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Enhancing synchrotron modulated Microbeam Radiation Therapy in vivo with novel high Z nanoparticles

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With limited improvement in brain cancer patient survival in the last 30 years, the search for a treatment strategy that is targeted and effective continues. This study is harnessing the unique properties of synchrotron radiation for anti-cancer radiotherapy. The Imaging and Medical Beamline (IMBL) at the ANSTO Australian Synchrotron (AS) offers the possibility to perform pre-clinical synchrotron radiation trials using extremely high dose-rates, sparing normal tissue whilst delivering large doses to the tumour site. This study focused on patient specific treatments combining Microbeam Radiation Therapy (MRT) with novel high Z nanoparticles (NPs), and was the largest rodent survival study utilising nanoparticle enhancement ever undertaken at AS. Thulium oxide NPs (Z=69) are a promising sensitising and imaging agent with limited cytotoxicity and proven synchrotron enhancement. 32 Fischer 344 rats were inoculated with 9L gliosarcoma in the right caudate nucleus of the brain. 11 days later, the rats were imaged with Computed Tomography (CT) to locate the tumour in relation to bony anatomy. The following day, nanoparticles were injected directly to the tumour of each rat. Using the CT scans, the rats were aligned in-beam, and a bolus was placed over the irradiation site. One radiation fraction was given to different treatment groups at valley doses of 8, 14 or 15Gy, with a radiation field of 8mm by 8mm and microbeams produced using the 4T magnet and Al/Al filtration. Utilising a heavily improved oedema protocol, seizure symptoms and adverse events immediately post MRT were significantly reduced. Overall survival compared to rodents with MRT alone was found to be improved when considering the tumour to brain volume.

Level of Expertise

Student

Presenter Gender

Woman

Pronouns

She/Her

Which facility did you use for your research

Australian Synchrotron

Students Only - Are you interested in AINSE student funding

Yes

Do you wish to take part in the Student Poster Slam

No

Condition of submission

Yes

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