Despite late complications related to radiation therapy, RT remains a standard component of treatment among pediatric patients. The current aim of many pediatric clinical trials is to reduce dose and volume of irradiation to decrease side effects without affecting the rate of local control using multimodality treatment.

Recent advances in radiotherapy technology contribute also to improve therapeutic ratio thanks to better conformal dose distribution and avoidance of surrounding critical structures. Integration of multimodal imaging in target delineation, use of CT for treatment planning (3D conformal radiation therapy) and immobilization devices have significantly decreased clinical and planning target volume margins.

Intensity modulated radiation therapy could be particularly useful in cases of complex and large volume closed to critical structures. While high dose to neighboring structures can be selectively decreased by the means of IMRT, low dose is raised in the rest of the body with theoretical increased risk of secondary malignancies or unexpected toxicities related to irradiation of very sensitive organs at risk located at distance of target volume. Number of prospective studies comparing IMRT to 3D CRT is low. However available data suggest that IMRT provided local control equivalent to 3D CRT with favorable short term toxicity profile and reduction of some sequelae. No excess of second tumor is described but follow-up is still limited.

Concerning strategies for management of internal target movement due to respiratory motion, the more widespread modality in pediatric radiotherapy is 4-dimensional CT for radiation. Other techniques such as active breathing control or respiratory gating is not widely widespread because their use is conditioned by collaboration ability and patient age. Up to now stereotactic radiotherapy has been mainly used in childhood for intracranial benign disease by neurosurgeon. However development of non-invasive repositioning system and LINAC dedicated to stereotactic irradiation gives the opportunity of hypofractionated treatment of metastasis or recurrence in previously irradiated field with minimal impact of quality of live in palliative setting.

With high precision techniques, reproducibility in daily set-up becomes more critical to prevent geographic misses and image-guided RT (IGRT) has become a common practice of care for children as for the adults. One of the most applied IGRT technique is cone-beam computed tomography (CBCT). A limitation in use of CBCT among pediatric population is the extra dose deposit to critical structures which is higher in children than in adults. Because of potential of yielding a secondary cancer at long term, it is essential to adapt scanning protocol when CBCT is applied to pediatric cancer patients routinely.

SP-0307 131-Iodine meta-iodobenzylguanidine molecular radiotherapy for neuroblastoma

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Neuroblastoma, predominantly a cancer of young children, is derived from the sympathetic nervous system. Patients are risk-stratified by age, stage and molecular pathology to guide treatment and predict outcome. High-risk neuroblastoma, usually defined as metastatic disease over the age of one year, or the presence of MYCN amplification, is the most common risk group, and carries a high mortality. New and better treatments are necessary.

Neuroblastoma cells usually express the Noradrenaline Transporter (NAT) molecule which takes up meta-iodobenzylguanidine (mIBG), a noradrenaline analogue. Labelled with iodine-123 for imaging or iodine-131 for therapy, mIBG has been used clinically in neuroblastoma and other NAT expressing tumours for about 30 years. Semi-quantitative scoring of 123I-mIBG scintigraphy has become the gold standard imaging technique for staging, response assessment and follow-up of patients with neuroblastoma.

Molecular radiotherapy with 131I-mIBG is an attractive treatment option for children with high-risk metastatic neuroblastoma because (1) the disease is disseminated, making local therapies alone inadequate, (2) 123I-mIBG scintigraphy is a predictive imaging biomarker for avid accumulation of 131I-mIBG in the primary tumour and metastatic sites, and (3) neuroblastoma is often relatively radiosensitive meaning impressive responses to treatment can be seen.

Initially used in relapsed patients with only palliative intent, the use of 131I-mIBG therapy has in recent years been brought forward in the course of the illness as either a first- or second-line strategy with the aim of increasing the prospects for cure. Further research efforts, especially randomised trials, are however needed to demonstrate its true value.

The principal and therefore dose-limiting toxicity of 131I-mIBG therapy is haematological. The whole body absorbed radiation dose correlates with the haematological toxicity, and so whole body dosimetry can be used, in conjunction with peripheral blood stem cell support, to allow the use of higher administered activities than were previously considered safe. There is laboratory evidence to support the hypothesis that improvements in outcome may possibly be achieved by the simultaneous use of radiosensitising drugs such as topoisomerase I inhibitors. Initial clinical experience has been published, and clinical trials using irinotecan and topotecan in conjunction with 131I-mIBG are in progress or planned to evaluate this approach further.

There are practical challenges when young children need to receive high administered activities of 131I-mIBG. The use of comforters and carers, usually the child’s parents, is an essential addition to medical and nursing care. All individuals involved need to appreciate the risks, and be trained in sensible radiation protection precautions.

Other forms of molecular radiotherapy for neuroblastoma are being investigated, particularly peptide receptor radionuclide therapy targeting the somatostatin receptor, using radiolabelled somatostatin analogues. Examples are 90Y-DOTATOC and 177Lu-DOTATATE. These are not necessarily alternatives to 131I-mIBG therapy. Both immunohistochemical studies of NAT and somatostatin receptor expression in neuroblastoma tissue, and imaging comparisons of 123I-mIBG scintigraphy and 68Ga-DOTATATE PET/CT demonstrate a heterogeneity of appearances suggesting that they may be complementary.

This presentation reviews the published evidence in relation to 131I-mIBG therapy for neuroblastoma, and describes the plans to further evaluate its place through clinical trials in the context of other systemic treatments for this hard-to-cure disease.

OC-0308 Identification of significant biological subvolumes from MRI in pediatric ependymoma related to treatment outcome