Dose Distribution Within the Pelvis With the Use of Telecobalt Moving Therapy

By

Hisashi Ohtake, Tohru Yanagisawa* and Kiyoji Higuchi

Dept. of Radiology, School of Medicine, Iwate Medical University, Morioka

(Director: Prof. S. Tarusawa)

Hajime Iida

Dept. of Obstetrics and Gynecology, School of Medicine, Iwate Medical University, Morioka

(Director: Prof. Y. Hata)

^{60}Co 運動照射時の骨盤内線量分布について

岩手医科大学医学部放射線医学講座（主任：足沢三之介教授）

大竹 久　柳沢 融　樋口喜代治

同産婦人科学講座（主任：秦 良麿教授）

飯田 肇

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運動照射を行なう場合，体内での正確な空間的線量分布を知つておくことが必要である．今回，子宮頸癌に対する ^{60}Co 振子照射の骨盤内線量分布を測定したので報告する．

照射装置は島津製 RT- 2,000．断面が略々楕円形の水ファントームを用い，照射野 4 cm×10cm と 5 cm×10cmの 2 通りについて，両側のB点を中心として，左右から 220°の振子照射を行なつた．（B点の線量）：（A点の線量）は 4 cm巾の照射野では 100：70，5 cm巾のときは 100：75であつた．

また，左右のB点は，それぞれ反対側からの照射の際に，回転中心の線量の10%程度の線量を受けるので，Tumor-air ratio から計算された線量に，反対側からの照射で受ける分を加える必要がある．

人間の骨盤骨と大腿骨上部を水ファントーム内に入れて線量を測定してみたが，骨のない場合にくらべ，最大 4～5 %位の減弱を示すに過ぎないので，臨床的には水ファントームでの線量分布をそのまま人体に応用しても差支えないと思われる．

Introduction

To perform a moving irradiation therapy, it is necessary to know the accurate spatial dose distribution in the body. Many reports are available concerning this point.[1)~3)5)6)]

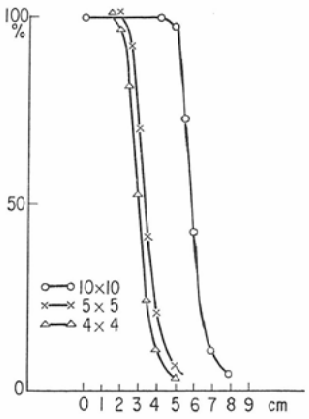
In the present report,the dose distribution from a telecobalt moving therapy against carcinoma of the uterine cervix is reported.

Method of Measurement, Results and Discussion

As the apparatus for irradiation, a Shimadzu double rotation type RT-2000 was used. The source

*Present adress: Dept. of Dental Radiology, School of Dentistry, Iwate Medical University, Morioka.

Fig. 1. Penumbra at SSD 75 cm (measured in air). Field size of 4 cm × 4 cm, 5 cm × 5 cm and 10cm × 10 cm.



was cobalt-60 600 Ci (as of September 1960) in wafer type measuring 20 mmϕ × 1 mm × 6. The degree of haziness at the border of the radiation cone in air was measured with the Colonial's rate meter (Nihon Hoshasen Bogyo Co. Ltd.). The source-surface distance was 75 cm. In a field of radiation of 10 cm × 10 cm, the dose was 97% of that of the center at the edge of the field (5 cm from the center), 72% at 0.5 cm from this point, 42% at 1 cm, and 10% at 2 cm (Fig. 1). In a field of radiation of 5 cm × 5 cm, and a field 4 cm × 4 cm, approximately similar results were obtained. The obscuring of the border was practically unrelated to the field size.

As the phantom, an approximately oval 5 mm thick plastic vessel, filled with water was used, with an outside diameter of 30 cm in the transverse direction, 18 cm in the longitudinal direction, 40 cm in the length. Radiation was aimed at both parametria. Placing both points B at the center, pendulum irradiation of 220 was carried out from both right and left. Source-center distance was 75 cm, and the field size was 4 cm × 10 cm and 5 cm × 10 cm at the center of rotation. The Colonial's rate meter was used for measurement of dose, according to the method reported by us previously[4]. The dose distribution is

Fig. 2. Isodose chart in water phantom. Field size of 4 cm × 10 cm.
Left side: Unilateral irradiation
Right side: Bilateral irradiation

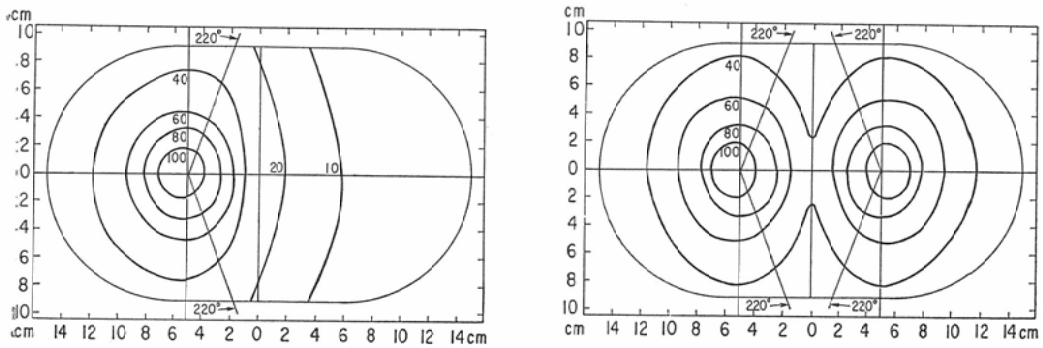
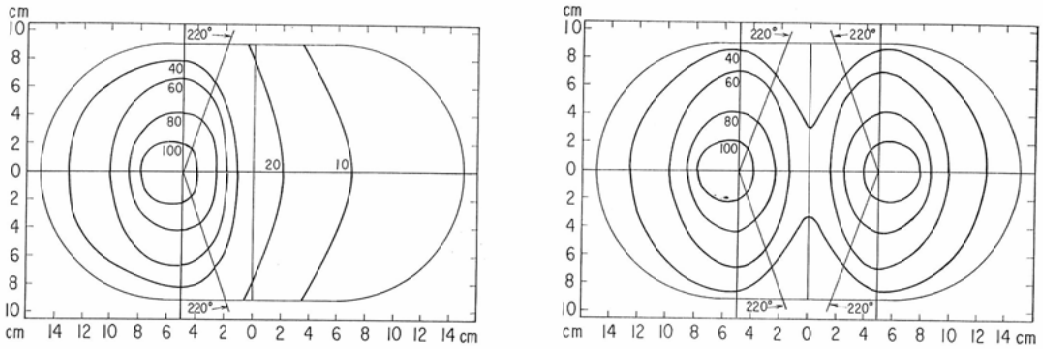


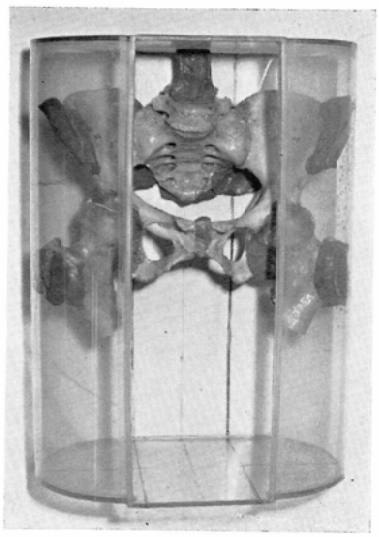
Fig. 3. Isodose chart in water phantom. Field size of 5 cm × 10 cm.
Left side: Unilateral irradiation
Right side: Bilateral irradiation



shown in Fig. 2 and 3. Upon irradiation on the field 4 cm × 10 cm, the ratio between the dose at point B and that at point A was 100 : 70, while the corresponding value was 100 : 75 in the field 5 cm × 10 cm.

Since point B, on both sides, received a dose of radiation about 10% of the dose at the center of rotation of the contralateral side, the addition of this amount to the dose calculated from the tumor-air ratio by H. E. Johns should not be forgotten.

Fig. 4. Water phantom placed pelvic bone and femur of man.



As shown in Fig. 4, the dose was measured in the pelvic bone and femur of man placed in a water containing phantom. As compared to the occasion without bone, the maximum decrease of the dose was only 4–5%, and the presence of the bone may be almost completely ignored. Consequently, the dose distribution within the water phantom appears to be sufficient for clinical purposes.

Summary

The dose distribution with the use of telecobalt moving therapy revealed a good distribution from the

pendulum irradiation using both points B as centers. Besides such external irradiation, internal irradiation or radical operation was used in combination in the therapy of carcinoma of the uterine cervix, and excellent results were obtained. Since it was established that the absorption by bone may be almost completly ignored in γ-ray from cobalt-60, the results obtained in a water phantom may be used without any correction.

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