Purpose/Objectives

To evaluate the predictive value of EUD for late rectal toxicity after I-125 brachytherapy for prostate cancer.

Materials/Methods

From 2003 to 2006, consecutive 321 patients with prostate cancer were treated with I-125 monotherapy at Tokyo Medical Center. In total, 319 patients whose CT-based postimplant dosimetry had been performed one month after the implant were analyzed. The prescription dose was set at 145 Gy. Late complications were recorded using the Radiation Therapy Oncology Group scale.

Dose-volume histograms (DVHs) of the rectum retrieved from a treatment planning system were converted to equivalent dose-based DVHs in order to account for differences in radiation treatment modality.

EUD for rectum were calculated from both the equivalent dose-based DVHs (EUDeq2) and the physical dose-based DVHs (EUDphys). (Burman et al. 1991)

\[ EUD = \left( \sum v_i \cdot \frac{1}{D_i^n} \right)^{\frac{1}{n}} \]

The values of n was taken as 0.12 as given by Burman et al.

Results

The average EUDeq2 to the rectum was 77.8 Gy (range, 40.3-137.9 Gy).

The average EUDphys to the rectum was 103.7 Gy (range, 53.7-183.8 Gy). EUDeq2 were exactly proportional to EUDphys.

EUD were correlated with known postoperative dosimetric parameters of the rectum, such as V100, D30, D10 and D1. Especially, D1 had a strong correlation with EUD.

Correlation with known postoperative dosimetric factors

<table>
<thead>
<tr>
<th>R100 (cc)</th>
<th>D30 (Gy)</th>
<th>D5 (Gy)</th>
<th>D1 (Gy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation factor</td>
<td>0.819*</td>
<td>0.727*</td>
<td>0.849*</td>
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</tbody>
</table>

*: statistically significant

Conclusions

EUD of the rectum after I-125 brachytherapy for prostate cancer were calculated.

Conversion of physical doses in DVHs to equivalent doses enabled a comparison of EUD between the standard fractionated 3D-CRT and I-125 brachytherapy.

Although few patients developed Grade 2 late rectal toxicity after I-125 monotherapy, their rectal EUD were higher.

EUD may be a more useful predictive indicator of late rectal toxicity than known postimplant dosimetric parameters.