RADIOGRAPHIC ANALYSIS OF BODY COMPOSITION BY COMPUTERIZED AXIAL TOMOGRAPHY

by

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ABSTRACT

Radiographic methods of evaluating body composition have been applied for over five decades. A marked improvement in this approach occurred in the mid-nineteen-seventies with the introduction of computerized axial tomography. High image contrast, cross-sectional imaging and rapid computerized data processing make this technique a sophisticated clinically applicable tool.

1. RADIOGRAPHY IN THE STUDY OF BODY COMPOSITION

1.1. Early workers

Pioneering workers in the early decades of the twentieth century applied radiographic methods to the study of body composition (1,2). The principal focus was to assess the amount of fat, muscle and bone in a limb exposed to x-rays. The "shadow" cast by each of these three structures on the x-ray film was measured with a ruler, and converted to life size by correcting with a magnification number. Clear demarcation between fat, muscle and bone was possible, because these three structures differed markedly in x-ray attenuation. Discrimination of one soft tissue from another of similar attenuation was not possible, as for example liver from kidney or spleen.

1.2. Recent advances

Over the last several decades, electronic components and computers have revolutionized radiology. In addition, complex mathematical functions were solved that enabled reconstruction of images produced from a routine x-ray beam and detector. The theory and electronics were combined in the early nineteen-seventies, and the technique was referred to as computerized axial tomography (CT). Cross-sectional images through the human body were reproduced that provided high image contrast. Extensive data processing facilities allowed analysis of vast amounts of scan data. Emory University installed a head scanner in 1975, and a whole body scanner in 1978. Technological improvements were added on a regular basis to each scanner, and in 1981 a second body scanner was installed. The most recent instruments provide much sharper pictures and improve the flow of data when compared to models built only several years ago.

2. APPLICATIONS OF CT TO BODY COMPOSITION ANALYSIS

2.1. The present

Very sharp cross-sectional images through a limb, trunk or abdomen allow quantification of the following: volume of air (3), and volume or mass of subcutaneous and mesenteric fat (3), muscle (4), liver (5), spleen (6), kidney (5), brain (5), and bone (7). The study of bone mineralization by CT has been the subject of numerous investigations (e.g. 7), and some workers have advocated CT in the analysis of liver fat (8) and iron concentration (9).

2.2. The future

Improving technology will continue to expand the potential applications of CT. Analyzing the composition (e.g. H_2O, protein fat) as well as the mass of soft tissues is one feasible goal with respect to the study of body composition.

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