Carcinoembryonic Antigen Assay in Thyroid Screening

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Summary. CEA assay was incorporated into a screening program in which a high risk population for thyroid diseases due to previous irradiation for benign conditions in the head and neck areas were studied. Seven hundred eleven CEA determinations were available from 735 patients screened; 22 (3.1%) were found to have an elevated level. This is compared to 31 (1.7%) from 1875 healthy control subjects. Although the difference is statistically significant, we conclude the use of CEA assay in thyroid screening is not rewarding due to its lack of activity and specificity.

Key words: CEA-Screening – Thyroid diseases – Radiation therapy

A screening program for individuals at a higher risk of developing both benign and malignant thyroid diseases due to previous irradiation for benign conditions in the head and neck areas during childhood and adolescence was established at Roswell Park Memorial Institute (RPMI) in 1977. The results from the first 12 months of this program have recently been reported (Shimaoka et al. 1979). We have incorporated the carcinoembryonic antigen (CEA) assay as a part of the screening program, since the previous report by Rochman et al. (1975) indicated a higher incidence of elevated CEA levels in patients with a history of irradiation of the thymic or tonsillar region and with thyroid cancer than in nonsmoking, healthy individuals taken as controls. An association between elevated levels of circulating CEA and medullary carcinoma of the thyroid was also reported (Ishikawa and Hamada 1976). The development of medullary carcinoma of the thyroid in previously irradiated individuals is very rare and only two cases have been reported (Block 1977). In experimental animals, however, irradiation can induce this type of cancer more frequently (Williams and Trigg 1977).

Material and Methods

The thyroid screening procedures and their results are reported elsewhere (Shimaoka et al. 1979). There were 275 males and 460 females with a male/female ratio of 1:1.7 during the period February 1977 to

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January 1978. The median age of these patients was 35 years. Eight patients were found to have thyroid carcinoma during the first year of the study. The average interval between radiation therapy and screening was 25.6 years.

Ten millimeters of blood were collected in a vacutainer (B-D 4727), which contained ethylene-diamine tetra-acetic acid tripotassium salt as anticoagulant. After centrifugation, the plasma was separated from the blood cells and was assayed for CEA by radioimmunoassay, using zirconyl phosphate gel as previously described (Chu and Murphy 1978). Previously studied healthy individuals were used as controls (Chu and Murphy 1978). A plasma CEA level of 2.5 ng/ml or more was considered elevated.

Results

Among the 735 patients, who underwent the thyroid screening, the CEA results are available in 711 and 22 (3.1%) were found to have an elevated plasma CEA level. Multiple specimens from eight of these patients were studied 2 to 12 months after the original determinations were made; three had persistent elevations in more than two specimens and the remaining five were found to have a normal range in the subsequent specimens as summarized in Table 1. Whether the latter represent transient elevations or are due to other factors unknown at present could not be determined on review. Case 10 has been found to have colitis, which is known to be associated with an elevated CEA level. Cases 16 and 19 did not have conditions known to have an associated CEA elevation. All eight patients who returned for retesting were female patients but we feel that this is a coincidence, since compliance to our request for repeat testing in cases where abnormal test result were obtained was overwhelmingly better among female than male patients.

Table 2 shows the age distribution of the thyroid screenee and healthy control subjects. Table 3 presents the breakdown into male and female of the study population. The average age of the 22 patients with an elevated CEA level was 38.2 years and did not differ from the other screenees. There were ten smokers and 12 nonsmokers. Five had a past history of thyroid diseases and seven were found to have palpable abnormalities on screening (4.4%). Nine were found to be taking medication on a regular basis, five with concurrent benign conditions; in only one patient with multiple basal cell carcinomas of the skin could malignancy be found.

Discussion

The results of our thyroid screening program have shown that physical examination of previously irradiated areas would be an efficient way of screening high-risk populations with radiation exposure in the past (Shimaoka et al. 1979). We have also included CEA determinations as part of the thyroid screening; 22 of 711 patients (3.1%) were found to have an elevated level of CEA, while only 31 of 1875 controls (1.7%) did so. The difference is statistically significant ($p < 0.05$), but those in the screening program who had an elevated level of CEA presented a variety of thyroidal and nonthyroidal disorders.

More recently, CEA was measured preoperatively in 258 patients who were found to have thyroid nodules; 15 had elevated levels of CEA (5.8%), while none of 95 normal subjects did so (Mededdu et al. 1980). Upon operation, 24 were found to have various forms of thyroid cancer; all those who had medullary or anaplastic