and the third to measure porosity. These proton radiography will be clinically useful for monitoring of proton therapy or proton computed tomography.

FM cyclotron of Institute of Nuclear Science, The University of Tokyo, was used as the following conditions; proton energy of 52 MeV, beam size of $3 \times 7$ cm$^2$ or diameter of 15 cm, max. range of 23 mm in paraffin, primary proton beam or scattered beam by a bloc of iron or aluminum, several kinds of non-screen film with seven layers sandwich of Al foil (1 or 2 mm) and film.

Proton radiographs to use marginal range showed sharp edges which were similar to relief photographs with low contrast at the inner part, but it was unsufficient to image the bone. Proton radiographs with continuous energy spectra scattered by a bloc of iron showed high contrast of the air way such as the trachea, pharynx, the air in bowels and the meatus in the temporal bones. Several films were obtained from sandwich technique of film and Al foil; the first one showed proton radiographs by multiple scattering, the second or third one showed the area over Bragg's peak of the transmitted weekend proton, and the next one showed greater area without proton reaching. The superimposed four proton radiographs were similar to an isodensity curve photograph in proportion to the thickness or atomic composition of an object.

In Vivo X-ray Fluorescent Analysis of Iodine Concentration in the Thyroid

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A simple apparatus was made for the in vivo X-ray fluorescent analysis of stable iodine in the thyroid. The apparatus consists of disc type $^{241}$Am source of 300 mCi and pure Ge detector of 50 mm$^2 \times 5$ mm. Diverging collimators were designed both for the source and the detector to achieve a full view of the thyroid lobe. The detectable concentration was 0.2 mg iodine/g tissue assuming the coefficient of variance of 30% and the counting time of 5 minutes. It allows to determine the iodine concentration within a suitable time unless the concentration is extremely low.

Measurement was performed for autopsied normal 10 thyroids and the results were consistent with those by neutron activation analysis. Iodine concentration ranged 0.3–1.2 mg/g (mean 0.6 mg/g) and compared well with the data in literatures. Comparing with other techniques which enable to know the bulk iodine concentration, like in vivo neutron activation analysis and X-ray fluorescent scanning, this technique is simple and does not need reactor or strong exciting sources.

Diagnostic Significance of Combined Use of Radionuclide Scintigraphy and Ultrasonography

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Diagnostic usefulness of combined use of two non-invasive imaging, i.e. radionuclide scintigraphy and ultrasonography were investigated. LFOV gamma camera (Searl) and multi-purpose ultrasonic device (Aloka SSD-60B) were the instruments used. Radionuclide scan was performed first. Using persistentscope and anatomical marker, contour of an organ and the site of space occupying lesion, if any, were marked on the patient body surface and a poraloid image. Following radionuclide
imaging including 24 liver, 8 kidney, 4 pancreas, 1 spleen and 2 tumor scan, ultrasonographic examinations were performed using the marks as reference. Forty one studies on 39 patients with suspected S.O.L. There were 22 radionuclide scans positive and 13 equivocal for S.O.L. In 20 of the former group and 3 of the latter group, nature of the lesions could be diagnosed by ultrasonography. 7 cases in which ultrasonography following scintigram was useful for the specific diagnosis were demonstrated. They included hepatoma, two cases of liver metastasis, subphrenic abscess, polycystic liver, renal cell ca. and hydronephrosis.

Combination of the two procedure decreased false positive without increasing false negative studies. Reference markers made on the basis of scintigram assisted the ultrasonographic examination by allowing easy access to the organs or lesions and identification of the site of the lesions. Several diagnostic imaging procedures have recently been performed including conventional radiograph, RI scintigram, ultrasonography, and computed tomography. Such studies should be of value that decide the most effective combination of those procedures to avoid unnecessary physical and economical load to patients.

Experience of DEC GAMMA-11 for Nuclear Medicine Data Analysis


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We have equipped a DEC GAMMA-11 computer system for nuclear medicine data analysis. The system includes RT-11 minicomputer of 28 KW corememory, teletype writer, console terminal, color graphic CRT display, 2 disk drives of 1.2 million 16-bit word each, high speed paper reader, 2 magnetic tape drives for edited memory storage, and hard copy.

The system deals with Foreground/Background operation. While collecting data from a scintillation camera in the foreground, the system also analyze data, or run BASIC, or run any other RT-11 program, or develope and run a user-program in the background. This realtime device saves time greatly. Addition to this, the automatic analysis feature of the system allows us to specify that predefined routine analysis is to be automatically started immediately when data acquisition has been completed.

Most of data manipulations are performed by using simple two letter commands. Random specification of irregular regions of interest can be defined by using a Joy stick, however, this Joy stick manipulation has some difficulties in setting favorable ROIs.

The original language is MACRO-ASSEMBLER but the RT-11 accepts BASIC FORTRAN IV or FOCAL, so we have made data analysis program for the in vivo assay in BASIC and analyzing data in off-line fashion.

Quickness and accuracy of the system are quite suitable for observation of sequential movement of dynamic study.

In summary, the GAMMA-11 has many “ease of use” devices and useful for nuclear medicine data analysis, however, the capacity of disk seems still unsatisfactory for complicated analysis, and we are going to equip higher capacity disk of 7.2 M words.