THE EFFECT OF CONTRAST AGENTS ON DOSE CALCULATION IN CONFORMAL RADIOTHERAPY PLANNING USING COMPUTED TOMOGRAPHY FOR TUMORS AT DIFFERENT ANATOMICAL REGIONS

SUMALEE YABSANTIA

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE (MEDICAL PHYSICS) FACULTY OF GRADUATE STUDIES MAHIDOL UNIVERSITY 2010

COPYRIGHT OF MAHIDOL UNIVERSITY
THE EFFECT OF CONTRAST AGENTS ON DOSE CALCULATION IN CONFORMAL RADIOTHERAPY PLANNING USING COMPUTED TOMOGRAPHY FOR TUMORS AT DIFFERENT ANATOMICAL REGIONS

SUMALEE YABSANTIA 5036372 RAMP/M

Ms.C. (MEDICAL PHYSICS)

THESIS ADVISORY COMMITTEE: PUANGPEN TANGBOONDUANGJIT, Ph.D. (MEDICAL RADIATION PHYSICS), CHIRAPHA TANNANONTA, M.Sc. (MEDICAL PHYSICS)

ABSTRACT

The purpose of this study was to evaluate the effect of contrast agents on dose calculation in 3-Dimensional Conformal Radiotherapy (3D-CRT) for brain, thorax and upper abdomen regions in Ramathibodi Hospital, Thailand. Five, six and four cancer patients of the brain, thorax and upper abdomen regions were studied, respectively. Two sets of CT images of each patient were taken from the same position before and after IV contrast agent injection. A treatment plan was approved by radiation oncologists for each patient in study. A “without contrast agent CT images” set was simulated for the thorax and the upper abdomen regions by measuring the density of the organs or regions that were filled with a contrast agent (in real without contrast agent CT image) then overridden by measured density in the “with contrast agent CT images”. The approved treatment plan was copied to “without contrast agent CT images” and dose was calculated and then treatment plan was copied to “with contrast agent CT images” with the same monitor units and the dose was calculated again. The doses calculated from two treatment plans were compared with regard to tumor volume and organs at risk by paired sample t-test. Gamma evaluation (3%/3mm) was used to evaluate the differences in dose distribution between the two treatment plans. The results for doses of tumor volume and organs at risk were not significantly different between with and without contrast agent CT image for brain, thorax and upper abdomen regions (p>0.05), except for the heart organ in the thorax region (p<0.05) but the dose differences were less than 1% compared to doses calculated from “without contrast agent CT images”. Dose distributions between the two sets of CT images were not different (percent pixel pass > 95% and mean gamma value < 0.5). From these results, using contrast agent at the time of CT simulation does not significantly affect dose calculation in 3D-CRT.

KEY WORDS: CONFORMAL RADIOTHERAPY/ CONTRAST AGENT/ TREATMENT PLANNING/ DOSE CALCULATION

53 pages
The effect of contrast agents on dose calculation in conformal radiotherapy planning using computed tomography for tumors at different anatomical regions

Soomi, Yubattani 5036372 RAMP/P

Th.M. (Physics)

Advisor: Ph-D. (Medical Radiation Physics), Jirakorn Dananant, M.Sc. (Medical Physics)

Objectives

The purpose of this study is to evaluate the effects of contrast agents on dose calculation in conformal radiotherapy planning using computed tomography for tumors at different anatomical regions. The study involves five patients with cancer in the head, neck, and chest regions at the Ramathibodi Hospital. Five patients were selected for treatment with computed tomography images before and after administration of contrast agents, and images without contrast agents for the chest and head regions. The treatment plans were created using the prescribed radiation doses, with the total dose set to be equal between the two treatment plans. The dose was compared using the paired sample t-test and gamma evaluation with a tolerance of 3%/3 mm. The results showed that there was no significant difference in dose distribution between the two treatment plans with the gamma value less than 0.5. Therefore, the use of computed tomography with contrast agents in conformal radiotherapy planning does not affect dose calculation.