plan- 3dimensional conformal radiotherapy (3DCRT), intensity modulated radiotherapy (IMRT) and bone marrow sparing intensity modulated radiotherapy (BMS-IMRT) in 5 consecutive patients of locally advanced carcinoma rectum undergoing pre-operative radiation.
Materials and Methods: After immobilization with thermoplastic abdominopelvic cast, planning CT scan (Philips Big Bore CT; 3 mm slice thickness) was performed with intravenous and oral contrast. Clinical target volume (CTV) consisted of CTVA: mesorectal, presacral, internal iliac and obturator lymphnodal site and CTVB: external iliac lymphnodal site (in case of involvement of genitourinary structures). An isotropic expansion of 1 cm was given around CTV to generate the planning target volume (PTV). The dose-limiting organs at risk (OAR) included the urinary bladder, bowel, femoral head (FH) and iliac bone marrow (BM). Prescribed dose was 45 Gy/25#/5 weeks. 3DCRT was planned by 2 anteroposterior fields (6MV photons) and 2 lateral fields (15MV photons) after field shaping with multileaf collimator. Dynamic IMRT was planned by 7 equally spaced coplanar beams with 6 MV photons with dose prescribed at 95% iosdose (Eclipse TPS). Input constraints for BM (V20 < 40%; V10 < 50%) were used only in BMS-IMRT. Dosimetric comparison between the 3sets of plan was performed using paired t test with p value being <0.05 being statistically significant.
Results: See the table.

Parameters	3DCRT	IMRT	BMS-IMRT	p-values		
				3DCRT vs. IMRT	3DCRT vs. BMS-IMRT	IMRT vs. BMS-IMRT
Target coverage						
Median D95 PTV(Gy)	45.98	45.37	45.31	0.4123	0.232	*0.012*
Median V45 PTV(%)	97.72	98	97.23	0.2055	0.9397	*0.0094*
Median PTV mean dose (Gy)	47.86	46.78	46.95	0.1336	0.1154	0.4263
Conformity index (CI)						
Median CI	1.69	1.09	1.11	*0.0004*	*0.0004*	0.5614
Homogeneity index (HI)-D2/D98						
Median HI	1.09	1.09	1.09	0.7174	0.8712	0.208
Normal tissue sparing						
Median bowel V45 (cc)	18.74	9.42	11.17	0.3059	0.3023	0.9354
Median bowel Dmax (Gy)	48.79	48.22	48.17	0.0709	0.5493	0.3199
Median bladder V40 (%)	66.48	38.84	45.5	*0.0213*	*0.0185*	0.101
Median bladder Dmax (Gy)	49.28	48.11	48.46	0.3621	0.4015	0.7715
Median left FH Dmax (Gy)	47.06	44.96	44.78	0.2397	0.26	0.464
Median right FH Dmax (Gy)	47.07	45.67	45.39	0.2952	0.3061	0.4235
Median BM V20 (%)	87.99	79.81	60.13	0.2643	*0.0041*	*0.004*
Median BM mean dose (Gy)	33.59	31.06	27.13	0.0592	*0.0009*	*0*
Irradiated body volume (IBV)						
Median IBV5 Gy (cc)	8319.81	9058	9004.78	0.053	0.0691	*0.0096*
Median IBV10 Gy (cc)	7074.61	7669.88	7570.92	*0.0211*	*0.0462*	*0.0034*
Median IBV20 Gy (cc)	5767.28	4944.41	4702.74	*0.0031*	*0.001*	*0.0022*
Total monitor unit (MU)						
Median MU	217	1235	1422	*0.002*	*0.0006*	*0.0226*

Conclusion: Compared to 3DCRT, IMRT plans led to enhanced conformity and sparing of bladder and iliac bone marrow at the cost of increased IBV at low doses (5−10 Gy) and longer treatment time(increased MU). BMS-IMRT substantially decreased the bone marrow volume receiving in excess of 20 Gy and should be explored in clinical trials focusing on preoperative radiochemotherapy in locally advanced carcinoma rectum.

6056 POSTER

Brachytherapy Versus Tomotherapy Versus Stereotactic Body Radiotherapy (SBRT) for the Delivery of a Rectal Tumour Boost – a Comparative Dosimetric Study

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Introduction: The standard treatment for patients diagnosed with locally advanced rectal cancer includes neoadjuvant radiation followed by surgery. For patients not amenable to resection, the use of a radiation boost could provide better tumour control. Data from our institution indicates that high-dose rate endorectal brachytherapy can be used in the pre-operative setting to deliver conformal radiation to the primary tumour. In view towards the delivery of a conformal boost to rectal tumours, the present analysis compares the dosimetry of endorectal brachytherapy with Tomotherapy and SBRT.
Materials and Methods: The planning CT scans were retrieved for 10 endorectal brachytherapy patients previously treated at our centre with 26 Gy in 4 consecutive daily fractions prescribed to the deepest radial margin of the tumour. These CT scans were acquired with the endorectal applicator in place which distends the rectal wall and facilitates rectal immobilization and tumour localization. From these scans, Tomotherapy and 7-field linac-based SBRT dose distributions were generated for the same dose schedule of 26 Gy in 4 fractions. SBRT plans were prescribed to an isodose envelope covering 95% of the target and ensuring 99% of the target receives a minimum of 90% of the prescribed dose. For this comparative dosimetric study, the PTV was considered equal to the GTV for all plans. One-way ANOVA testing was used to compare mean values observed for select dose-volume parameters.
Results: All modalities achieved complete coverage of the target by the prescription dose. The target near maximum dose (D2%) was 175.9 Gy, 26.7 Gy and 29.1 Gy for brachytherapy, Tomotherapy and SBRT respectively (p =0.00). For the brachytherapy, Tomotherapy and SBRT plans respectively: the conformality index (prescription vol (cc)/target vol (cc)) was 4.1, 1.5 and 1.5 (p = 0.01) and the homogeneity index ((D2%-D98%)/D50%) was 2.79, 0.03 and 0.13 (p = 0.00).

	Brachy	Tomo	SBRT	Sig.
Uninvolved rectal mucosa max/mean (Gy)	181.5/22.7	26.5/9.4	27.4/5.8	<0.05
Anal canal max/mean (Gy)	14.3/4.3	4.9/1.5	3.2/0.6	<0.05
Bowel max/mean (Gy)	17.4/3.2	9.3/2.0	9.4/1.4	NS
Bladder max/mean (Gy)	23.4/5.2	15.2/4.2	14.5/3.6	NS
L Fem H max/mean (Gy)	4.6/2.0	5.8/3.0	8.4/2.4	NS
R Fem H max/mean (Gy)	4.5/1.9	5.4/2.8	6.6/2.3	NS

Conclusion: The Tomotherapy and SBRT plans provided better target conformality and homogeneity compared to endorectal brachytherapy. Brachytherapy was also associated with significantly higher doses to the uninvolved rectal wall and adjacent anal canal. Conformal external beam techniques may be preferable for boost delivery, particularly with patients for whom the irradiated tissue will not subsequently be resected.

6057 POSTER

Influence of Bladder Distension Control on Postoperative Radiotherapy in Rectal Cancer Patients Using Belly Board

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Background: Prone position with a belly board and bladder distension are the most commonly applied to reduce the irradiated small bowel volume. While conventional bladder distention result in low practicability and reproducibility throughout the course of pelvic radiotherapy. A consistent bladder volume is important. This present study compared the effects of the combination of belly board with or without bladder irrigation on reducing the irradiated small bowel volume during postoperative pelvic radiation in rectal cancer patients.
Materials and Methods: 11 consecutive patients who received pelvic radiation therapy for rectal cancer with belly board were included in this study. All patients underwent three sets of CT scans. The first one was taken before radiotherapy with a full (not empty) bladder. The second was taken 4 weeks after the beginning of the radiotherapy with a full bladder, and then immediately empty the bladder, and injecting the same volume of sodium chloride to the volume of the bladder recorded in the first scan. The conventional four-field treatment plan was made using a three-dimensional treatment planning system. The total volume of small bowel in pelvis, the volume of small bowel, bladder within every isodose level and their maximum dose and mean dose were analysed for 3 scans (group I, II, III). Data were analysed using nonparametric test.
Results: Compared to group I, the bladder volume was reduced significantly in group II. The median reduction of bladder volume was 148.36 cm^3. The volume of small bowel below fourth lumbar vertebra and its volume within every isodose level was increased (p < 0.05). The median increment of small bowel below fourth lumbar vertebra in group II compared with group I was 121.23 cm^3 (31.17%). The total volume, the irradiated volume in every isodose level for small bowel and bladder had no significant difference between group I and III (p > 0.05).
Conclusions: The bladder volume declined significantly during the course of radiotherapy. Hence an increment of irradiated small bowel volume. It is regrettable that the statistical analyse showed no correlation between the volume change of bladder and small bowel. Bladder irrigation is a feasible method to guarantee a consistent bladder volume and reduce the irradiated small bowel volume.