

Note: p-values highlighted in red on the following pages are significant at 0.05 level.

Supplemental Table 1. Six-month CTCAE liver toxicity grade outcomes for 34 patients with measures available at six months per CTCAE v5.0.

CTCAE Grade	AST	ALT	Alkphos	Total Bilirubin
0	10	16	11	22
1	17	16	18	3
2	5	1	3	6
3	1	N/A	2	3
4	1	1	N/A	N/A
Total	34	34	34	34

Supplemental Table 2. Correlation (ρ) matrix for healthy liver dose metrics among 43 patients with measured cytokines and uncensored for systemic focal therapy. All doses are measured in Gy.

	MLD	BED	EQD2	DC10	DC30	DC90	DC700cc	BEDC10	BEDC30	BEDC90	BEDC700cc
MLD	1.00	0.83	0.83	0.69	0.80	0.83	0.75	0.67	0.76	0.75	0.68
BED	0.83	1.00	1.00	0.39	0.49	0.73	0.58	0.37	0.45	0.72	0.53
EQD2	0.83	1.00	1.00	0.39	0.49	0.73	0.58	0.37	0.45	0.72	0.53
DC10	0.69	0.39	0.39	1.00	0.96	0.33	0.55	1.00	0.97	0.27	0.47
DC30	0.80	0.49	0.49	0.96	1.00	0.41	0.63	0.95	0.99	0.34	0.55
DC90	0.83	0.73	0.73	0.33	0.41	1.00	0.56	0.32	0.38	0.97	0.53
DC700cc	0.75	0.58	0.58	0.55	0.63	0.56	1.00	0.54	0.61	0.55	0.97
BEDC10	0.67	0.37	0.37	1.00	0.95	0.32	0.54	1.00	0.97	0.26	0.46
BEDC30	0.76	0.45	0.45	0.97	0.99	0.38	0.61	0.97	1.00	0.32	0.54
BEDC90	0.75	0.72	0.72	0.27	0.34	0.97	50.55	0.26	0.32	1.00	0.52
BEDC700cc	0.68	0.53	0.53	0.47	0.55	0.53	0.97	0.46	0.54	0.52	1.00

Supplemental Table 3. Multivariable linear models for Δ ALBI with cytokines, baseline ALBI score, receipt of prior liver directed therapies, and additional dose metrics (DC700cc) as covariates.

Model	Covariate	Coefficient	95% CI LB	95% CI UB	p-value
1	DC700cc (Gy)	0.002	-0.001	0.005	0.286
	Log(sTNFR1)	0.645	0.112	1.178	0.024
	Baseline ALBI Score	-0.192	-0.616	0.231	0.380
	Prior Liver Directed Therapy	0.001	-0.346	0.347	0.998
2	DC700cc (Gy)	0.003	-0.0004	0.005	0.095
	Log(HGF)	0.776	0.340	1.211	0.002
	Baseline ALBI Score	-0.187	-0.559	0.184	0.331
	Prior Liver Directed Therapy	0.136	-0.200	0.471	0.434

Supplemental Table 4. Correlation (ρ) matrix for cytokines.

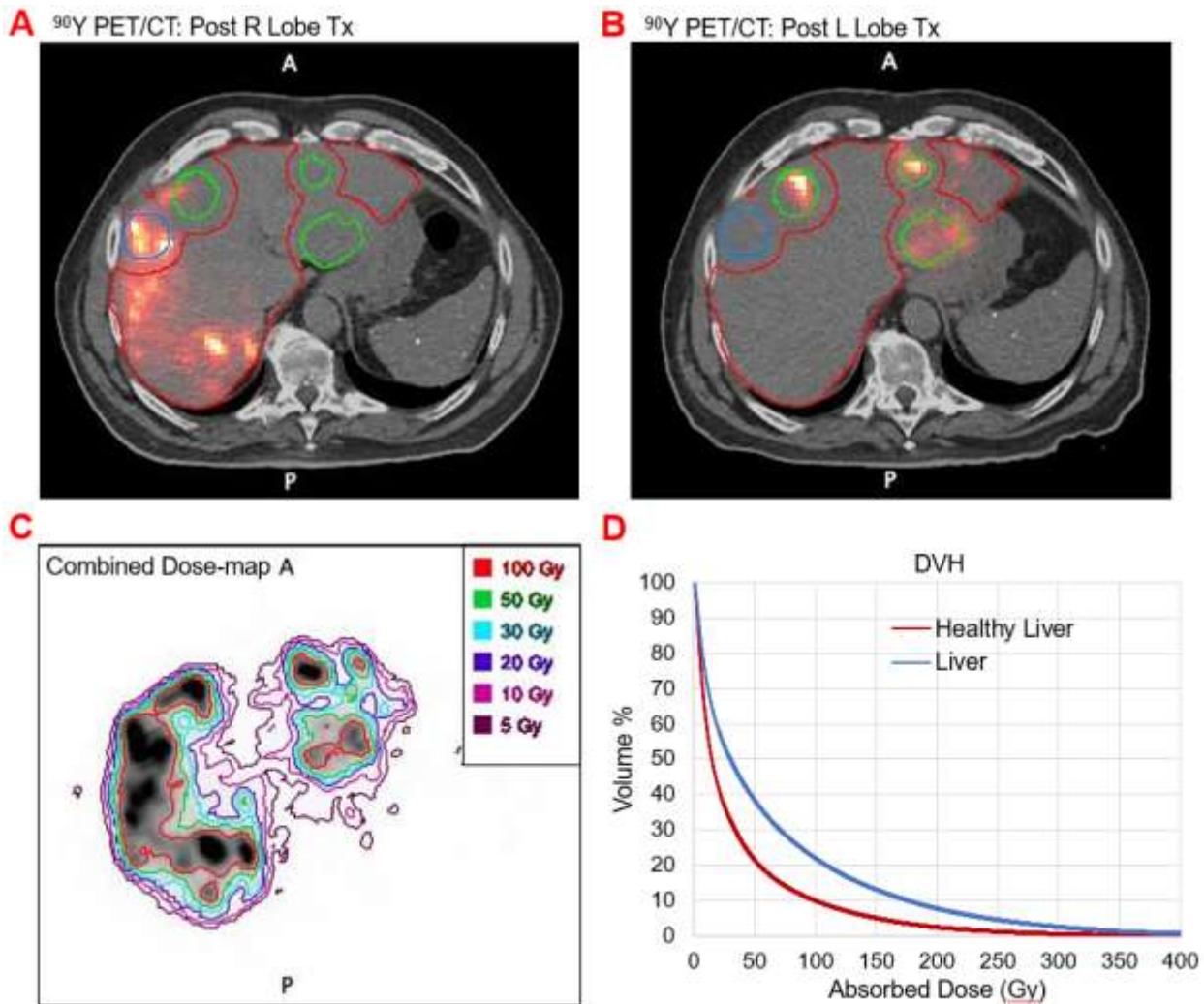
	HGF	TNFR1
HGF	1.00	0.50 (p=0.001)
sTNFR1	0.50	1.00

Supplemental Table 5. Multivariable model for Δ ALBI with multiple cytokines.

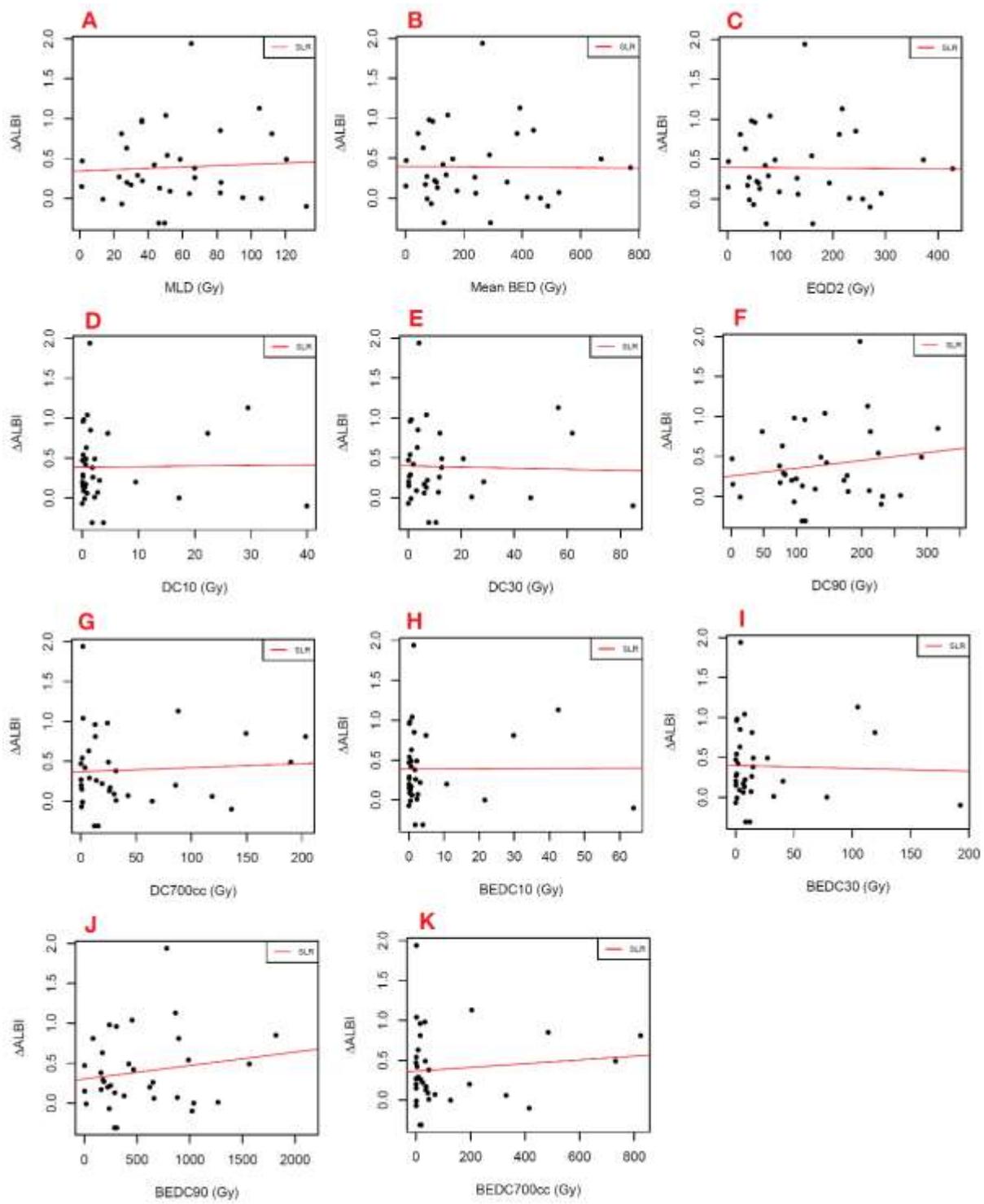
Covariate	Coefficient	95% CI LB	95% CI UB	p-value
Log(HGF)	0.488	0.042	0.933	0.040
Log(sTNFR1)	0.177	-0.329	0.683	0.498

Supplemental Table 6. Univariate Cox proportional-hazards model results with dose metrics as covariates for OS. All doses are measured in Gy.

Model	Covariate	HR	95% CI LB	95% CI UB	p-value	c-index
1	MLD	0.99	0.98	1.01	0.403	0.58
2	BED	0.99	0.99	1.00	0.132	0.62
3	EQD2	0.99	0.99	1.00	0.132	0.62
4	DC10	0.98	0.93	1.03	0.381	0.55
5	DC30	0.99	0.97	1.01	0.435	0.54
6	DC90	0.99	0.99	1.00	0.383	0.55
7	DC700cc	0.99	0.99	1.01	0.673	0.55
8	BEDC10	0.99	0.95	1.02	0.393	0.55
9	BEDC30	0.99	0.99	1.01	0.415	0.54
10	BEDC90	0.99	0.99	1.00	0.192	0.55
11	BEDC700cc	0.99	0.99	1.00	0.710	0.55



Supplemental Figure 1. Example images for a patient who had two ^{90}Y treatments. A) ^{90}Y PET/CT for a 2.2 GBq treatment to R Lobe and B) ^{90}Y PET/CT for a 0.7 GBq treatment to L Lobe 5 weeks later, co-registered to A. The lesion contours corresponding to the R and L lobe treatments are indicated in blue and green respectively and the non-tumoral liver is indicated in red. C) Dose map and D) DVHs from the two treatments with combined mean absorbed dose to healthy liver of 37 Gy and DC90 100 Gy.



Supplemental Figure 2. Scatterplots of dose metrics (A) MLD, (B) BED, (C) EQD2, (D) DC10, (E) DC30, (F) DC90, (G) DC700cc, (H) BEDC10, (I) BEDC30, (J) BEDC90, and (K) BEDC700cc vs. change in ALBI. Solid red line represents simple linear fit.