AbstractID: 9774 Title: CT scanner-based IGRT

While small animal models of cancer have evolved to more closely resemble the corresponding human disease, radiation therapy (RT) techniques for small animals are dramatically different than those routinely used in the clinic. Recently there has been considerable interest in developing conformal radiotherapy methods for small animals so as to incorporate more clinically-relevant treatment modalities into laboratory studies of cancer.

An attractive approach to this engineering problem is to add radiotherapy capabilities to a micro-computed tomography (microCT) scanner. This strategy exploits the high imaging performance of existing microCT units in order to produce a small animal image-guided radiation therapy (IGRT) system employing a single X-ray beam for imaging and treatment. If successful, this small animal IGRT option could be made available as an add-on option to existing commercial microCT scanners, allowing widespread adoption of small animal conformal radiotherapy throughout the research community.

Initial experiments demonstrated that the dose rate of a GE microCT system is suitable for delivering therapeutic radiation doses in reasonable treatment times. A variable aperture collimator capable of restricting the microCT X-ray beam to a variable pseudo-circular profile has been developed and evaluated. This prototype microCT/RT system is now online for experimental use, and is currently being applied towards a variety of biological studies.

In this lecture I will briefly describe the current status and future work for this approach to small animal conformal radiotherapy. I will then discuss initial biological applications of this system, including treatment of orthotopic models of disease and evaluation of positron emission tomography (PET)-guided radiotherapy strategies.

Educational Objectives

At the end of this lecture, the audience will be able to:

1. Describe the relative advantages and disadvantages of developing small animal radiotherapy within the context of existing microCT scanners,
2. Identify biological applications of small animal IGRT where existing small animal irradiation techniques are inadequate, and
3. Discuss the use of small animal IGRT as both a tool for small animal research and a method for conducting clinical trials in an experimental setting.