were retrospectively examined. PATIENTS AND METHODS: Clinical characteristics of seven radiation-induced brain tumors that developed in 6 patients irradiated in their childhood at our hospital were analyzed. The background disease, age at irradiation, irradiation dose, period from irradiation to onset, pathological diagnosis, and treatment for radiation-induced brain tumor were examined. RESULTS: Background diseases for irradiation were leukemia in 3 patients, germinoma in 2, medulloblastoma in 1, and the average cranial irradiation dose was 23.2 Gy. The patients tended to be young at irradiation (2–17 yeays; median:4 years old). The time between irradiation and the onset of radiation-induced brain tumors ranged from 9.5 to 39.1 years (median:28 years). Radiation-induced brain tumors comprised 6 meningioma (grade I:5, grade II:1) and 1 high-grade gliomas. All patients underwent surgical removal of the radiation-induced brain tumors and 2 received additional irradiation. During a median of 5.3 years of follow-up after the diagnosis of radiation-induced brain tumors, 2 underwent second surgery, while the remaining 4 have no recurrence. DISCUSSION: In most cases, radiation-induced brain tumors occur for a long time after irradiation in childhood. Monitoring of radiation-induced brain tumors as well as primary tumor recurrence was considered important.

RONC-19. TWO CASES OF RE-IRRADIATION FOR LATE RECURRENT OR RADIATION-INDUCED TUMOR AFTER RADIATION THERAPY FOR PEDIATRIC BRAIN TUMORS

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BACKGROUND: As the outcome of pediatric brain tumors improves, late recurrence and radiation-induced tumor cases are more likely to occur, and the number of cases requiring re-irradiation is expected to increase. Here we report two cases performed intracranial re-irradiation after radiotherapy for pediatric brain tumors. CASE 1: 21-year-old male. He was diagnosed with craniopharyngioma at eight years old and underwent a tumor resection. At 10 years old, the local recurrence of suprasellar region was treated with 50.4 Gy/28 fr of stereotactic radiotherapy (SRT). After that, other recurrent lesions appeared in the left cerebellopontine angle, and he received surgery three times. The tumor was gross totally resected and re-irradiation with 40 Gy/20 fr of SRT was performed. We have found no recurrence or late effects during the one year follow-up. CASE 2: 15-year-old female. At three years old, she received 18 Gy/10 fr of craniospinal irradiation and 36 Gy/20 fr of boost to the posterior fossa as postoperative irradiation for anaplastic ependymoma and cured. However, a anaplastic meningioma appeared on the left side of the skull base at the age of 15, and 50 Gy/25 fr of postoperative intensity-modulated radiation therapy was performed. Two years later, another meningioma developed in the right cerebellar tent, and 54 Gy/27 fr of SRT was performed. Thirty-three months after re-irradiation, MRI showed a slight increase of the lesion, but no late toxicities are observed. CONCLUSION: The follow-up periods are short, however intracranial re-irradiation after radiotherapy for pediatric brain tumors were feasible and effective.

RONC-20. RECURRENT HIGH-GRADE ASTROBLASTOMA TREATED WITH STEREOTACTIC RADIOTHERAPY

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INTRODUCTION: Astroblastoma is a rare, mostly supratentorial glial tumor, occurring predominantly in children and young adults. However, treatment strategies have not yet been established for this rare disease. CASE PRESENTATION: A 6-year-old male presented with headache and nausea. CT and MR imaging revealed a left frontal mass lesion with slight edema and macrocalcifications. Gross tumor resection was performed. Histological examination found neoplastic cells with astroblastic characteristics, and a striking perivascular array of pseudorosettes. The final diagnosis was high-grade astroblastoma. MR imaging 13 months after surgery suggested local recurrence and enlargement was found 3 months later. Stereotactic radiotherapy (SRT) was performed. MR imaging after SRT showed enhanced cyst formation around the tumor bed, suggesting tumor recurrence. However, ^{11}C-methionine PET revealed radiation necrosis. The last follow-up MR imaging 15 months after SRT showed no further recurrence. CONCLUSION: Astroblastoma is rare, so no optimal management is known. SRT may be effective to treat recurrent astroblastomas. ^{11}C-methionine PET/CT is useful for the differentiation from radiation necrosis.

RONC-21. IDENTIFICATION OF EPIGENETIC DRUGS AS RADIOSENSITIZERS IN PEDIATRIC HIGH-GRADE GLIOMAS

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Pediatric high-grade gliomas (pHGG) are malignant brain tumors with a high mortality rate. Radiotherapy (RT) is one of the cornerstones of current pHGG treatment, while the efficacy of chemotherapeutics remains inferior. The use of chemotherapeutics that specifically sensitize tumor cells to irradiation are poorly understood, but may help to increase the effect of RT in pHGG treatment. Since recent studies revealed pHGG to be epigenetically dysregulated, we tested 148 epigenetic drugs on eight primary pHGG models in the presence and absence of RT, to assess their radiosensitizing potential. Based on synergy scores, we found 22 compounds that resulted in enhanced cytotoxicity in the presence of RT. The effect of these compounds on pHGG was further investigated by tracking spheroid growth microscopically for 30 days, identifying four molecules that stopped spheroid-expansion solely in combination with RT ($p=<0.001$, multilevel regression). Parallel cell-viability assays reported identical results. Furthermore, tumor migration in 3D matrigel growth assays, using non-toxic doses of the four identified compounds, revealed that two compounds (the selective HDAC-inhibitors; chidamide and entinostat) stop the infiltrative growth characteristics of pHGG cells, exclusively in combination with RT. RNA-Seq data showed that entinostat and chidamide inhibit DNA-repair pathways like the Fanconi anemia cascade and homologous recombination. Since we anticipate that entinostat- or chidamide-induced radiosensitization can be enhanced by blocking kinase-driven escape mechanisms, we are currently conducting a kinome-wide CRISPR/Cas9 knockout screen in three primary pHGG models to develop combinational therapies. These results highlight entinostat and chidamide as potential radiosensitizers in pHGG treatment.

RONC-22. SECOND TUMORS IN PEDIATRIC PATIENTS TREATED WITH PROTON THERAPY TO THE CENTRAL NERVOUS SYSTEM

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BACKGROUND: Previous institutional data suggests the 10-year cumulative incidence of second tumors is 3% in children treated with photon radiation for central nervous system (CNS) malignancy, with 90% of these tumors occurring in areas receiving ≤36 Gy. Comparative figures for children treated with proton therapy (PT) does not exist. METHODS: 1056 consecutive pediatric patients with a median follow-up of 5.0 years were treated between 2006–2019 with double-scattered PT to a site within the craniospinal axis. 230 patients were ≤3 years old and 14 had neurofibromatosis. A second tumor was defined as any solid neoplasm with histologic features different from the original tumor that had arisen within the irradiated volume. RESULTS: Five patients developed second tumors resulting in a 5- and 10-year cumulative incidence of 0.2% (95% CI: 0–1.2%) and 1.6% (95% CI: 0.6%-3.9%), respectively. Of those who developed second tumors, median age at radiation was 4.3 years old (range, 2.1 to 5.1 years old) and diagnoses consisted of medulloblastoma (n=2), ependymoma (n=2), and craniopharyngioma (n=1). The second tumors included high grade gliomas (n=3) and high grade sarcoma (n=1) that occurred in regions receiving at least 54 Gy. One patient with neurofibromatosis developed both a low-grade glioma and choroidal melanoma in craniospinal irradiation regions receiving 36 Gy. Four of five patients with second tumors are alive. CONCLUSION: The reduction in moderate-to-low dose radiation exposure from proton therapy may be associated with a decreased incidence of second tumors in children treated for CNS neoplasms. More follow-up is needed to confirm these findings.

RONC-23. NOVEL APPROACH TO REDUCE ACUTE ESOPHAGEAL TOXICITY IN CRANIO-SPINAL IRRADIATION USING INTENSITY MODULATED PROTON THERAPY

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INTRODUCTION: We present our experience of a novel approach using intensity modulated proton therapy(IMPT) for cranio-spinal irradiation(CSI) leading to reduced acute esophageal toxicity and reduced treatment interruptions. MATERIAL AND METHODS: Seven children younger than 12 years old treated consecutively with CSI using IMPT were included in this study. Three among 7 children received concurrent chemotherapy(CCT). En-