published RTOG study 0933). Assessment of health status and neurocognitive function after hyperfractionated radiotherapy of CSA in the SIOP PNET IV trial showed in part a better outcome as compared with conventional fractionation, especially in younger children.
Conclusions: The impact of radiotherapy on the risk for late effects and its clinical pattern apparently strongly depends on the exposure of functionally relevant regions within the brain to irradiation. Neuroregeneration and the preservation of the corresponding anatomical regions may play an important role in the reduction of radiation induced decline of cognitive function. The impact of fractionation on the risk to develop a decline in neurocognitive function is controversial and requires further research.

SP-0339
Long-term results of brachytherapy in gynaecological pelvic tumours
A. Levy[1], C. Haie-Meder[1]
[1]*Gustave Roussy, Radiation Oncology, Villejuif, France*

Purpose: Reported experiences focusing on vulvo-vaginal brachytherapy during childhood are rare and most reported children have been treated at Gustave Roussy in France. Our technique of gynaecological brachytherapy has always been anatomy-adapted with use of the mould applicator. Here, we assessed the long-term toxicities of conservative treatments integrating brachytherapy in female survivors with localized vulvo-vaginal tumors.
Patients and Methods: The data from 42 patients treated at Gustave Roussy between 1971 and 2004, were both retrospectively and prospectively analyzed. Strictly confidential surveys buildup based on the LENT SOMA questionnaires were mailed and 51% were filled up (minor: 29%; adult: 71%). Complications were recorded throughout follow-up and graded according to the CTCAE version 4.0.
Results: The median age at diagnosis was 1.7 years (range, 0.6-16.6) and most patients (69%) had rhabdomyosarcomas. Treatments included brachytherapy for all patients, chemotherapy (88%), surgery (31%), and external-beam radiotherapy (5%). At a median follow-up of 15.5 years, 41/42 patients were alive. There was 160 late effects identified in 32/42 (76%) patients: 72% G1-G2, and 28% G3-4 (mean all grade late effect per patients: 4±4 [median: 2.5; range, 0-16] and mean G3-4 late effect per patients: 1±1.9 [median: 0; range, 0-8]). The most commons late toxicities were gynecologic for all grade (75/160; 47%) and urinary for G3-4 (24/45; 53%). Fourteen patients (33%) required surgical treatment of late complications. The 15-year actuarial incidence rate of G3-4 late effects was 51%. The total number of all grade and G3-4 late effects was significantly increased in patients treated before 1990 (p=0.005 and p=0.008) and with higher cumulated dose (p=0.03 and p=0.02) and maximal dose delivered to ovaries (p=0.002 and p=0.04), and larger brachytherapy volume (p=0.03 and p=0.02). Quality of life was good or very good in 91% of patients that answered the surveys.
Conclusion: The burden of late effects decreased with advances in treatment. A highly specialized multidisciplinary approach combining stringently controlled brachytherapy parameters, elective surgical indications, and efficient chemotherapy regimens should allow pursue improvements in terms of long-term sequelae.

SP-0340
External irradiation-related late toxicities in extracranial childhood tumours
K. Dieckmann[1]
[1]*Medizinische Universität Wien Medical University of Vienna, Department of Radiation Oncology, Vienna, Austria*

Side effects after external radiotherapy in pediatric oncology are multifaceted and depend on the age of the patient at time of treatment, location, size of the target volume, and the OAR inside or in the neighborhood of the target. Not only high doses do have an effect on the growing structures but as well low doses can provoke severe long term side effects. Most of the side effects are not visible during the first 5 years after treatment but develop continuously over decades, and can influence quality of lifelong. Based on the experience in pediatric radiooncology and dose distribution at the growing structures, most of these side effects are predictable and some of them are avoidable using adequate techniques. According to the age of the patient different long term side effects are to be aspected. For example children in the of > than 9 years after mantel field irradiation have a much higher risk to develop breast carcinoma than younger children, meanwhile the growing deficit of the bones are much pronounced after RT in younger children than in older ones. Due to the combined treatment schedules most of the side effects are combined and the real dimension of RT–dose and irradiated volume cannot always be evaluated. Based on different patient cases the development of long term side effects will be discussed.

OC-0341
Radiation-associated cerebrovascular accidents in =5-year childhood cancer survivors
I.W.E.M. Van Dijk[1], H.J.H. Van der Pal[2], R.M. Van Os[1], Y.B.W.E.M. Roos[3], E. Sieswerda[2], E.C. Van Dalen[4], C.M. Ronckers[4], F. Oldenburger[1], H.N. Caron[2], C.C.E. Koning[1], L.C.M. Kremer[4]
[1]*Academic Medical Center, Radiation Oncology, Amsterdam, The Netherlands*
[2]*Academic Medical Center, Medical Oncology - Pediatric Oncology - Emma Children's Hospital, Amsterdam, The Netherlands*
[3]*Academic Medical Center, Neurology, Amsterdam, The Netherlands*
[4]*Academic Medical Center, Pediatric Oncology - Emma Children's Hospital, Amsterdam, The Netherlands*

Purpose/Objective: Improved childhood cancer survival is accompanied by an increased incidence of tumor- and treatment-related adverse events later in life. Cerebrovascular accidents (CVAs) including ischemic and hemorrhagic stroke are amongst the most serious events. The purpose of this study was to determine the incidence and severity of symptomatic CVAs occurring 5 years or later after the primary cancer diagnosis in a cohort of long-term childhood cancer survivors, and to assess dose-effect relationships for cranial radiotherapy (CRT) and supradiaphragmatic radiotherapy (SDRT).
Materials and Methods: The single-center study cohort consisted of 1362 ≥5-year survivors diagnosed between 1966 and 1996; two survivors who had a CVA within 5 years after diagnosis were excluded from the cohort. CVAs were clinically confirmed, and defined and graded for severity using the Common Terminology Criteria for Adverse Events (CTCAEv.3.0). Physical radiation doses were available for 411 (93.8%) of the 438 survivors treated with CRT and/or SDRT, and converted into the equivalent dose in 2-Gy fractions (EQD_2). Cox proportional hazard models were used to estimate the hazard ratio (HR) and 95% confidence interval (95%CI) for sex, age at diagnosis, brain surgery, chemotherapy, CRT and SDRT. In a second model, the

relationship between the EQD_2 for both treatment locations (CRT, SDRT) and the occurrence of a first CVA was assessed. **Results:** After a median time of 24.9 years from the primary diagnosis and at a median attained age of 31.2 years, 28 survivors had a first CVA. Of them, 18 (64.3%) had ischemic events (Grade 3-4), and 10 (35.7%) had hemorrhagic events (Grade 2-5). One survivor was not treated with CRT nor with SDRT. Subsequently, two survivors had a second, and one a third CVA. The 35-year cumulative hazard in survivors treated with CRT only was 14.2% (95%CI, 3.5-24.9%), in survivors treated with SDRT only 6.8% (95%CI, 0-13.7%), and in survivors who received both CRT and SDRT 24.3% (95%CI, 6.7-41.8%) (Figure). The Cox analyses showed that both treatment locations significantly increased the risk of CVA in a dose-dependent manner (HR_{CRT} 1.02 Gy^{-1}; 95%CI, 1.01-1.03, and HR_{SDRT} 1.04 Gy^{-1}; 95%CI, 1.02-1.05).

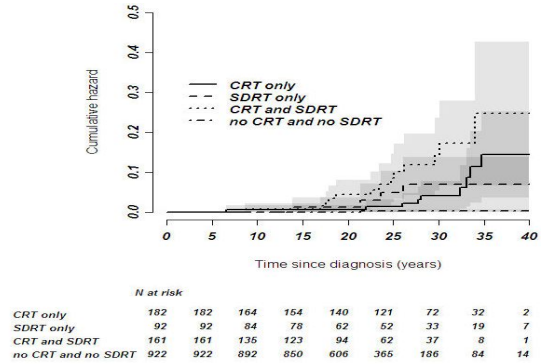


Figure. Cumulative hazards and 95%CIs for the first CVA ≥5 years after the primary cancer diagnosis in survivors treated with CRT only, SDRT only, both CRT and SDRT, and in survivors who had no CRT and no SDRT. Note: The SDRT only group consisted of 95 survivors; SDRT treatment could not be confirmed for 3 survivors, leaving 92 survivors for analysis.

Conclusions: Our results demonstrate that childhood cancer survivors treated with CRT and/or SDRT have an increased risk of CVAs as compared with survivors who had no CRT and no SDRT. Thirty-five years after treatment, almost 1 in 4 childhood cancer survivors treated with both CRT and SDRT experience a symptomatic CVA. In addition, these radiation-associated CVAs occur at a very young age. Therefore, continuing follow-up with a focus on tailored preventive strategies to reduce the risk of CVAs in this young population deserves special attention.

OC-0342

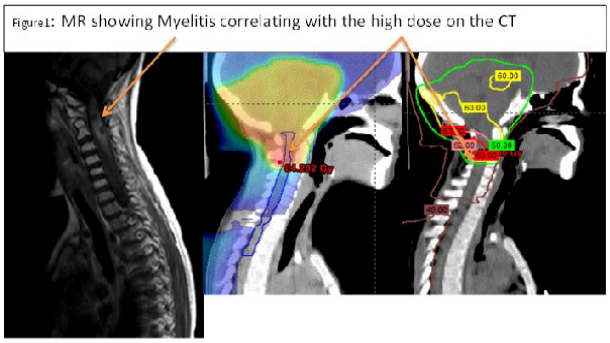
A UK national review of radiotherapy treatment plans for paediatric medulloblastoma in cases of neurotoxicity

H. Mayles[1], A. Baker[2], N. Thorp[2], J. Hayden[3], G. Horan[4]
[1]*The Clatterbridge Cancer Centre - Wirral NHS Foundation Trust, Physics Department, Bebington Wirral, United Kingdom*
[2]*The Clatterbridge Cancer Centre - Wirral NHS Foundation Trust, Radiotherapy Department, Bebington Wirral, United Kingdom*
[3]*Alder Hey Children's Hospital NHS Foundation Trust, Oncology Department, Liverpool, United Kingdom*
[4]*Addenbrooke's Hospital NHS Foundation Trust, Radiotherapy Department, Cambridge, United Kingdom*

Purpose/Objective: Paediatric metastatic medulloblastoma requires intensive treatment for the best results. Since 2007 the majority of UK centres used the Milan strategy (High dose Chemotherapy and twice daily Radiotherapy) to treat these patients. There were some reported cases of profound neurotoxicity and a review of plans and treatment method was done in order to check whether radiotherapy had contributed to the toxicity.

Materials and Methods: Patients with Grade 3-4 neurotoxicity, treated between 2008 and 2014, were identified and the toxicities classified into global and myelitis. Plan data (CT planning scans, Plans and Dosegrids) for the CranioSpinal (CNS) phase 1 and the Posterior Fossa Boost (PFB) phase 2 , was collected and imported into Eclipse (Varian). The dosimetry was reviewed for individual and summed phases. Where possible MR images showing myelitis were blended with the dose distribution on the CT scan. A questionnaire was circulated around all Centres to establish the RT technique and immobilisation used.

Results: 10 cases (8 male, all under 12 years), from 6 Centres were reviewed. All the children had a poor response to induction chemotherapy and received thiotepa as part of their high dose chemotherapy regime. The CNS dose was 39Gy in 30 Fr for 9 cases and 31.2 Gy in 1 Fr for 1. All received a PFB to a dose of 59.7 – 60 Gy. All Centres used a conformal Linac based technique with opposed Head fields matched to posterior Spine fields, and a shifting gap. 5 out of 6 centres used a supine technique. 1 Centre used VMAT for the PFB, others a 3DCRT plan. 1 Centre checked plans using summed doses, others checked each phase separately. The myelitis occurred in the PFB volume and it was noted that for these patients the C1 summed dose was >62 Gy, although less than 63Gy (105%), see Fig 1.



Conclusions: There was no evidence of radiation techniques contributing to neurotoxicity. However when the Milan protocol was adapted for the UK, there was no involvement of physics and certain details of the treatment were different, in particular that in Milan the PFB PTV would not include the spinal cord. This review also highlighted the importance of planning and summing both phases in order to assess the combined dose. It is recommended that special attention is paid to the cervical spinal cord dose with a strict dose constraint of 61Gy. Lessons learnt from this review highlight the importance of sharing experience both nationally and internationally especially for rare tumours.

Debate: SBRT / oligometastatic disease: Oligomets then SABR is standard of care

SP-0343

SBRT for oligometastatic disease: For the motion

M. Guckenberger[1]
[1]*University Hospital Zürich, Department of Radiation Oncology, Zurich, Switzerland*

Stereotactic Body Radiotherapy (SBRT) is today the accepted standard of care for early stage non-small cell lung cancer if