

Evaluasi distribusi dosis radiasi CT scan abdomen dalam fantom rando menggunakan film gafchromic XR-QA2 dan thermoluminescent dosimeters = Evaluation of radiation dose distribution of abdomen CT scan on rando phantom using gafchromic XR-QA2 film and thermoluminescent dosimeters / Emidatul Manzil

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Abstrak

[ABSTRAK

Dosimetri CT scan dapat dilakukan dengan menggunakan konsep CTDI, Monte Carlo, atau dengan pengukuran langsung dalam fantom fisis. Pengukuran langsung menggunakan thermoluminescent dosimeter (TLD) merupakan prosedur yang rumit dan membutuhkan waktu yang lama. Saat ini sudah tersedia film radiochromic yang dapat digunakan di radiologi. Pada penelitian ini dilakukan pengukuran distribusi dosis radiasi dalam fantom Rando menggunakan film Gafchromic XR-QA2 dan TLD. Film Gafchromic XR-QA2 dan TLD dikalibrasi di CT scanner Siemens Sensation 64. Pengukuran distribusi dosis dengan film dilakukan pada faktor pitch 0.8, 1.0, dan 1.4. Film Gafchromic XR-QA2 disisipkan diantara slab 22-23 (Film A), 23-24 (Film B), dan slab 24-25 (Film C). Pengukuran distribusi dosis dengan TLD dilakukan dalam slab nomor 23 dengan faktor pitch 1.4. Film Gafchromic XR-QA2 yang telah dieksposi dipindai dengan flatbed scanner Epson Perfection V700 Photo. Dosis serap tulang belakang pada Film A, Film B, dan Film C yang dieksposi dengan faktor pitch 1.4 secara berturut-turut adalah 2.0 mGy, 1.9 mGy, dan 2.2 mGy. Berdasarkan profil dosis, rata-rata dosis serap pada film yang dieksposi dengan faktor pitch 1.0 dan 1.4 secara berturut-turut adalah 8% dan 24% lebih tinggi dibanding rata-rata dosis serap pada film yang dieksposi dengan faktor pitch 0.8. Rentang dosis hasil pengukuran dengan TLD adalah $(1.9 \pm 0.1) - (2.3 \pm 0.2)$ mGy dan rentang dosis hasil pengukuran dengan film Gafchromic XR-QA2 adalah 1.8 – 2.3 mGy dengan perbedaan maksimum 10.6%. Perbedaan tersebut masih berada dalam rentang keakurasian TLD yaitu < 15%. Berdasarkan hasil tersebut, film Gafchromic XRQA2 dapat digunakan untuk pengukuran dosis CT scan selanjutnya.

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ABSTRACT

Computed tomography (CT) dosimetry can be approached by using CTDI method, Monte Carlo computer technique, and direct measurement within physical phantom. Direct measurement using thermoluminescent dosimeters (TLDs) is a laborious procedure. Radiochromic film for radiology application was available. In this study, dose distribution within adult anthropomorphic physical phantom was measured using TLD and Gafchromic XR-QA2 film. TLD and

Gafchromic XR-QA2 film was calibrated on CT scanner Siemens Sensation 64. Gafchromic XR-QA2 film was sandwiched between slab Rando phantom number 22-23 (Film A), 23-24 (Film B), and 24-25 (Film C). Pitch factor 0.8, 1.0, and 1.4 were used. TLDs were placed at the holes in the slab number 23 of anthropomorphic phantom. TLDs were scanned using pitch factor 1.4. After exposure, Gafchromic XR-QA2 film was digitized using Epson Perfection V700 Photo flatbed scanner. Absorbed dose at vertebra on Film A, Film B, and Film C which exposed by using pitch 1.4 respectively were 2.0 mGy, 1.9 mGy, and 2.2 mGy. Based on dose profile, average dose of XR-QA2 film which exposed by using pitch 1.0 and 1.4 respectively were 8% and 24% higher than average dose of XR-QA2 film which exposed by pitch 0.8. TLDs dose range were $(1.9 \pm 0.1) - (2.3 \pm 0.2)$ mGy and Gafchromic XR-QA2 film dose range were 1.8 – 2.3 mGy with maximum difference 10.6%. The difference is still within the range of TLD accuracy, < 15%. Based on this result, Gafchromic XR-QA2 film can be used to measure CT dose, Computed tomography (CT) dosimetry can be approached by using CTDI method, Monte Carlo computer technique, and direct measurement within physical phantom. Direct measurement using thermoluminescent dosimeters (TLDs) is a laborious procedure. Radiochromic film for radiology application was available. In this study, dose distribution within adult anthropomorphic physical phantom was measured using TLD and Gafchromic XR-QA2 film. TLD and Gafchromic XR-QA2 film was calibrated on CT scanner Siemens Sensation 64. Gafchromic XR-QA2 film was sandwiched between slab Rando phantom number 22-23 (Film A), 23-24 (Film B), and 24-25 (Film C). Pitch factor 0.8, 1.0, and 1.4 were used. TLDs were placed at the holes in the slab number 23 of anthropomorphic phantom. TLDs were scanned using pitch factor 1.4. After exposure, Gafchromic XR-QA2 film was digitized using Epson Perfection V700 Photo flatbed scanner. Absorbed dose at vertebra on Film A, Film B, and Film C which exposed by using pitch 1.4 respectively were 2.0 mGy, 1.9 mGy, and 2.2 mGy. Based on dose profile, average dose of XR-QA2 film which exposed by using pitch 1.0 and 1.4 respectively were 8% and 24% higher than average dose of XR-QA2 film which exposed by pitch 0.8. TLDs dose range were $(1.9 \pm 0.1) - (2.3 \pm 0.2)$ mGy and Gafchromic XR-QA2 film dose range were 1.8 – 2.3 mGy with maximum difference 10.6%. The difference is still within the range of TLD accuracy, < 15%. Based on this result, Gafchromic XR-QA2 film can be used to measure CT dose]