Contribution ID: **81** Type: **not specified**

The role of the radiotherapy in cancer therapy

Thursday, 4 September 2014 08:30 (30 minutes)

Cancer remains leading cause of death globally. Epidemiology studies estimated that 7.6 million deaths worldwide were due to cancer with 12.7 million new cases per year being reported worldwide. A significant proportion of this burden is borne by developing countries; 63% of cancer deaths are reported to be from developing countries. If uncontrolled cell growth or metastatic spread occurs it will result in death of the individual. The past decade has witnessed a considerable progress towards the treatment and understanding of the earlier proposed hallmarks of cancer and together with advances in early detection and in the various treatment modalities, many cancers have become curable. Along with surgery and chemotherapy, radiation therapy remains an important modality used in cancer treatment being a highly cost effective single modality treatment accounting about only 5% of the total cost of cancer care. Furthermore, approximately 50% of all cancer patients will receive radiation therapy during their course of illness with an estimation that radiation therapy contributes to around 40% towards curative treatment. Rapid progress in this field continues to be boosted by advances in imaging techniques, computerized treatment planning systems, radiation treatment machines (with improved X-ray or particle beam production and treatment delivery) as well as improved understanding of the radiobiology of radiation therapy. Radiation can be given with the intent of cure as well as being used as a very effective modality of palliative treatment to relieve patients from symptoms caused by the cancer. Further indications of radiation therapy include combination strategies with other treatment modalities such as surgery, chemotherapy or immunotherapy. If used before surgery (neoadjuvant therapy), radiation will aim to shrink the tumor. If used after surgery (adjuvant therapy), radiation will destroy microscopic tumor cells that may have been left behind. It is well known that tumors differ in their sensitivity to radiation treatment. The goal of radiotherapy is to deliver as much dose to the tumour whilst sparing normal tissue. Technological advances incorporating new imaging modalities, more powerful computers and software, and new delivery systems such as advanced linear accelerators have helped achieve this. 3D radiation therapy based on CT imaging which allows accurate localization of the tumour and critical normal organ structures for optimal beam placement and shielding. IMRT allows the oncologist to create irregular-shaped radiation doses that conform to the tumour whilst simultaneously avoiding critical organs. IMRT is made possible through: a) inverse planning software and b) computer-controlled intensity-modulation of multiple radiation beams during treatment. IMRT is now available in many clinical departments and can be delivered by linear accelerators with static or dynamic multi-leaf collimators or tomotherapy machines. As treatment margins become tighter and more conformal, the potential to miss tumour due to organ motion and patient setup variations become greater. When critical structures are close to the tumour, a slight positional error may also lead to inadvertent radiation of the normal organs. IGRT allows the detection of such errors by information acquired through pre-radiotherapy imaging which allows for correction. One such example is with daily cone-beam CT scans acquired before each treatment. The improved accuracy has made dose escalation feasible, and this has allowed an improvement in the therapeutic ratio for several tumor sites. The above technological advancements have enabled SBRT, which precisely delivers very high individual doses of radiation over only a few treatment fractions to ablate small, well-defined primary and oligometastatic tumours anywhere in the body. Due to the high radiation dose, any tissue immediately adjacent to the tumour is likely to be damaged. However as the amount of normal tissue in the high dose region is small and non-eloquent, clinically significant toxicity is low. External beam radiation therapy is also carried out with heavier particles such as: neutrons produced by neutron generators and cyclotrons; protons produced by cyclotrons and synchrotrons; and heavy ions (helium, carbon, nitrogen, argon, neon) produced by synchrocyclotrons and synchrotrons. Proton beams are a newer form of particle beam radiation used to treat cancer. It can offer better dose distribution due to its unique absorption profile in tissues, known as the Bragg's peak, allowing deposition of maximum destructive energy at the tumor site while minimizing the damage to healthy tissues along their path. Neutron beams are generated inside neutron generators after proton beams are deflected to a target. They have high LET and can cause more DNA damage than photons. The limitations have been mainly due to difficulty in generating neutron particles as well as the construction of such treatment facilities. Particle radiation has higher LET than photons with higher biological effectiveness. Therefore, these forms of radiations may be more effective to the radioresistant cancers. However, equipment for production of particle radiation therapy is considerably more expensive than for photons. The decreasing costs of cyclotrons are likely to result in a wider use of proton beam therapy in the future.

Presenter: Prof. ORECCHIA, Roberto (european institute of oncology)

Session Classification: RADIOTHERAPY SESSION