Assessing Longitudinal CT Perfusion Changes in Pancreas and Pelvic Node Tumors Treated with SBRT On Prospective Phase I Dose Escalation Trials

T Patton[1], A Santoso[1], T Reinicke[1], Y Vinogradskiy[1], Q Diot[1], C Fisher[1], K Goodman[2], B Jones[1]

[1]University of Colorado Anschutz Medical Campus, [2]Mount Sinai

University of Colorado Anschutz Medical Campus

Background

- Perfusion imaging can predict response to RT
- SBRT has an ablative vascular component which perfusion imaging can assess
- CT perfusion imaging can assess tumor blood flow
- **Purpose:** Use CT perfusion (CTP) imaging to assess longitudinal changes in pancreas and pelvic node SBRT patients

Methods

- 14 pancreas patients
- 9 pelvic nodal patients
- 27 – 33 Gy in 3 fractions
- CTP scans performed at:
  - Simulation (SIM)
  - After 1st fraction (1FX)
  - 6 weeks post treatment (6WK)
- Perfusion metrics assessed:
  - Blood flow (BF)
  - Blood volume (BV)
  - Permeability/flow extraction (FE)
- Perfusion metrics were analyzed inside GTV
- Median perfusion metric calculated for each time point

Results
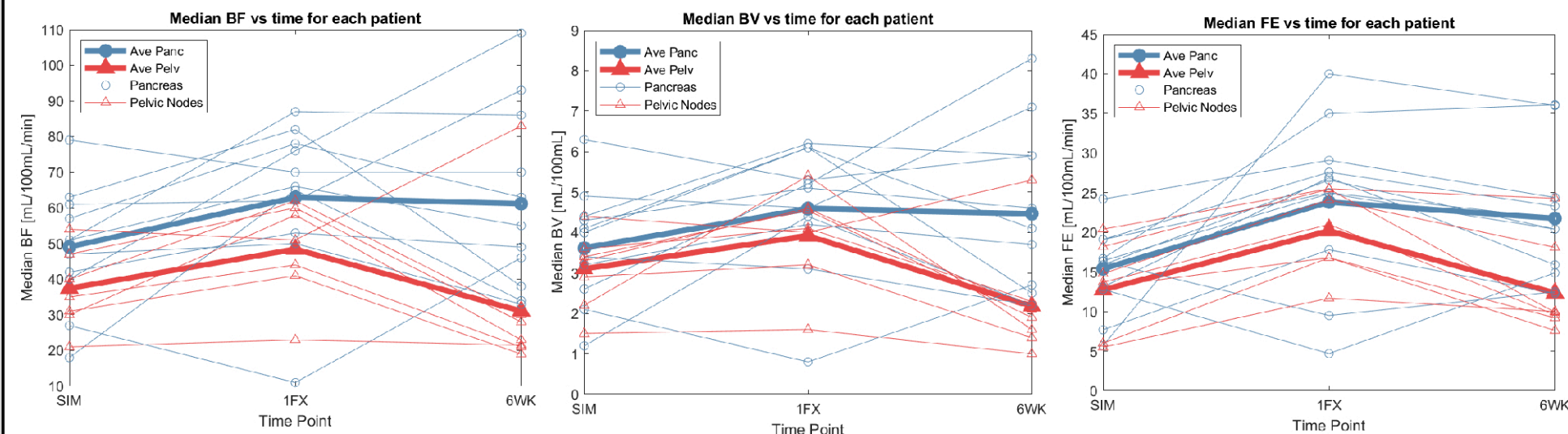
Figure 1: Perfusion metrics plotted for each patient at each time point. Bold lines represent the averages for each disease site, blue lines represent pancreas SBRT patients, and red lines represent pelvic node SBRT patients.
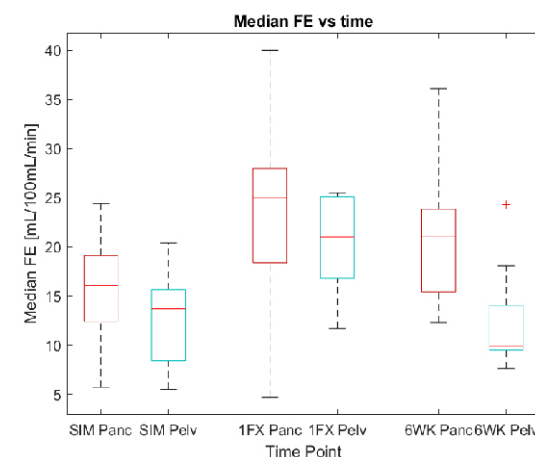
Figure 2: Box plot of median FE values at each time point.

- No significant baseline differences observed between disease site
- Tumor response was observed immediately after SBRT treatment (1FX)
  - All perfusion metrics significantly increased at 1FX compared to SIM ($p < 0.005$)
- At 6 weeks:
  - Pelvic nodal tumors returned to baseline
  - Pancreatic tumors remained significantly increased

Table 1: Perfusion metrics reported for each cohort of patients plus combined cohort. Each value tabulated is the median perfusion metric in the GTV averaged over all patients. Of note is the significant increase in each perfusion metric from SIM to 1FX and the 6WK decrease in pelvic compared to pancreas patients.

Time Point	Pancreas SBRT Patients				Pelvic Node SBRT Patients				All Patients		
	FE	BF	BV		FE	BF	BV		FE	BF	BV
SIM	15.4	49.1	3.6		12.7	37.4	3.1		14.4	44.5	3.4
1FX	23.8	62.9	4.6		20.2	48.4	3.9		22.6	57.9	4.4
6WK	21.8	61.2	4.5		12.3	31.1	2.2		17.7	48.3	3.5

Conclusions

- CT perfusion shows changes in vascularity for SBRT patients
- Significant increases in blood flow and permeability after 1st fraction
- Significant difference between response of pancreas and pelvic node tumors 6 weeks after treatment, potentially due to differences in local control
- CTP is promising modality for treatment response

Future Work

- Establish perfusion as a treatment biomarker
  - Correlate initial perfusion with outcome
  - Correlate perfusion changes with outcome

Disclosures

- Pancreas: Protocol 16-1139
- Pelvic Node: Protocol 17-1333