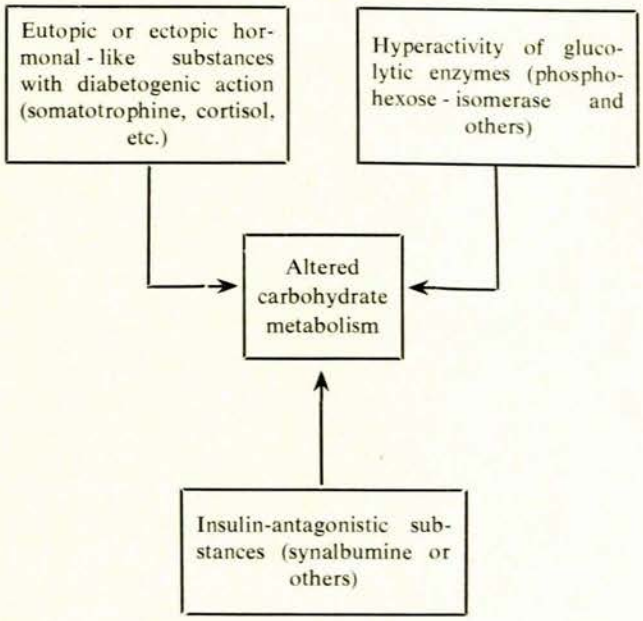


Fig. 2. Bio-histopathological correlation between bronchogenic carcinoma with diabetogenic test and the histopathology of the tumour.

Investigations should be continued in order to clarify the mechanism by which diabetes is so commonly associated with bronchogenic carcinomas and to obtain a better understanding of the biological changes that take place in cancer.

TABLE I. DIABETOGENIC FACTORS INCRIMINATED IN THE BRONCHOGENIC CANCER



SUMMARY

Studies have been conducted to evaluate carbohydrate metabolism in 2 groups of 35 patients of comparable age and sex. One group consisted of patients with bronchogenic carcinoma (free of treatment), while the normal subjects formed the control group.

The results revealed an incidence of abnormal GTT in 43·9% of the cases of bronchogenic cancer, as against 22·6% in the control group.

According to the histopathology of neoplasms the abnormal glucose-tolerance tests were more frequent in the epithelial type (50%) than in the adenocarcinoma (32%) or the undifferentiated type (18%).

The pathogenic mechanism of this change is not known, but it is suggested that the tumour produces insulin-antagonistic substances of a hormonal-like diabetogenic substance.

ADDENDUM

Recent studies have shown that the GTT returned to normal after surgical (2 cases) and radiotherapeutic (1 case) treatment of carcinomas.

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