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Advanced Vessel- and Cell-Size MRI to Assess Chemo-Radiation Treatment Response in Pediatric Ependymoma Models

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DISCLOSURES

I have no disclosures to report.

OBJECTIVE

To develop and optimize an advanced mpMRI protocol (cell-size, vessel-size and inflammation imaging) to characterize the phenotype and chemo-radiation treatment (CRT) response in an orthotopic mouse of patient-derived xenografts (PDX) of pediatric EPN.

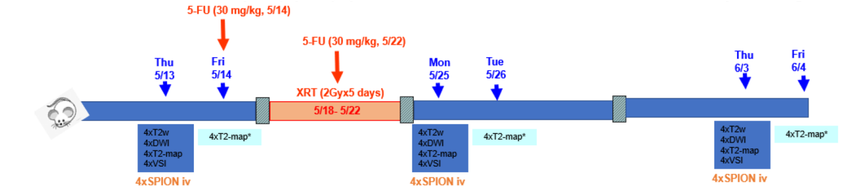
BACKGROUND

- Ependymoma (EPN) is an aggressive pediatric brain tumor
- After radiation therapy and surgery, EPN recurs in 23-66% of patients
- EPN is characterized by high tumor cellularity, cytological anaplasia, high mitotic index, tumor necrosis, and inflammatory cells.

METHODS

Mouse Models:
- Female severe immunodeficient mice (n=22)
- Placebo group and CRT group (10 Gy radiation plus 30 mg/kg 3-fluorouracil)

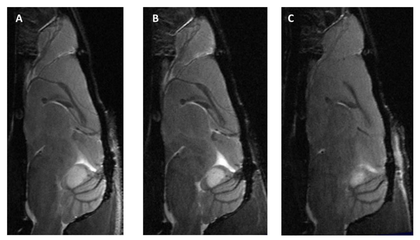
MRI protocol:
- High resolution T2w turboRARE (sagittal and axial) for tumor volume
- Diffusion weighted imaging (DWI)
- Selective size imaging using filters via diffusion times (SSIFT)
- Vessel size imaging (VSI) (fast T2* during 10 mg/kg iron-oxide ferumoxytol injection)
- Quantitative T2maps (qT2) (before and 24hr after ferumoxytol injection)

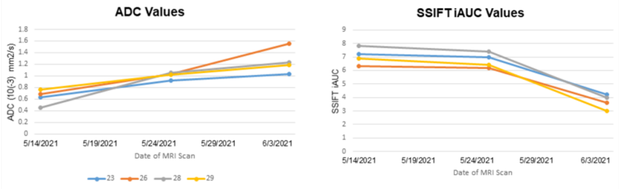


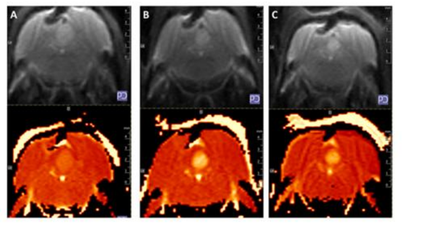
Analysis performed in ParaVision NEO Software and in house MATLAB simulations.

RESULTS

- We report out an EPN-specific phenotype characterized by an increased cell size (S=14 microns), increased vessel density index (Q=0.54), and low ADC values ($0.63x10^{-3}$).
- The CRT group showed a decrease in the tumor volumes, increased ADC values and decreased SSIFT iAUC and cell size two weeks after CRT.

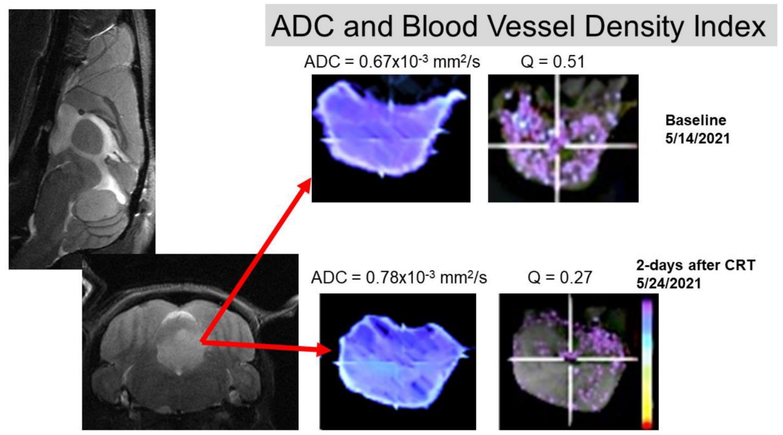






RESULTS (CONT.)

- The most immediate response (2 days after CRT) was a decreased blood vessel density and an increased presence of inflammatory macrophages and microglial cells in irradiated EPN.



CONCLUSIONS & IMPLICATIONS

- Limitation: current focus is on one type of EPN (PFA1 vs PFA2 vs PFB)
- Our advanced mpMRI protocol followed by novel MATLAB algorithm analysis allows for a unique characterization of pediatric EPN as well as assessing the tumor response to a clinically relevant CRT protocol in a mouse model.
- Introduced cell size imaging and ferumoxytol-enhanced transverse relaxation rates for in vivo VSI mapping and inflammatory cell imaging
- Can translate into human imaging for improved understanding diagnostic tools for EPN

ACKNOWLEDGEMENTS

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