Moving towards three-dimensional image-guided brachytherapy for cancer of cervix uteri: improving treatment accuracy

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Keywords:
Three-dimensional Image-Guided Brachytherapy
Cancer of Cervix Uteri
Dose-Reporting Parameters

Introduction
Since December 2013, three-dimensional image-guided brachytherapy for cancer of cervix uteri was implemented in Queen Mary Hospital. We have reported our preliminary experience in Hospital Authority Convention 2014. Different dose-reporting parameters have to be used for two-dimensional and three-dimensional image-guided brachytherapy. We have reported preliminary results in correlations between these dose-reporting parameters in Hong Kong College of Radiologists Annual Scientific Meeting 2014.

Objectives
To update results on correlations between these dose-reporting parameters, so as to determine if moving towards three-dimensional image-guided brachytherapy has resulted in improved treatment accuracy.

Methodology
Between January and December 2014, fifteen patients underwent CT-based brachytherapy (number of plans: 60). High Risk Clinical Target Volume (HR-CTV) and rectum were contoured according to international guidelines for three-dimensional image-guided brachytherapy. Point A and International Commission on Radiation Units (ICRU) rectal points, which are traditional dose-reporting parameters for two-dimensional image-guided brachytherapy, were also determined. The correlations between minimum dose to 90% (D90) of HR-CTV and Point A, and also between minimum dose to the most exposed 2cc (D2cc) of rectum and ICRU rectal points were determined by calculating the Pearson correlation coefficients. Two-sided paired t-test was used to determine if there are any statistically significant differences between HR-CTV D90 and Point A, and also between D2cc of rectum and ICRU rectal points.
**Result**
Comparing the dose of Point A and D90 of HR-CTV, neither statistically significant difference ($p = 0.21$) nor statistically significant correlation ($R = -0.20; p = 0.13$) were observed. Comparing the dose of ICRU reference rectal point and D2cc of rectum, statistically significant difference ($p < 0.0001$) was observed. However, positive correlation was observed ($p < 0.001$). These results suggest that, while HR-CTV D90 and Point A appear to show a random relationship, ICRU rectal point may tend to underestimate the dose to rectum in a plan achieved by CT-based planning compared with D2cc. Using three-dimensional image-guided planning has resulted in more accurate estimation of radiation doses to treatment target volume and surrounding organs at risk, thus potentially improve treatment outcome and reduce complications.