

Changes in Pelvic Active Bone Marrow seen on FDG-PET in Patients Receiving Concurrent Chemoradiation for Anal Cancer

Purpose/Objectives

Radical concurrent chemoradiation (CRT) for locally advanced anal cancer is associated with suppression of active bone marrow. We seek to determine the degree of suppression seen in FDG-PET imaging attributable to chemotherapy and attributable to chemoradiation.

Methods/Materials

Anal cancer patients undergoing CRT had FDG PET scans prior to treatment (baseline scan) and at radiotherapy fraction 8-10 (wk2 scan) as part of the ART Trial (Anal squamous cell carcinoma: Investigation of functional imaging during CRT NCT02145416). RT was delivered in 28 fractions; 53.2/50.4Gy to tumour and involved nodes, 40Gy to elective nodes. Chemotherapy consisted of 12mg/m² Mitomycin D1 and 825mg/m² Capecitabine D1-D28 radiotherapy days only. PET scans were taken on GE Discovery scanner after 60 min (75min on average) FDG uptake time. Whole bone was used to define bone marrow. Average SUV values were extracted from static scans for irradiated whole pelvic bone marrow (PBM), PBM substructures (iliac BM, lower pelvic BM and lumbosacral BM) and non-irradiated thoracic spine (T9-11) using Varian Eclipse contouring module v.13.0. Median SUV in whole PBM was compared using Wilcoxon signed-rank test.

Results

Of the 29 patients recruited to ART, 12 had PET scans at both time points. Of these, two patients received 61.6Gy in 28 and one 41.4Gy in 23. All other patients received standard radiotherapy of 50.4Gy (3 patients total) or 53.2Gy (6 patients total). RT plan PBM V10 exceeded 60% for all patients and V20 exceeded 47%, equating > 2.9Gy and 5.7Gy respectively at the time of wk2 scan. A summary of SUV values is seen in the table below.

		PBM	Iliac BM	Lower Pelvis BM	Lumbosacral BM	T9-11
Baseline						
	Median	1.13	1.17	1.00	1.33	1.66
	Max	1.63	1.69	1.40	2.07	2.70
	Min	0.83	0.90	0.73	0.90	1.28
Mid-Treatment						
	Median	0.99	1.09	0.85	1.16	1.67
	Max	1.23	1.33	1.09	1.43	2.37
	Min	0.74	0.74	0.64	0.79	0.45

There was a statistically significant reduction in the median SUV in the PBM from baseline to wk2 scan (median difference of -0.20 (95% CI: -0.29, -0.04), p=0.006). A decrease in SUV_{mean} was seen in all substructures with the largest decrease seen in lumbosacral (-0.22 (-0.41, -0.07) and roughly

equal reduction in iliac (-0.16 (-0.31, 0.01) and lower pelvis (-0.16 (-0.27, -0.01)). A reduction was not observed in the non-irradiated thoracic spine (0.05 (-0.25, 0.19)).

Conclusions

The impact of concurrent chemoradiation on PBM is seen in reduced SUV values at wk2 compared to baseline. The effect of chemo only on SUV appears non-significant at wk2. Suppression of active bone marrow in CRT for anal cancer is therefore likely the combined toxicity of chemoradiation with chemotherapy in isolation relatively well tolerated at wk2 of treatment. Larger scale studies are required.

The Oxford C REC ethically approved the trial. The trial was sponsored by the University of Oxford, funded by the CRUK & EPSRC Cancer Imaging Centre Oxford and managed by the Oxford Clinical Trials and Research Unit. Oversight was provided by the Radiotherapy and Imaging Oversight Committee.