Trace Element Profiles in Cancer Patients

WALTER J. PORIES* AND ANDRE M. VAN RIJ

Trace Element Laboratories, East Carolina University School of Medicine, Greenville, North Carolina

AND

EDWARD G. MANSOUR

Cleveland Metropolitan General Hospitals, Cleveland, Ohio

AND

ARTHUR FLYNN

Cleveland Clinic Foundation, Cleveland, Ohio

Received February 22, 1979; Accepted February 23, 1979

ABSTRACT

It has become evident over the last two decades that there is an intimate relationship between the trace elements and cancer. Some trace elements have been shown to be carcinogens, others appear to provide protection against cancer. Profound changes in trace element concentrations and distribution occur in patients with cancer, but most changes remain undefined.

A review of a number of studies of trace element changes in patients with cancer demonstrates that simple correlations of trace element levels in disease are of only limited use. Such reports underscore the need for large-scale studies that consider the many variables of malignancies and of trace element chemistry. The variables that must be considered for cancer include tissue of origin; histologic, pathologic and clinical staging; nutritional status as reflected by serum levels of calcium, iron, magnesium, phosphorus, the electrolytes, pH, albumen, and globulin; endocrine balance, effects of previous and concurrent therapies such as surgery, chemotherapy, hormonal manipulation, immunotherapy, and radiotherapy; history of exposure to toxic agents; and the presence of other disease.

Similarly, trace element studies entail variables that must be considered and controlled prospectively, including timing and techniques of sampling,
storage, and analysis, and simultaneous measurement of at least the majority of possibly interrelated elements rather than studying one element at a time. The various national cooperative oncology groups such as ECOG, SWOG, and SEOG now offer unusually well-studied groups of cancer patients who are managed according to carefully and prospectively defined protocols in participating institutions. With present knowledge, it is now time to approach these groups with a proposal to incorporate trace element studies in their protocols. A potential protocol will be discussed.

Key Words: Trace element profiles, in cancer patients; cancer, trace element profiles in patients with; profiles of trace elements in cancer patients.

INTRODUCTION

It has become evident over the last two decades that there is an intimate relationship between the trace elements and cancer. In extensive animal studies some trace elements have been shown to be carcinogens, others appear to provide protection against cancer, and a few can even act in both ways depending on their concentration and chemical state (1).

Because of these studies, a number of clinical investigations have been done to determine whether trace element levels can be useful in the management of human cancers. This paper will review these reports, examine the validity of their methods and conclusions, and propose a basic guideline for future protocols. In short, it is a progress report for a difficult and confusing area of research.

Measuring trace element changes during health and disease is certainly an appropriate approach to determining what role these elements play and whether changes in concentration or distribution can be clinically useful. It is a proven method, and one that has long provided medicine with dependable diagnostic tests, guides to treatment, and an understanding of underlying disease. Thus iodine levels have helped to unravel thyroid disease; determinations of calcium and phosphorus have elucidated the complexity of parathyroid disease; iron and cobalt studies have explained the anemias, and the “electrolytes” (Na, K, and Cl) have proven invaluable guides in the treatment of a large variety of illnesses.

We now finally possess the technology and the organizational structures to continue these studies into the trace element field. We should be able to determine whether any or all of these elements (As, Cd, Co, Cr, Cu, F, Hg, I, Mg, Mn, Mo, Ni, Se, Si, Sn, V, and Zn) provide us with clues to the prevention, diagnosis, and treatment of cancer. The exploratory studies published to date suggest that it is a promising approach.

PREVIOUS STUDIES

A number of exploratory studies of trace element changes in patients with cancer have been reported, primarily in cancers of the prostate, the liver, the