On the Multiple-Detector Type Whole Body Counter for Nuclear Medicine

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Whole body counter has originally been used in health physics and it has recently been applied also for nuclear medicine. Most of whole body counter in Japan have adopted the scanning technique with the single or twin large detectors and the 2π technique with plastic scintillators. We planned another type of whole body counter using the stretcher technique with multiple detectors, which may be suitable for measuring the patient's activity independent from its distribution as compared with the another technique. The counter was built in Chiba university hospital, in June 1969.

The length, width, and height of the counter are 220 cm in each inner dimension, and the thickness of the iron wall is 20 cm. Three millimeter lead sheet is lined inside the wall and the inner surface of the wall is covered by the lucite plate. The counter has eight detectors. Each detector is made of 5″ϕX4″ NaI crystal and RCA 8055 phototube. Four detectors are lined above the couch, and four below. The detectors can be moved manually to an optional position along the body axis, and can also be moved up to 12 cm vertically. The shift to the cross direction is limited to 10 or 15 cm from the center of the body axis. The counting system consists of 8 preamplifiers, the signal selecting and mixing circuits, 4 linear amplifiers, and a 200 channel pulse height analyser. Outputs of detectors are mixed to form the optional combination of eight detectors, and the signal then is fed into the pulse height analyser.

We tried to find the optimum arrangement for the positions of 8 detectors, as it should be desired to obtain constant counts while the radioactivity distribution changes in the body of a patient. The counting-rate response of detectors was determined by placing the point sources of ^{60}Co, ^{137}Cs, and ^{133}Ba at the center of water phantom (20 cm deep). The photo peak counting is used. The best arrangement of 8 detectors were thus obtained. First, 8 detectors, were lined in the same distance from the couch, and from each other. Second, the central 4 detectors (2 above and 2 below) were moved about 5 cm away from the couch. Third, the 4 detectors below were moved to the center of the couch. When the point source is moved 7 cm away from the center of the water phantom, the counting-rate response of detectors was higher than the source in the center. The increment of the counting-rate by the shift of the source is rather small with the use of the integral counting technique instead of the photo peak counting.

The integral counting and thus determined arrangement of detectors made the best counting-rate response in the bodies of patients.

The Use of the Whole Body Scanner for Measurements of Retention and Distribution of Radioisotopes in the Body

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The linear scanning has been prevailed as a convenient method for demonstrating the approximate longitudinal distribution of radioisotopes in the whole body from the outside. One dimentional maps of the distribution are obtained by the linear scanning, demonstrating the ni-sufficient information when the activity of each internal organ is concerned.