C. Measurement II

Position Scintigraphy by Coincidence Counting Method Using Anger Camera

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Positron emitters produce high energy gamma rays (511 keV), so commercially available collimators attached to Anger camera cannot avoid septal penetration effect. To overcome this effect and define the direction of gamma ray incidence, coincidence detector was set opposite to Anger camera (TOSHIBA GCA-101) with the distance of 30 centimeters. One method was; coincidence 3 inches NaI detector equipped in Scanner (NUCLEAR-CHICAGO PHO/DOT II) was covered by 85 parallel holes collimator and was scanned over the Anger camera sensitive area. The other method was; 5 inches plane NaI detector shielded by 20 millimeters lead was settled under Anger camera, and thus sensitive area was defined by 5 inches NaI. Coincidence signals served as unblanking signal to Anger camera. Coincidence resolving time was set as 0.2 microseconds. To obtain real coincidence, signals from coincidence detector was delayed 3.0 microseconds against Anger camera signal.

These method reduced counting efficiency to 1/2,000 compared with that of Anger camera. From electrical restriction (pile up, saturation, random coincidence), activity in coincidence sensitive area was limited within a few hundred microcuries.

Resolution in phantom images was 10 millimaters. Rb-81 and F-18 solutions were injected into rats and clear distribution images of these nuclides were obtained.

This method can get clear image of positron emitter with simple electrical equipments and could be applied in clinical studies. When multicrystal (NaI) system is used for coincidence detector, electrical restriction will disappear and more activity and less measuring time will be promissing.

Basic Study of ^{14}C- and ^{13}C-Breath Test Using Glycine-Cholate

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We have reported that measurement of $^{14}CO_2$ in the breath after oral administration of glycine-1-^{14}C-cholate can detect bacterial deconjugation of bile salts by their early significant peak in contrast to normal flat curves. The use of stable isotope ^{13}C in place of ^{14}C-compounds can extend the applicability of the technique to children, young adults, pregnant women and mass survey of healthy subjects. With the pourpose to validate the use of ^{13}C-compounds for the clinical breath test, animal experiments were carried out. Carbon dioxide in the exhaled breath was collected by the nutralization of alkaline solution in the vial connected to the outlet of respirator being applied to anesthetized rats. Isotope ratio of $^{13}CO_2/^{12}CO_2$ was measured in a mass spectrometer, ^{14}C was measured in a liquid scintillation counter. Curves of $^{14}CO_2$ and $^{13}CO_2$ after simultaneous oral or i.v. administration of glycine-1-^{14}C and glycine-1-^{13}C in rats were identical showing early peak at 30–35 min. and 10–15 min. ^{14}C and ^{13}C-glycine-cholate were administrated by mouth in rats preoperated to form jejunocolostomy. $^{13}CO_2$ curves showed early peak simillar to those shown in patients with bacterial over growth or ileal resection. The curves showed striking contrast to the