

Evaluasi distribusi dosis aksial pada angiografi rotasi tiga dimensi (3DRA) menggunakan thermoluminescence dosimeter (TLD) dan film radiochromic = Evaluation of axial dose distribution in three-dimensional rotational angiography (3DRA) using thermoluminescence dosimeter (TLD) and radiochromic film

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Abstrak

Perhitungan dosis radiasi melalui keluaran metrik 3DRA hanya tersedia pada protokol kontrol kualitas pada CBCT untuk radiologi intervensional. Hal ini dianggap belum andal karena perputaran gantry pada prosedur 3DRA tidak satu lingkaran penuh seperti pada Computed Tomography (CT). Penelitian ini bertujuan untuk mengevaluasi distribusi dosis aksial untuk prosedur 3DRA menggunakan tiga dosimeter relatif: thermoluminescence dosimeter (TLD), Film Gafchromic® XR-QA2, dan Film Gafchromic® XR-RV3. Dosimeter yang terkalibrasi diletakkan di dalam fantom in house berbentuk silinder dan dilakukan pengukuran pada pesawat angiografi Philips Allura Xper FD20 menggunakan tiga mode preset yang tersedia.

Hasil pengukuran menggunakan dosimeter relatif dibandingkan dengan hasil pengukuran menggunakan dosimeter absolut untuk mengetahui akurasi. Dari pengukuran didapatkan bahwa distribusi dosis 3DRA tidak homogen pada seluruh penampang fantom in house. Nilai dosis paling besar berada posisi jam 3 dan jam 9 sedangkan nilai dosis paling rendah berada pada posisi jam 12. Di antara dosimeter yang digunakan, distribusi dosis aksial yang paling akurat diperoleh melalui pengukuran menggunakan Gafchromic® XR-RV3, yang ditunjukkan dengan nilai diskrepansi rata-rata sebesar 33,82%. Selain itu, pengukuran mode Cranial Stent pada posisi jam 12 menunjukkan diskrepansi terkecil, dengan nilai 9,10%.

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The calculation of radiation dose for 3DRA output metrics is currently only available in quality control for cone-beam computed tomography (CBCT). This method is considered unreliable because the gantry rotation in the 3DRA procedure is not a full 360 degrees like in CBCT. The objective of this study is to determine the axial dose distribution during the 3DRA procedure using three different relative dosimeters: thermoluminescence dosimeter (TLD), Gafchromic® XR-QA2 Film, and Gafchromic® XR-RV3 Film. The calibrated dosimeters were placed within a cylindrical in-house phantom, and measurements were performed using a Philips Allura Xper FD20 angiography system (in three preset modes).

The output of measurements using a relative dosimeter were compared to those using an absolute dosimeter, with the aim of assessing the accuracy. It was found that the axial dose distribution in the 3DRA procedure is not evenly distributed across the cross-sectional area of the in-house phantom. The highest dose values were observed at the 3 and 9 o'clock positions, while the lowest dose values were recorded at the 12 o'clock position. Among the dosimeters used, the most accurate axial dose distribution was obtained through measurements using Gafchromic® XR-RV3, as indicated by an average discrepancy value of 33.82%. Additionally, the cranial stent mode measurements at the 12 o'clock position showed the smallest discrepancy, with a value of 9.10%.