Comparison of points and volumetric doses using CT and MR images for 3D planning brachytherapy: A Brazilian experience

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Introduction

Brachytherapy

- Plays a major role for local control and survival in the treatment of uterine cervix cancer patients
- High effective dose, while minimizing the dose in adjacent normal tissue or organs at risk (OAR)

Image-guided brachytherapy (IGBT)

- Optimizes the cost-benefit ratio between dose at tumor and organs at risk.
- Potential to improve local control and survival in these patients
Methods

12 patients 04/2010 to 09/2010
22 MR and 23 CT taken alternately

3D plans:
TPS
Oncentra
MasterPlan
(Nucletron®)

ICRU points (ICRU 38. 1999)
- Bladder (ICRU\textsubscript{Bladder})
- Rectum (ICRU\textsubscript{Rectum})
- Sigmoid point (Sig)
  (Guimarães. et al. 2009)

OAR volumes
- 0.1 cm\textsuperscript{3} (D0.1cc)
- 2 cm\textsuperscript{3} (D2cc)
  (Pötter. et al. 2006)

Treatment
4 x 7 Gy point A
2D Plan

Dosimetric Comparison
Results and Discussion

Comparison of point and volume doses for OAR´s in CT and MR based plans

<table>
<thead>
<tr>
<th>Organ</th>
<th>Dose at points (Gy)</th>
<th>D_{0.1cc} (Gy)</th>
<th>D_{2cc} (Gy)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bladder</td>
<td>3.7 ± 1.3</td>
<td>9.8 ± 2.4</td>
<td>6.7 ± 1.2</td>
<td>&lt; 0.05#</td>
</tr>
<tr>
<td>Rectum</td>
<td>3.2 ± 0.5</td>
<td>3.7 ± 1.0</td>
<td>2.8 ± 0.6</td>
<td>&lt; 0.05##</td>
</tr>
<tr>
<td>Sigmoid</td>
<td>2.3 ± 0.8</td>
<td>5.6 ± 2.0</td>
<td>3.9 ± 1.1</td>
<td>&lt; 0.05###</td>
</tr>
</tbody>
</table>

# Bladder point underestimates the bladder dose: the volume falls over the applicator in a high dose region while the vesical balloon stays in a low dose region
## Rectum has less mobility. Therefore the rectum point is more representative of volume dose
### Sigmoid has high mobility and the sigmoid point dose did not correspond to the volumetric dose for the organ
Conclusions

• 3D plans based on CT or MR for brachytherapy can help to spare OAR
• CT and MR were equivalent and both can be used to decrease volumetric dose at OAR’s
• 2D points did not show good correlation to volumetric dose
• The implementation of 3D image-guided brachytherapy seems to be very promising in order to improve gynecological brachytherapy treatment technique and patients’ outcomes