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Benefits of high-dose-rate intraluminal brachytherapy for rectal cancers during preoperative chemoradiation

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Purpose/Objective: The incidence of rectal cancer in Pakistan is similar to those in other Asian countries, but much lower than in the developed countries. At present, the risk is equal in both sexes. However a 41% rise in incidence was noted in Pakistani males during the period 1995-1999, which may indicate a higher risk in males in the future. Most rectal cancers present at advanced stages, and are not amenable to upfront curative surgery
The aim of this is study is to observe the Benefits of high-dose-rate intraluminal brachytherapy for rectal Cancers during preoperative chemo radiation.
Materials and Methods: Between 2009 and 2011, Seventy-two patients with locally advanced rectal cancer (≥ T3 or N+), were treated initially with concurrent capecitabine (825 mg/m2 oral twice daily) and pelvic external beam radiotherapy (EBRT) (45 Gy in 25 fractions), then were randomized to group A; HDR ILBT group (n = 34) to receive 5.5-7 Gy × 2 to gross tumor volume (GTV) and group B; EBRT group (n = 38) to receive 5.4 Gy × 3 fractions to GTV with EBRT
Results: All patients underwent total mesorectal excision. Grade 3 acute toxicities were registered in 24 patients (70.6%) in group A and in 16 (42.1%) in group B. Complete pathologic response of T stage (ypT0) in group A was registered in 20 patients (58.8%) and in group B, 6 patients (15.8%) had ypT0 (P < 0.0001). Sphincter preservation was reported in 12/18 patients (66.7%) in group A and in 10/20 patients (50%) in group B (P < 0.01). Overall radiological response was 68.15% and 66.04% in Group A and B, respectively. During a median follow up of 18 mo, late grade 1 and 2 sequelae were registered in 6 patients (17.6%) and 8 patients (21.1%) in the groups A and B, respectively.
Conclusions: From the study it is concluded that HDR-ILBT found to be effective dose escalation technique in preoperative chemoradiation for rectal cancers, with higher response rates, down staging and with manageable acute toxicities.

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Combining doses for external beam radiotherapy and a HDR brachytherapy boost ñ impact on metrics

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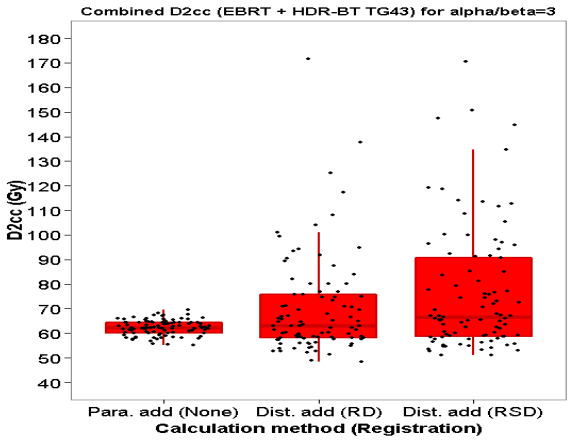
Purpose/Objective: This study aimed to use deformable image registration (DIR) to account for anatomical differences between each phase of a combined external beam (EBRT)/HDR brachytherapy prostate treatment and to allow the planned dose distributions to be combined. The objective was to extract reliable dose-volume parameters for correlation against recoded treatment toxicities.
Materials and Methods: 93 prostate cancer patients, accrued to the RADAR trial, received EBRT in 23 fractions of 2 Gy and HDR in 3 fractions of 6.5 Gy, with dose distribution calculated using the TG43 dose algorithm (replanned with the Acuros dose algorithm). The EBRT CT scan was registered to the HDR CT scan with rigid registration followed by a deformable multi-pass method (RD) in Velocity Advanced Imaging. Additionally, a rigid plus scale plus deformable multi-pass (RSD) method was used. The unregistered EBRT, unregistered/registered TG43 HDR and unregistered/registered Acuros HDR dose distributions were converted to equieffective doses at 2 Gy/fraction. Alpha-beta ratios of 3 and 5 were used. The rectum total D_{2cc} was calculated in two alternative ways. (1) Parameter adding: the D_{2cc} value from the unregistered $EQD2_{\alpha/\beta}$ EBRT dose distribution was added to the D_{2cc} from the unregistered $EQD2_{\alpha/\beta}$ HDR dose distribution. (2) Distribution adding: the unregistered $EQD2_{\alpha/\beta}$ EBRT dose distribution was summed voxel-by-voxel with the registered $EQD2_{\alpha/\beta}$ HDR dose distribution and then the total D_{2cc} was extracted. The pairwise percentage differences between the D_{2cc} values for the calculation methods were assessed via exact Wilcoxon singed-rank tests against a median percentage difference of zero.
Results: The figure provides the rectum D_{2cc} values for parameter and distribution adding with the TG43 dose algorithm and an alpha-beta ratio of 3. The maximum D_{2cc} values were larger for distribution adding after either registration method relative to the parameter adding values. The pairwise percentage difference between rectum D_{2cc} values for various parameter adding versus distribution adding comparisons were negative and significant ($p<0.05$, see table).



Calculation method comparison	DIR	HDR dose algorithm	α/β	Median difference in D_{2cc} (%)	Z-value	P-value
Parameter vs. Distribution	RD	TG43	3	-2.25	-2.48	0.0128
Parameter vs. Distribution	RSD	TG43	3	-6.94	-4.53	<0.0001
Parameter vs. Distribution	RD	Acuros	3	-1.64	-2.35	0.0182
Parameter vs. Distribution	RSD	Acuros	3	-3.66	-4.19	<0.0001
Parameter vs. Distribution	RD	TG43	5	-2.12	-2.39	0.0163
Parameter vs. Distribution	RSD	TG43	5	-6.04	-4.50	<0.0001
Parameter vs. Distribution	RD	Acuros	5	-1.36	-2.25	0.0240
Parameter vs. Distribution	RSD	Acuros	5	-3.12	-4.15	<0.0001

Conclusions: Applying registrations resulted in significantly different D_{2cc} values relative to summing the planned D_{2cc} values without registration. The percentage differences were low and the registration methods varied in terms of the final location of the anterior rectum surface relative to the HDR needles (e.g. the maximum D_{2cc}). Consequently, careful grouping of the accuracy/adequacy of the registrations is being undertaken before concluding the registrations lead to greater D_{2cc} values compared to parameter adding.