Evaluating the Differences Between Sexes of Mice in Response to Brain Radiation

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Introduction

Radiation is considered an effective form of therapy when treating brain tumors. Like with any other therapy, radiation comes with risks of potential side effects. Female pediatric patients have been shown to suffer from radiation side effects more than male patients. When scientists try to study the after-effects of radiation in the brain using animal models, such as mice, one sex is usually chosen for all experiments. However, we cannot assume what we see in males is the same as what we will see in females, or vice versa.

The purpose of this experiment was to determine the difference between the sexes of mice in their response to brain radiation. My hypothesis is that female mice will tend to show greater sensitivity to the effects of irradiation.

Methods

- Radiation of groups of both female and male mice
  - Groups of male and female mice irradiated at 10, 15, 20, 25, and 30 Gray
  - 5 mice of same sex irradiated at one time
  - Balb-c mice used, 5-6 weeks old
  - 6 MeV LINAC, (Linear Accelerator), from Vet School used for irradiation

- Staining of brain tissue at different times post mortem
  - Male and female mice euthanized at 4, 8, or 16 weeks post-radiation
  - Tissues processed in Purdue Histology Laboratory
  - Tissues stained with Hematoxylin and Eosin, (H & E), and compared

Male vs. Female Radiation Response

4 weeks post radiation at 30 Gray:

- 10x
- 40x

8 weeks post radiation at 30 Gray:

- 10x
- 40x

16 weeks post radiation at 30 Gray:

- 10x
- 40x

Radiation Dosage Response

- Control
- 10 Gy
- 15 Gy
- 20 Gy
- 25 Gy
- 30 Gy

Conclusions

All the observed neuroinflammatory damage in the brain tissue was localized to the white matter track. The features of the injury seen in the H & E section looked slightly different between the males and females. However, the severity of pathology was similar for both groups. The mouse model for radiation can now be used with the knowledge that the difference in each sex’s response to radiation should be accounted for in future experiments.

Future Directions

Recommendations from Pathologist for Future Staining:
- Luxol Fast Blue/Cresyl Etched Violet Stain for quantification of myelin degradation
- Rad51 for analysis of DNA damage to blood-brain barrier
- Develop a grading scale for multifocal versus linear lesions
- To make a full quantification, we want to use an average of all of the slides

Acknowledgements

We would like to thank the Purdue Histology Laboratory for processing of the slides and the Purdue Vet School for allowing us to use their radiation machinery.