BODY SURFACE EXPOSURE DISTRIBUTION OF EXAMINEES RECEIVED UPPER G.I.T. X-RAY EXAMINATION

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ABSTRACT

A special cloth for keeping LiF(Mg,Cu,P)TL dosimetry elements is worn by examinees. The exposures of 128 examinees received upper G.I.T (gastro-intestinal tract) X-ray examination are measured. The reference point of the maximum body surface exposure given is at the middle of stomach. The average of this point is $(4.97\pm1.94)\times10^{-4}C\cdot kg^{-1}$ person^{-1}examination^{-1} and $(1.33\pm0.28)\times10^{-4}C\cdot kg^{-1}\cdot min^{-1}$.

Keywords Upper G.I.T. X-ray examination, Body surface exposure, Radiation dose distribution, Reference point of maximum surface exposure

1 INTRODUCTION

Medicine radiation is the largest among man-made sources[1]. The investigation of dose from medical radiation is carried out both at home and abroad[2,3]. In medical radiation the doses from X-ray examinations are much higher than the others and the dose per the upper G.I.T. (gastro-intestinal tract)examination is the highest among X-ray ones[4]. Its frequency of residents is much more. Because of its quite uneven radiation, it is necessary to understand the distribution of body surface exposure and the reference point of maximum dose so as to calculate the dose level.

2 MEASUREMENT METHOD

Body surface dose of patient received the upper G.I.T. X-ray examination is associated with the type of X-ray machine, doctor's skill and state of disease. The dose is quite different from patient to patient. Owing to these factors the measurement of dose is necessary.

The survey is confined to two sets of X-ray machine with image intensifier in People's Hospital. The exposures of 128 examinees received upper G.I.T. X-ray examination in 16 work units are measured. A special cloth is used to do the measurement. This cloth is 70cm×35cm with 49 pockets (see Fig.1). In every pocket there are two LiF(Mg,Cu,P)TL dosimetry elements. The center of the up edge of the cloth aims at the seventh cerrical kertebra. When examination the patient wore the cloth with the side inserting TL dosimetry elements opposite to the X-ray incident direction. A piece of cloth was used for each work unit accumulating about 5–11 examinees. The exposed time, number of

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radiograph and X-ray machine working condition are recorded. FJ-377 TL dosimeter is used in the measurement.

3 RESULTS

The data from two TL elements in a pocket are averaged and the mean value at every point is obtained. After correction with calibration factor the surface exposure at every point is got. Through calculating mean value of surface exposure per person per examination for corresponding point of 16 groups, the relative distribution of surface exposure is obtained (see Fig.1). From measuring data of 16 groups of 128 examinees picking out the maximum surface exposure in every group and averaging, the mean value of maximum exposure per person per examination was obtained. That is the maximum of the body surface exposure in Table 1. Statistic test shows the maximum surface exposure was coincident with normal distribution.

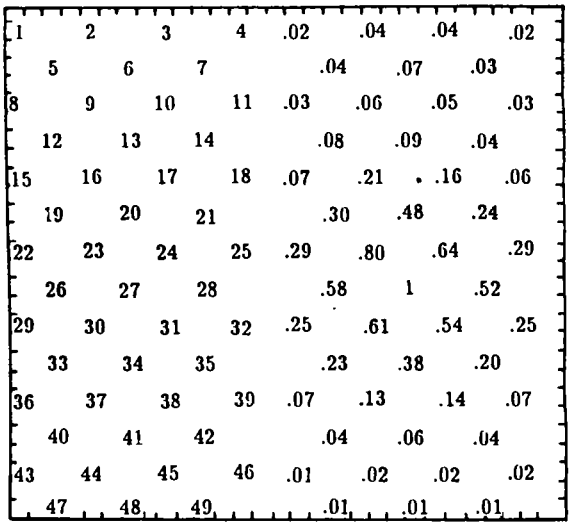

Fig.1 Distributions of measured points and relative body surface exposure

Table 1
Measured results of upper G.I.T. X-ray examination

	Body surface exposure / 10^{-4}C· kg^{-1}person^{-1}examination^{-1}		Exposed time /min	Number of radiograph
	Maximum dose points	No.27		
Mean	5.20	4.97	3.75	5.58
SD	1.86	1.94	1.93	1.76
Range	2.87–10.27	2.60–10.27	1.23–11.75	0–12

Notes: X-ray machine working condition: H.V. 76–125kV, current 0.5–3mA

4 DISCUSSION

4.1 As the examinee's illness state, doctor's skill and machine type are quite different and the examinee's exposed part always alters, the measurement data are comparatively dispersed. This measurement was carried out with two machines. The measurement data in one group was contributed by 5–11 examinees. So the dispersion of these data is less than the direct measuring of per examinee.

4.2 The relative distribution of surface exposure was presented in Fig.1. The reference point of maximum exposure is No.27 (see Fig.1). In measurement it showed up 11

times, about 69% of total measuring times. The times of maximum exposure appearing at the point No.23 was 3, about 19% of the total. Those of maximum exposure appearing at No.24 and No.31 was once respectively, about 6% of the total. It means that the reference point of maximum surface exposure from upper G.I.T. X-ray examination is at point No.27, i.e. at the middle of stomach.

4.3 The mean maximum surface exposure per person per examination at all max dose points was $(5.20\pm1.86)\times10^{-4}C\cdot kg^{-1}$. Taking No.27 as the reference point of maximum dose, the average is $(4.97\pm1.94)\times10^{-4}C\cdot kg^{-1}$. The difference between them is 4.5%. It is not significant statistically.

4.4 With the conversion factors between the body surface exposure and absorbed doses of organs (or tissues), the weighed dose equivalent was estimated. The male is 2.35mSv(1.23—4.86 mSv). The female is 2.31 mSv(1.21—4.78 mSv).

4.5 The maximum surface exposure depends on the radiation time. The longer radiation time is, the more dose is. The mean radiation time per person per examination is (3.75±1.93) min. The range is 1.23—11.75 min. On an average, in a minute of radiation time, the maximum point surface exposure is $(1.39\pm0.27)\times10^{-4}C\cdot kg^{-1}$, whereas at the point No.27 is $(1.33\pm0.28)\times10^{-4}C\cdot kg^{-1}$. In order to reduce the radiation dose received by the examinee it is required to reduce the exposed time.

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