protons and x-rays: x-ray dose of median 12.0 Gy (6.0−30 Gy) with daily dose of 1.8−2.0 Gy and proton dose of median 38 Gy (30.0−45.2 Gy) with daily dose of 1.8−2.5 Gy in median 36 days were given. Nine children were treated on sedation; No child needed general anesthesia.
Results: No child had to discontinue proton beam therapy, due to treatment. Acute morbidity according to the EORTC scoring criteria was grade 0 for 2 children, 1 for 26 and 2 for 3. Follow-up periods ranged from 8 months to 22 years with a median of 45 months. Over-all and disease-free survival for the 31 children was 61% and 53% at 10 years, respectively. Local control rate in the irradiated sites of the 31 children was 87% at 10 years. For 29 children who were followed for 6 months or longer, late morbidity according to the EORTC scoring criteria in the bone was grade 0 for 25 children, grade 1 for 1 and grade 2 for 3. There was no another serious late morbidity recorded.
Conclusion: Proton beam therapy is at least as feasible and effective as x-ray therapy is. Treatment related morbidity might be less than that of x-ray therapy. Further studies are needed to define the role of proton beam therapy in the treatment of children with sarcomas.

1405 ORAL

Health-related quality of life in long-term survivors of childhood brain tumours

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Purpose: To analyse the impact of potential predictors [gender, age at the time of diagnosis, tumour location, the presence or absence of hydrocephalus requiring shunt inserted at diagnosis, and treatment with radiotherapy (RT)] on health-related quality of life (HRQL) in an unselected population of survivors of childhood brain tumours, and to examine the relationship between cognitive function and HRQL.
Methods: We analysed a consecutive sample of 126 patients [7.9−40.4 years] who had a brain tumour diagnosed before the age of 15 years and were treated during the period January 1970 through February 1997 in the eastern part of Denmark. Sixty-nine had received radiotherapy (RT). In addition to assessment of general intelligence (IQ), an early version of the Minneapolis-Manchester Quality of Life (MMQL) questionnaire was administered.
Results: In multiple linear regression, treatment with RT was the most important risk factor for reduced HRQL. RT showed significantly negative associations with physical functioning, physical energy, body image, social functioning, intimate relations, and outlook of life. Tumour location in the cerebral hemisphere was associated with a less positive body image and older age at diagnosis with better social functioning and relations to the opposite sex. When IQ was included as a covariate, RT only remained significant for social functioning while hemisphere tumour location remained significant for body image, and age of diagnosis for social functioning.
Conclusions: The results suggest that IQ is a very sensitive measure of the effects of brain tumour and a strong determinant of health-related quality of life.

1406 ORAL

Parotid gland sparing in paediatric patients receiving radiotherapy for infratentorial tumours: Optimization of treatment technique to improve normal tissue sparing

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Background: Radiation damage to the parotid glands can be irreversible, and studies of adult patient population have shown that an improvement in some measures of quality of life is achievable with salivary-gland-sparing intensity modulated radiotherapy (IMRT). Avoidance of xerostomia to maintain healthy dentition is especially important in the paediatric population. The use of IMRT is increasing for paediatric brain tumours. Minimizing radiation toxicity to the parotid glands should be included as a priority in planning, particularly for those tumours arising in the infratentorium, in addition to maintaining dose tolerances for other organs-at-risk (OAR), such as optic structures and brainstem. Radiation oncologists and medical dosimetrists are adapting their treatment planning practices towards this end. An average radiation dose of $\leqslant$2600 cGy was found to be the threshold for preserved salivary flow. Three-dimensional radiation dosimetry using non-coplanar beam arrangements could assist with the objective of reducing radiation dose to the parotid glands.
Methods: Computed tomography (CT) and magnetic resonance imaging (MRI) datasets of paediatric patients diagnosed with medulloblastoma or ependymoma were retrieved from the radiotherapy planning archives. Bilateral parotid glands were contoured by the medical dosimetrist and the radiation oncologist using ADAC Pinnacle software. Dose constraints for parotids consistent with those utilised within head and neck radiotherapy planning were applied. Dose calculations were repeated for the purpose of evaluating the dose delivered by conventional and intensity-modulated treatment plans. The gantry angles chosen for target coverage were examined retrospectively, and new non-coplanar beam orientations were employed with the aim to avoid beam entry through the parotid glands.
Results: Dose distributions of an initial six treated plans were compared against the plans generated using non-coplanar beam orientation. Percentage difference of dose to OARs was measured and then averaged. Evaluation of dose-volume histograms and radiation dose statistics demonstrated that non-coplanar beam dosimetry resulted in lower dose to the parotid glands and other OARs. On average, the non-coplanar plans resulted in a decrease of the maximum (−23.1% [right], −23.6% [left]) and mean dose (−16.6% [right], −16.1% [left]) for both parotid glands. The average dose to parotids was within threshold toxicity of $\leqslant$2600 cGy (2314.2 [right], 2294.9 [left]), while maintaining dose limits to the optic structures and brainstem. Further analysis of an additional fourteen patients is ongoing.
Conclusion: IMRT techniques introduce radiation dose to normal tissue surrounding target volumes by the gradient effect; hence, it is important to consider beam orientation when applying it to radiotherapy treatments, especially for paediatric patients.

1407 ORAL

Successful treatment of childhood brainstem gliomas with cisplatin and irinotecan

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Background: Childhood brainstem gliomas (BSGs) are a heterogeneous group of neoplasms with dissimilar natural histories. Historically, the prognosis of BSGs has been exceedingly poor, median survival 4−15 months. No standard chemotherapy has shown a significant impact on BSG outcome, particularly the diffuse intrinsic (median time to progression, 6 months). A pilot study suggested that irinotecan/cisplatin (I/C) is effective for spinal cord astrocytomas (Mora et al, Neuro-Oncol 2007), thus in November 2005 a phase II I/C trial for all progressing astrocytomas was initiated. Here, we focus on the brainstem subgroup.
Materials: From January 2002 to December 2006, 77 patients have been managed for astrocytoma in our institution. Twenty-two (28%) were BSG, 16 managed prior to the I/C protocol, the historical cohort. The indication for adjuvant therapy was based upon histology, surgical resection, or clinical symptoms. Weekly Irinotecan (50 mg/m^2 and 65 mg/m^2 the last 2 cycles) and Cisplatin (30 mg/m^2) for four consecutive weeks (1 cycle), and a total of 4 cycles was used ambulatory. The diffuse intrinsic and high-grade tumors also received antiangiogenic therapy with bevacizumab (5−10 mg/kg, biweekly) and radiation therapy.
Results: Primary sites of the 22 BSGs include: 7 (32%) midbrain/thalamus; 15 (68%) pontine tumors (7 nondiffuse and 6 intrinsic diffuse); and 2 (9%) cervicomedullary. Histology is available for 15 tumors, 4 (26%) being high-grade's (3 pontine and one thalamic) and 11 (74%) low-grade's (4 pilocytic). No patient had clinical signs of neurofibromatosis. Of the 6 patients enrolled, 4 had pontine tumors (2 nondiffuse and 2 diffuse) and 2 low-grade, midbrain tumors. All pts had complete and rapid clinical responses to the I/C regimen. Remarkably, a >20% reduction of the tumor size was achieved with the I/C treatment at the end of therapy, including the 2 intrinsic diffuse BSGs. One midbrain, low-grade tumor has progressed requiring further therapy. All 6 pts are alive and well, median f/u 9 months. In the historical cohort, 10 (62%) pts are alive, median f/u 25 months.
Conclusions: Remarkable early clinicoradiological responses were obtained using the I/C regimen for childhood BSGs.