AbstractID: 6996 Title: An overview of proton therapy

Proton therapy is making the move out of the research laboratory and into the clinic. New hospital based facilities in the US, Asia and Europe testify to the growing interest in this treatment modality. Protons have the advantageous characteristic that the energy from a mono-energetic proton beam is deposited in a small region known as the Bragg peak, beyond which the deposited dose is almost, but not quite, zero. Numerous comparative treatment planning studies have shown the theoretical advantage for protons in a number of indications, and the existing and new facilities are working towards translating this theoretical advantage into a real clinical advantage.

In order to make the essentially mono-energetic, and narrow, pencil beams that are emitted from proton accelerators useful for therapy, the method most widely used is the so-called passive scattering technique. In this, the narrow beam is widened through the use of scattering elements, whilst the narrow Bragg peak is extended in depth through the application of a series of depth shifted and modulated Bragg peaks in order to form a so-called 'Spread-Out-Bragg Peak' (SOBP). The final form of the delivered field is defined by the use of field specific collimators and compensators, the latter of which match the distal end of the field to the distal extent of the target volume.

Coupled with the development of the new proton facilities is a growing interest in more sophisticated delivery techniques. One such is active scanning, in which narrow, mono-energetic pencil beams are magnetically scanned throughout the target volume under computer control. This approach has a number of potential advantages over the passive approach. It is very flexible, makes more efficient use of the available protons, is more conformal than passive scattering, results in lower secondary irradiations to the patient (i.e. neutron background) and last, but certainly not least, allows for the delivery of Intensity Modulated Proton Therapy (IMPT), the proton equivalent of IMRT. Currently only one centre is clinically using the scanning approach and IMPT (PSI in Switzerland), but all new facilities are currently planning to implement scanning technology in the near future.

However, the advantages of protons don't come for free. There are a number of challenges (and perhaps even worries) about its introduction resulting from the same characteristics of protons which bring their main advantages. It is the role of this symposium to present both the good and perhaps not-so-good of protons. The advantages have been outlined above, but we will also take a closer look at a number of issues that can make effective proton therapy quite challenging. These include the effects of density heterogeneities and range uncertainties, the effects of organ motion and the issue of secondary neutron doses resulting from interactions of protons with atomic nuclei.

Educational objectives:

1. Understand the basic principles of proton therapy
2. Understand the main advantages, both physical and clinical, of proton therapy
3. Understand the main challenges of proton therapy.