

AbstractID: 13391 Title: Tolerance of Source Position Accuracy in HDR Brachytherapy in the era of 3-Dimensional Treatment Planning

**Purpose:**

3D CT/MRI based treatment planning has largely replaced 2D radiographs in HDR brachytherapy. Although dose-volume-histogram provides better estimate of organ dose than ICRU point, its accuracy suffers from source position errors due to intrinsic high dose gradients. The actual source dwelling position deviates from the position shown in plan because: applicator gets pushed in or pulled out during transportation between OR, CT/MRI and HDR; slice thickness of CT/MRI images introduces localization error in reconstructed applicator; HDR machine has ~1mm mechanic error in specification. In this study, we estimated the dosimetric changes due to source position errors.

**Method:**

Nineteen fractions from ten cervical patients were included. Prescription was 6 Gy using tandem/ovoids. CT-based plans were evaluated following GYN-GEC-ESTRO guidelines ( $D_{90}$  for CTV,  $D_{2cc}$  for OAR). H point and ICRU bladder/rectal point dose were also calculated. For each plan, source positions were shifted to mimic source position error, and resulting dosimetric changes were computed. Two levels of error were studied: 2.5 mm and 5.0 mm.

**Results:**

For a 2.5 mm error, CTV  $D_{90}$  changed by 1.8% while H point dose changed by 2.2%.  $D_{2cc}$  for bladder, rectum and sigmoid changed by 4.8%, 3.4% and 3.9% respectively. ICRU bladder and rectal point dose changed by 11.4% and 3.3% respectively.

For a 5.0 mm error, CTV  $D_{90}$  changed by 3.7% while H point dose changed by 4.6%.  $D_{2cc}$  for bladder, rectum and sigmoid changed by 10.9%, 6.6% and 8.4% respectively. ICRU bladder and rectal point dose changed by 23.8% and 6.9% respectively.

**Conclusion:**

Volumetric parameters are less sensitive to source position errors than ICRU points. Tumor coverage is not affected much by such errors. ICRU bladder point is extremely sensitive to such errors. To achieve an overall accuracy of 5% in dose delivery, combined source position error should be kept within 2.5 mm.