Micro-Mini & Nano-Dosimetry & Innovative Technologies in Radiation Therapy (MMND&ITRO2016)

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Introduction to Mini-Micro-Nano Dosimetry (MMND) 2016

The biennial MMND (formerly MMD) - IPCT workshops, founded in collaboration with Memorial Sloan Kettering Cancer Center (MSKCC) in 2001, has become an important international multidisciplinary forum for the discussion of advanced dosimetric technology for radiation therapy quality assurance (QA) and space science, as well as advanced technologies for prostate cancer treatment.

In more recent years, the interests of participants and the scope of the workshops have extended far beyond prostate cancer treatment alone to include all aspects of radiation therapy, radiation science and technology. We therefore decided to change the name in 2016 to Innovative Technologies in Radiation Oncology (ITRO). MMND ITRO 2016 was held on 26-31 January, 2016 at the beautiful Wrest Point Hotel in Hobart, Tasmania and attracted an outstanding international faculty and nearly 200 delegates from 18 countries (http://mmnditro2016.com/)

The MMND 2016 program continued to cover advanced medical physics aspects of IMRT, IGRT, VMAT, SBRT, MRI LINAC, innovative brachytherapy, and synchrotron MRT. The demand for sophisticated real time and high temporal and spatial resolution (down to the submillimetre scale) dosimetry methods and instrumentation for end–to-end QA for these radiotherapy technologies is increasing. Special attention was paid to the contribution of advanced imaging and the application of nanoscience to the recent improvements in imaging and radiotherapy.

The last decade has seen great progress in charged particle therapy technology which has spread throughout the world and attracted strong current interest in Australia. This demands a better understanding of the fundamental aspects of ion interactions with biological tissue and the relative biological effectiveness (RBE) of protons and heavy ions. The further development of computational and experimental micro-and nano-dosimetry for ions has important application in radiobiology based treatment planning and space radiation hazard prediction. New compact accelerator technologies for the delivery of proton and heavy ion therapy and relevant QA dosimetry instrumentation were an additional focus of MMND 2016.

The ITRO program this year was dedicated to clinical aspects of innovative SBRT for cancer treatment. It represented a unique opportunity to learn from didactic lectures as well as case based discussions with world leaders in the field in the relaxed atmosphere of Hobart.

As well as the outstanding scientific program, MMND ITRO 2016 included an Australian beach BBQ to celebrate Australia Day on the evening of 26th January and an exciting social program on 29th January followed by the conference dinner and great Australian hospitality.

The MMND workshop represents an important next step for improving current cancer treatments with radiation and the development of new radiation based cancer treatments.

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The world is changing with ever increasing rapidity, and the oncologic world even more so. Yet as the writer of Ecclesiastes has observed “The thing that hath been, it is that which shall be; and that which is done is that which shall be done: and there is no new thing under the sun.” (Ecclesiastes 1:9) New technologies, such as image guidance, inverse treatment algorithms, exponential increases in computing power and advances in medical imaging technology, have all converged to give birth to stereotactic body radiotherapy or SBRT. There is no question that SBRT is revolutionizing radiation oncology in the 21st century. At the heart of SBRT is the hypofractionation paradigm. In this, very high dose per fraction is given in typically 1-5 fractions with ablative intent, while minimizing target volume margins and normal tissue doses and volumes, allowing extremely high doses of radiation that provide very durable tumor control typically in the range of 90%, while maintaining the risk of severe complications to less than 5-10%. Fractionation has long been the staple of radiation therapy since Coutard first demonstrated that deeply seated head and neck tumors could be cured with fractionation in the
1930’s. Fractionation was introduced not out of efforts to improve tumor control, but to limit the effect of radiation on normal tissues, since single session radiation with the limited technology at the time included so much normal tissue that the complications associated with non-fractionated therapy was simply intolerable. SBRT is the technology that has made feasible what we have always known, that high dose per fraction therapy is the most efficient way to kill tumor cells. The marriage of image guidance and highly conformal treatment planning and delivery technology has provided the means to minimize toxicity by limiting the dose to surrounding normal tissue, and creating high dose gradients to concentrate radiation dose within tumors. This is new and wonderful. But the biology of killing tumors, that is, very high dose per fraction radiotherapy to achieve maximal cell kill-- this is nothing new. Indeed, “there is no new thing under the sun.”

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