Contribution ID : **99** Type : **Oral**

Synchrotron Radiotherapy of Pet Cadavers at the Imaging and Medical Beamline in Anticipation of Live Veterinary Animal Trials

Monday, 2 December 2019 11:35 (15)

Introduction

Hutch 3B at the Australian Synchrotron's Imaging and Medical Beamline (IMBL) offers the unique opportunity to deliver Synchrotron Radiotherapy (SR) to pet animals and human patients with much larger field sizes than is possible in Hutch 2B. Hutch 3B, located 140m away from the Synchrotron X-ray source, allows for a minimally-divergent beam and clinically comparable field-sizes, while maintaining dose rates of 100's Gy/s in water.

Veterinary interest in performing radiotherapy on domestic pets has facilitated recent preliminary studies into the applicability of using the Large Animal Position System (LAPS) robot in Hutch 3B to delivery mock radiotherapy fields to animal cadavers. All stages of the treatment delivery were investigated including CT simulation, treatment planning, patient positioning, dose delivery, and dose verification.

Method

2 Dog cadavers and 1 lamb cadaver, each provided by an Australian Synchrotron on-site veterinarian, were CT scanned at the Monash Biomedical Imaging facility. Care was taken to ensure that the animals were scanned in the position they would be in during treatment. A carbon fibre CT imaging board with fiducial markers was used for coarse alignment. For 1 of the 2 dog cadaver trials, air-vacuum bags were used to position the cadaver with the assistance of a veterinarian and a trained clinical radiation therapist.

The CT scans of the cadaver animals were imported into the Eclipse Treatment Planning System (TPS) were SR fields were planned for treatment. A Hybrid Monte Carlo dose algorithm was used to calculate the dose distributions through the patient CTs. Reference dosimetry plans were also produced in order to calculate Monitor Units (the exposure time required to deliver the prescribed dose).

For treatment, the animal cadavers were re-positioned onto the LAPS, and an Australian Synchrotron in-house developed software (SMRT) was used to align the cadaver. Radiochromic film was used to verify the treatment delivery. Doses calculated in the Quality Assurance (QA) plans where verified using ionisation chamber measurements in liquid water and Solid Water phantoms.

Results

We irradiated the cadaver animals using the LAPS in Hutch 3B under image guidance, with successful patient alignment and treatment planning. Larger fields were delivered via a 'step-and-shoot' method and Radiochromic film was used to verify the delivery of the treatment field to the target.

Ionisation chamber measurements in liquid water and Solid Water showed good agreement (within 5%) with the QA plans.

Dynamic scanning of the animal cadaver is not currently feasible due to technical limitations of the LAPS, and so 'step-and-shoot' remains the only viable method for delivering clinically relevant treatment field sizes.

Conclusion

Synchrotron Radiotherapy for live animal trials is achievable with our current software implementations, including image guidance and treatment planning. Larger fields can be delivered adequately using step-and-shoot for Synchrotron Broadbeam Radiotherapy, with good dosimetric agreement.

Microbeam Radiotherapy veterinary trials for client-owned pets will require the animal to be dynamically scanned through the beam. Future work will therefore focus on implementing a combination of software and hardware improvements to the LAPS in order to facilitate dynamic Synchrotron Radiotherapy in Hutch 3B.

Speakers Gender

Male

Travel Funding

No

Level of Expertise

Student

Do yo wish to take part in the poster slam

No

Primary author(s) : DAY, Liam (Royal Melbourne Institute of Technology); BARNES, Micah (RMIT); SMYTH, Lloyd (University of Melbourne, Epworth HealthCare); KLEIN, Mitzi (Australian Synchrotron); BUTLER, Duncan (ARPANSA); HAUSERMANN, Daniel (Australian Synchrotron); Dr RYAN, Stewart (The University of Melbourne); CROSBIE, Jeffrey (RMIT University)

Presenter(s) : DAY, Liam (Royal Melbourne Institute of Technology)

Session Classification : Session 2

Track Classification : Technique Development