Adaptive Planning Berdasarkan Citra Cone Beam Computed Tomography (CBCT) = Adaptive Planning Based on Cone Beam Computed Tomography Images

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Abstrak

Penelitian ini bertujuan untuk mengevaluasi akurasi perhitungan dosis berdasarkan citra Cone Beam Computed Tomography (CBCT) sebagai adaptive planning. Perencanaan terapi radiasi dilakukan terhadap 3 pasien kanker laring, 7 pasien kanker paru dan 5 pasien kanker prostat dengan menggunakan teknik Intensity Modulated Radiotherapy (IMRT) dan Volumetric Modulated Arc Therapy (VMAT). Perhitungan dosis dilakukan pada TPS Eclipse v13.6 dengan variasi algoritma Analytical Anisotropic Algorithm (AAA) dan Acuros External Beam (AXB).

Penelitian ini diawali dengan tahapan (1) kalibrasi HU citra CBCT menggunakan fantom CIRS 002LFC (2) analisa dose volume histogram (DVH), (3) analisa gamma index dengan kriteria DD 2% / DTA 2mm serta DD 3% / DTA 3mm menggunakan perangkat EPID. Penyimpangan D_{98%}, D_{50%} dan D_{2%} dari DVH dievaluasi dengan menjadikan citra CT algoritma AAA sebagai referensi. Diperoleh nilai penyimpangan D_{98%}, D_{50%}dan D_{2%} tertinggi pada kasus kanker laring yaitu sebesar 9,08% ± 2,21 (CBCT AXBm - CT AAA), 0,74% ± 0,37 (CBCT AXBw - CT AAA) dan 3,79% ± 0,55 (CBCT AXBw - CT AAA). Penyimpangan D_{98%}, D_{50%} dan D_{2%} pada kasus kanker paru dan kanker prostat diperoleh lebih kecil dari 2%. Conformity index (CI) diperoleh pada rentang 0,98 ± 0,011 dan homogeneity index (HI) diperoleh pada rentang 0,08 ± 0,015. Analisa gamma index dengan kriteria 2%/2mm diperoleh pada range 87% - 94% dan kriteria 3%/3mm diperoleh 93% - 99%. Dari hasil penelitian ini didapati bahwa hasil kalkulasi dosis berdasarkan citra CBCT hampir sama dibandingkan dengan citra FBCT sehingga citra CBCT dilihat layak digunakan sebagai adaptive planning radiotherapy.

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This study was divided into three major parts : (1) HU calibration for CBCT images by using CIRS phantom 002LFC (2) dose volume histogram (DVH) analysis, (3) analysis of Gamma Passing Rate with criteria DD 2% / DTA 2mm and DD 3% / DTA 3mm using EPID. The DVH analysis for D_{98%}, D_{50%} dan D_{2%}deviation was evaluated and CT images with AAA algorithm used as reference. The highest deviation of D_{98%}, D_{50%}dan D_{2%}was found for larynx cancer with value 9,08% ± 2,21 (CBCT AXBm - CT AAA), 0,74% ± 0,37 (CBCT AXBw - CT AAA) and 3,79% ± 0,55 (CBCT AXBw - CT AAA).

Deviation of D_{98%}, D_{50%} dan D_{2%}for lung and prostate cancer is less than 2%. Range of conformity index based on CBCT images is 0,98 ± 0,011 and homogeneity index is in the range of 0,08 ± 0,015. The gamma criteria of dose difference and dose to agreement for 2%/2mm are 87% - 94% and for 3%/3mm are 96% - 98%. From the result, we found that the difference of dose calculation based on CBCT images is almost similar to CT images, so CBCT images are proper to be used for adaptive planning.</i>