although survival improvement has not been adequately documented. Intraoperative radiotherapy (IORT) is in some institutions given as a boost of 12–18 Gy to improve local control and survival. However, data from randomized studies are lacking and results obtained without IORT may be as good as those obtained with IORT. Hypertermia is currently being investigated in the same groups of patients.

How much should be given to obtain a high probability of survival and a good life quality? Current knowledge and practice will be discussed.

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Dose/volume effects – The foundation of conformal radiotherapy

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3-Dimensional imaging and the development of advanced planning programmes and treatment delivery and verification techniques have enabled the clinical development of conformal, and now intensity modulated, radiotherapy. The clinician "knows" that reducing the amount of normal tissues irradiated in radical treatments must be beneficial, but quantification and modelling of potential advantages is not easy. There is controversy about how to handle data from inhomogeneous dose distributions and the validity of dose reduction algorithms. For tubular structures such as the rectum, dose volume (solid organ), dose surface, dose wall or dose contour histograms can be derived and the appropriate dose descriptor may change with endpoint studies. For example, different tissue organisation may be related most clearly to stricture (series) rather than rectal bleeding/proctitis (parallel). Data for dose response NTCP have been largely derived from pooled clinical data and a major aim in on-going trials must be the collection of high quality dose-volume-complication clinical data. Phase III studies in prostate cancer have now clearly demonstrated the presence of a significant volume effect. The challenge for the future is to document the benefit of dose escalation in increasing tumour control and develop user friendly models to guide, for example, the selection of optimal treatment techniques and margin as well as customised dose delivery.

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Objective evaluation of tumor response of non-small cell lung cancer (NSCLC) after 70 Gy conformal radiotherapy using matched CT scan data

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Purpose: To evaluate tumor response, 16 patients were analyzed that were irradiated to a dose of 70 Gy in 35 fractions because of an inoperable NSCLC.

Methods: Three months after the end of irradiation a CT scan of the thorax was repeated conform the planning CT scan (in treatment position). The CT scan was matched to the pre-radiotherapy (pre-RT) planning CT scan using chamfer matching. On the CT scan "post-RT" the Gross Tumor Volume (GTV) was delineated and compared to the GTV "pre-RT". The GTV includes the primary tumor and pathologic lymph nodes plus abnormal findings detected on bronchoscopy and/or mediastinoscopy. The GTV "post-RT" was drawn with the spatial information of the matched CT scan "pre-RT".

Results: In two patients the GTV "post-RT" could not be defined because of the development of a pleural effusion in one patient and a massive atelectasis in the other patient. The mean GTV "pre-RT" was 106 cm3 (range 10–368 cm3) in these 16 patients. The GTV was not related with TNM stage. The GTV "post-RT" ranged from 0 to 86 cm3, with a mean of 29 cm3. The mean relative decrease in GTV in the 14 patients was 76% (range 46–100%). One complete response, 12 partial responses and one stable disease was objectively measured.

Conclusion: Matching CT scans is a helpful instrument to delineate and compare the GTV on the "post-RT" scan. It is useful to have spacial information to evaluate tumor reponse. In our current phase I/II dose escalation study a CT scan in treatment position is repeated to evaluate tumor response objectively.

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Conformal radiotherapy and paediatric tumours

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The expected cure rate for children with cancer approaches 80%. The majority of these children are managed with multi-disciplinary approaches with a goal of cure without late consequences of therapy.

Prescribed doses for radiotherapy are limited by the radiation sensitivity of the surrounding normal tissue. Unique to paediatric radiotherapy is the sensitivity of rapidly growing/developing tissues, thus organ-specific tolerances are lower in children. Combined modality therapy further increases the radiosensitivity of normal tissues, potentially limiting radiation doses.

Three-dimensional conformal radiotherapy (3DCRT) improves the accuracy of targeting tumours while reducing the radiation exposure of normal tissues, allowing for dose escalation. High resolution CT scanners, CT and MRI image fusion, 3D reconstruction with beams-eye-view graphics, isodose distributions and dose-volume histograms are useful in constructing and evaluating treatment plans. Linear accelerators with dynamic multi-leaf and mini-multi-leaf collimators allow the delivery of even more conformal dose distributions. Inverse planning with intensity-modulated radiation therapy (IMRT) allows complex treatment while sparing tissues directly adjacent to the treatment volume. This most conformal treatment requires exquisite target and normal tissue delineation with precise patient positioning. For children, precise immobilization is crucial and often requires general anesthesia. Children have short attention spans thus requiting short treatment times. Young children with benign and malignant brain tumours, and soft tissue sarcomas such as rhabdomyosarcoma presenting in critical organs are most likely to profit from this new technology. Different techniques are being developed to minimize treatment duration for children. Quantitative studies comparing outcome, expense, and treatment time from routine, conformal, and IMRT plans in children are needed.

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Intensity modulated radiotherapy with dynamic multileaf collimators. Technology and clinical potential

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Since early 1997, dynamic multileaf collimators (DMLCs) are used in our division for intensity modulated radiotherapy (IMRT). We have used IMRT to i) irradiate concave targets (head and neck, paraspinal tumors); ii) combine beams with shallow hinge angles (mediastinum, lung tumors); and iii) deliver intentionally inhomogeneous dose distributions (prostate, paranasal sinuses, brain tumors). IMRT is now our standard treatment for locoregional relapse (after high-dose radiotherapy) of head and neck cancer and for radical treatment of localized prostate cancer. For a variety of other tumors, conventional 3D-plans are compared with IMRT-plans, the latter being clinically implemented if superior.

We developed a geometry based IMRT planning strategy to create assemblies of static intensity modulated (IM)-beams which consist of uniform (unmodulated) segments. By a translator program, segments are combined in a single prescription which allows delivery under computer control. Cost-containment is further improved by automation of the planning. After manual or semiautomated contouring of PTV and the organs at risk, prostate IMRT plans, based on a class solution, are generated and optimized by a computer. IMRT for pharyngeal relapses and most other tumor sites is planned semi-automatically. IMRT replaces gradually conventional treatments in our division. Interesting dose distributions generated by IMRT allow better sparing of normal tissues with decreased acute and late toxicity and offer a window for further dose escalation.

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Abstract not received.