III. Apparatus, Scanning Technique

The Fundamental Studies on Linear Scanning by Use of the Scanner Equipped with three Detectors

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This report deals with improvement of the conventional linear scanner (Shimazu) for detecting quantitative distribution of radioisotope administered. The new scanner reported here is confirmed to be satisfactorily useful in clinical practice.

Two detectors (NaI crystals $2''\phi\times2''$) were additionally installed under the bed of the conventional apparatus which was equipped with only one detector (NaI crystal $3''\phi\times2''$) above the bed. The distance between upper and lower detectors was 90 cm and that between the bed and lower detectors was 33 cm. The distance between 2 lower detectors was changeable from 15 cm to 30 cm. Every crystal was shielded with lead of 5 cm thick. The upper parallel collimator was 5 cm in width, 16.5 cm in length and 25 cm in breadth. The lower one was 5 cm, 15.5 cm and 40 cm respectively. Bed was drived by motor with constant speed of 4, 8, 16 and 32 cm per minute. By use of an adder introduced between detectors and medical spectrometer, the pulses from upper and lower detectors are able to be recorded either seperately or as a sum of those from 3 different detectors. By adjusting the shift of photopeak of spectrum, sensitivities of 2 lower detectors were controlled with high voltage divider and then those of upper and lower detectors were adjusted with gain controller of adder.

The distribution of sensitivety and resolution in air, in water and in a body phantom (Alderson Research Lab.) filled with water was measured under the condition as follows. As a point source, ^{59}Fe was used. Two lower detectors were separated 30 cm wide. Slit width was 2 cm. Time constant was one second. Bed speed was 16 cm per minute. Radioactivity was measured by discriminating below about 600 KeV. The isoresponse curve in the body phantom was obtained by mechanical addition of the counting rates from three detectors.

The peripheral area on the central ventrodorsal axis showed relatively high counting rates of 13% when the counting rates at the center of the body phanto mwas taken as 100%. But inner area showed almost uniform distribution from 100% to 110%. Distribution of resolution on the central ventrodorsal axis of the body phantom was 5.8 cm at both surface and 7.6 cm at the center.

The isoresponse curve was drawn with the geometric mean calculated from the counting rates obtained seperately from upper and lower detectors. In tis case was obtained more uniform distribution of the counting rates than in the method with mechanical addition of the counting rates from 3 detectors.

These results may confirm that the improved scanner reported here is able to be satisfactorily useful in clinical practice.