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# Mise au point : Indications présentes et futures, le point de vue du clinicien

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## Résumé

### **Current and future indications of Proton Therapy, the clinician's point of view**

Proton Therapy (PT) has gained interest recently. Indeed, protons have the advantage of depositing minimal dose until the end of its path, where a peak of energy deposition occurs (Bragg Peak). As a consequence of the reduced entrance dose and no exit dose, PT is expected to better spare normal tissues from radiation exposure, and should therefore facilitate the delivery of high radiation dose to the targets that are close to critical dose-limiting organs, or when severe late effects are foreseen.

From the clinical perspective, children would benefit most from the ballistic advantage of protons. First, they have a high susceptibility to the deleterious effects of radiation on organ growth and function which can cause significant morbidity and devastating cosmetic outcomes. In addition, since the incidence of radiation-induced cancers rises over the lifetime period, with a long latent period, secondary tumours are mainly a concern when radiation is given at young ages, especially during the paediatric period. For such specific population, the benefit of reducing integral dose to normal tissues is intuitively clear.

On the other hand, adults are less prone to secondary malignancies and developmental issues. Because of the higher cost of PT, superior dosimetry alone cannot justify its choice. A measurable clinical advantage must be demonstrated, either in terms of tumor local control (radioresistant tumours, dose escalation strategies) and/or in terms of late toxicities or quality of life. Chondrosarcomas and chordomas are typical examples of tumours for which PT may help at resolving the dilemma of achieving high tumour dose while preserving organs at risk in complex anatomical sites.

In the coming years, the PT indications will certainly expand to more frequent cancers, like locally-advanced head and neck, lung, liver or pancreatic tumours, for which conventional radiotherapy (RT) still faces severe limitations in terms of efficacy and safety. To achieve this goal, the scientific community together with industrial partners will have first to address some technological issues (interplay effect for moving tumours, range uncertainty related to anatomical changes), and to prove the superiority of PT over conventional RT with proper randomized trials and prospective collection of clinical data.

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