

CERN Medical Applications Workshop

Clinical Results and Perspectives: summary of discussion

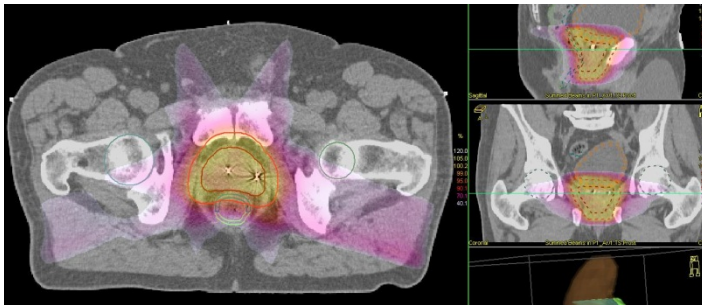
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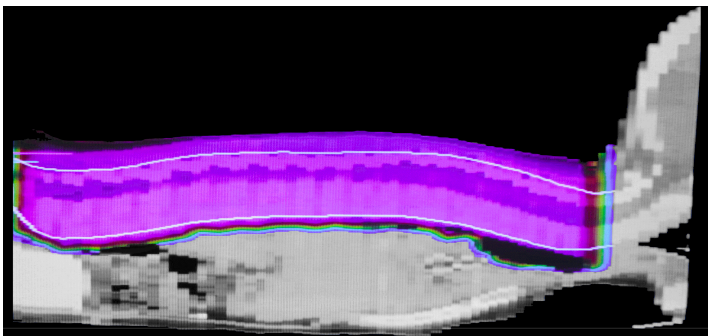
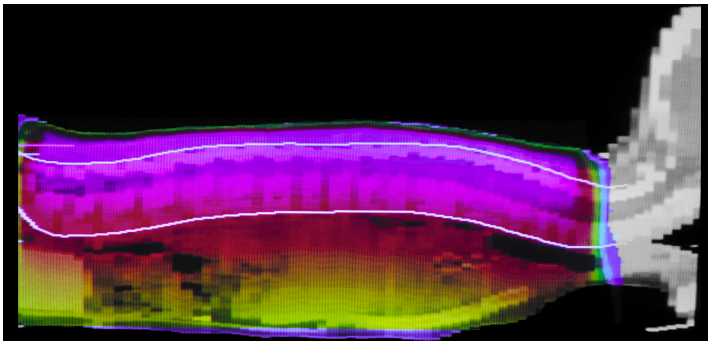


Introduction: Today's radiotherapy



- RT in 50% of cancer patients
- 1:1 curative / palliative
- Demography, multimodality, and increasing awareness of QoL/ function will increase RT utilization and complexity
- Mainstay of therapy currently is Linac-based advanced photon therapy
- Numbers for particle indications less clear, perhaps 10-20% is an underestimation long term.
Different particle beams available

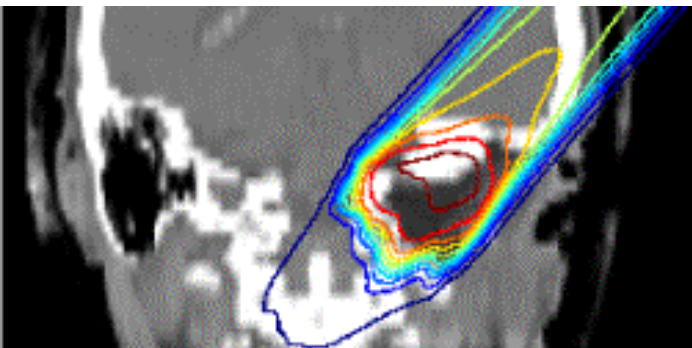
Introduction: Particle therapy



- Accepted currently in few indications; very exciting results in others
- (Too)few randomised studies, but evidence can not only be based on randomized trials (lower level of evidence can also be acceptable)
- Putting particles vs. photons too simplistic, gaining evidence for effect of better radiotherapy is the issue
- Photons will remain mainstay of RT for majority of patients
- Currently PT Technology (beside of beam) does not match standards of modern photon therapy; cost much higher

Introduction: Particle therapy

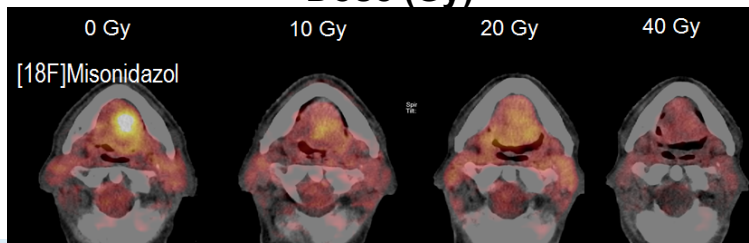
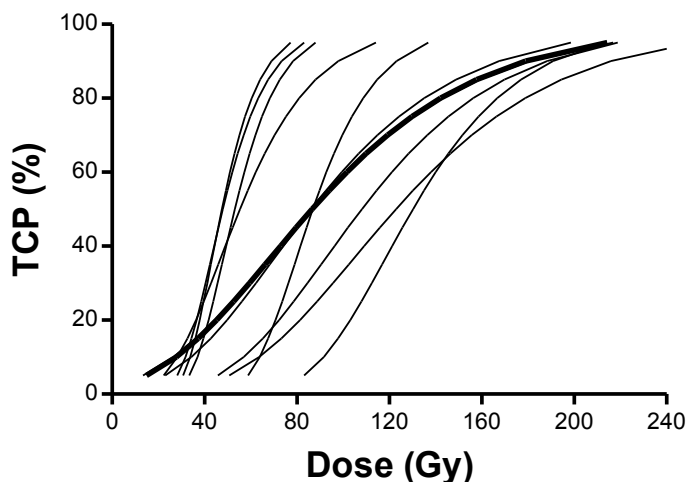
Potential for improvement - equipment



- Compact, less pricy, high quality equipment; considerable progress underway but „desktop technology far away“
- Fully integrated image guidance, motion control, beam position control, in vivo dosimetry key issue
- Adaptive treatment, ultrafast TPS, (semi)automated segmentation tools necessary
- Lighter ion beams have potential, but certainly protons and carbon need continued evaluation
- (also do not forget about photons; in the end best radiotherapy counts)

Introduction: Particle and other RT

Potential for improvement - knowledge



- Dose as surrogate not good enough
- RBE big issue (models, endpoints, experimental set-ups, ...). Integration in TPS
- RBE issue also for protons
- Biological mechanistic basis of effects?
- Interaction with other anticancer therapy (majority of patients receives combined treatments; multimodality). Not only drugs, also e.g. surgery
- Imaging/Bioimaging particularly important for improved RTs
- Use of imaging and non-image biomarkers for selection, stratification, prescription; among others also biology-driven beam selection („personalized medicine“). Co-morbidity also to be considered in personalized approaches
- Anatomical and biological adaptation during treatment

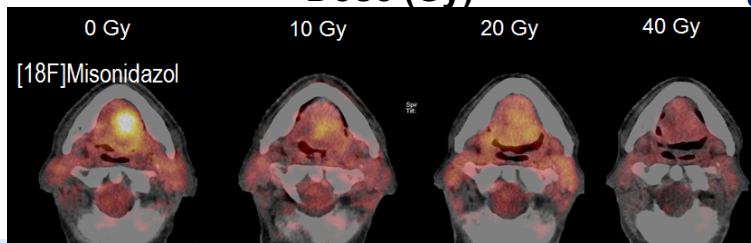
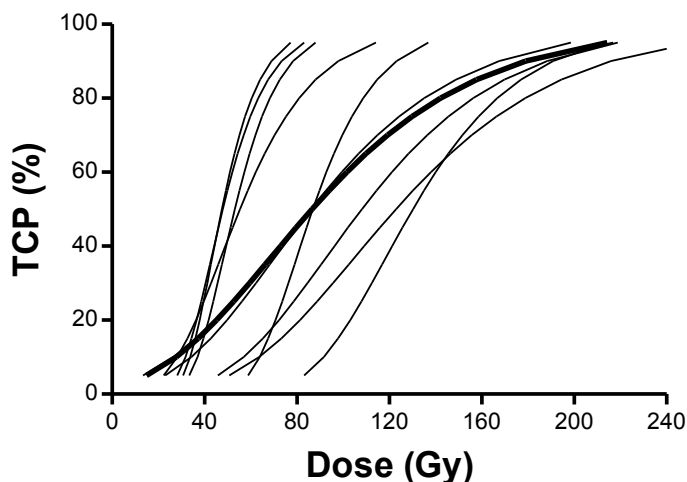
Introduction: Particle and other RT

Potential for improvement - knowledge



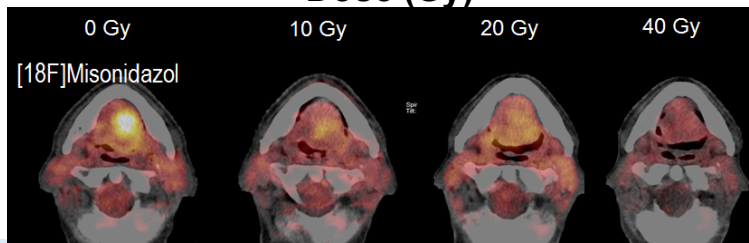
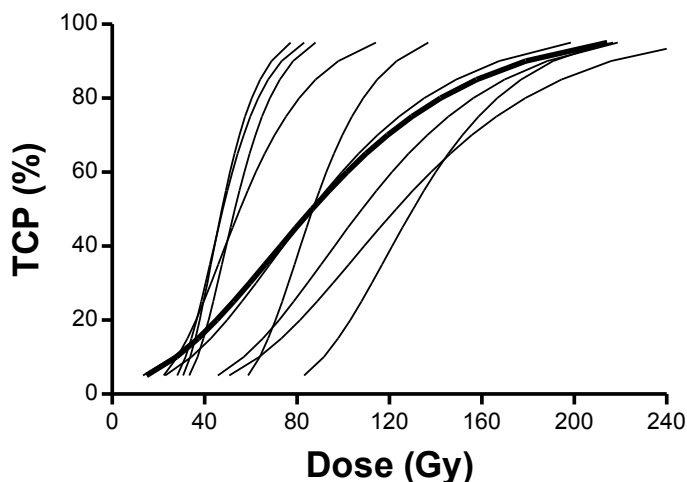
CERN lab:

- Provide enough beam time and different relevant beams (including standards)
- Integrate biology, imaging, technology research infrastructure
- Experimental models start in vitro but use more relevant models (3D) and endpoints. Microenvironment (e.g. hypoxia), multimodal, modern cell biology
- Animal study capacity at some point also in this hub lab necessary
- Link up with labs in community will need some infrastructure (IT, QA network etc)



Introduction: Particle and other RT

Potential for improvement - knowledge

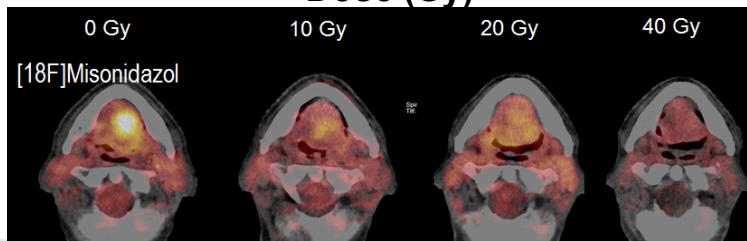
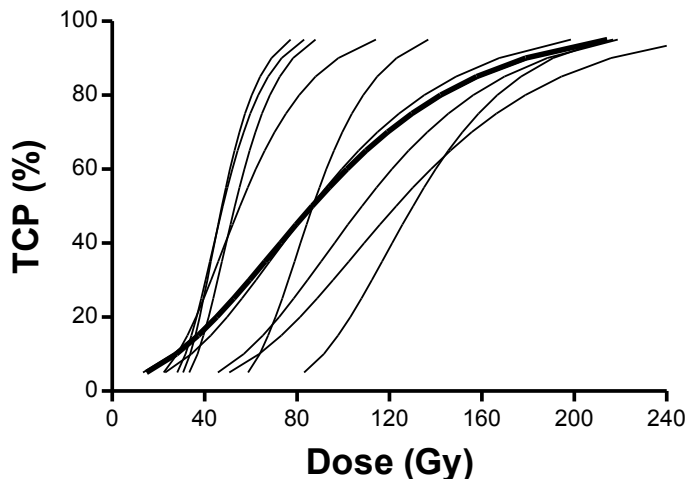


GENERAL

- Mathematical power for large data handling, extraction of predictive and mechanistic information (CERN very well positioned here as potential hub)
- Link this computational power and expertise up with data-bases in the community (very good point in time as several such initiatives are on the way in Europe and in the US)
- Inclusion in treatment planning support systems (certification! Industry cooperation needed)
- Legal issues here need close link with experts from community
- Challenge the predictive modelling (not retrospective modelling only) by generating loop to outcome data (also needs integration with community)
- More and better clinical trial designs
- Overall cooperative open approach key to reach these aims

Potential for improvement

– work together



- Plenty of room for research
- Time frame limited
- Strong structured consortium (perhaps better name institute?) of large scale research facility (facilities) with global „key community“ most promising
- Develop bold vision which could be followed, globally
- Need of active involvement of clinicians, biologist, physicists, information scientists from the beginning
- Education and training need to be integrated
- Aim is evidence-supported major improvement of radiotherapy (and general oncology), which will continue to apply photon and particle therapy