γ-ray Thickness Gauge for Medical Use and Its Clinical Application

F. HOSHINO and K. UEMURA

Department of Radiology, School of Medicine, Tohoku University, Sendai

Thickness gauge applying radiatoin is widely known in industrial use, but little is known in medical practice. The purpose of this study is to find that radiation thickness gauge can be used for measuring the lung density, and local respiratoty function.

* The apparatus; The original apparatus was consist of conventional profile scanner and ^{137}Cs γ-source (250mCi) which was built in scanner.

Patient is lying on scanning bed between the scource and a scintillation detector, which measures the radiation passing through the subject. The Detector is connected to the spectrometer and the log converter. The output is recorded as subject thickness (equivalent water) by Y axis of XY-recorder, and its X axis is connected to position signal of scanning bed. This gauge can measure from 5mm to 30cm thickness (equivalent water) with good linearity. Recently, a new apparatus, which had tilting couch and dual measering system, was made in our laboratory.

The scanning speed is 32 cm/min to 250 cm /min, the collimeter aperture is 5 mm × 25 mm or 5 mm ϕ.

With this apparatus, at every posture and at any breath holding state, the raiological chest thickness can be measured.

* Results of medical use; Lung density and local ventilatory function was measured.

The lung density, which will decrease at parenchymal destruction and overinflation, is calculated as follows;

$$\text{Lung density} = \frac{\text{Chest thickners (equivalent water)} - \text{Thorax soft tissue thickness}}{\text{Lung thickness}}$$

The chest thickness (equivalent water) is measured by γ-ray thickness gauge, and thorax soft tissue thickness and lung thickness is obtained from radiogram.

54 Patients with chronic obstructive lung disease were examined, The patients are divided into 3 groups by % $FEV_{1.0}/VC$; in the 1st group, % $FEV_{1.0}VC$ is less than 5.5%, the 2nd group, 55-70%, and the 3rd group, ober 70%.

The lung density of the 1st group (22 patients) indicate less than 0.22 in all patients, in the 2nd group (18 patients), less than 0.22 in 10 patients, and in the 3rd group (14 patients), the lung density is from 0.23 to 0.39.

With this gauge, the ventilatory distribution of the lung can be measured easily at every posture.

In addition, our new apparatus can be used successfully as scanning pulmonary analyser using ^{133}Xe gass.

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