Short Communication
Open Access
CrossMark

Re-irradiation therapy for recurrent brain stem tumors in children and adolescents

Abstract

Objectives: This study is devoted to the evaluation of the possibility and effectiveness of re-irradiation treatment of children and adolescents with the relapses of diffusely growing brainstem tumor (BST).

Methods: Repeated radiotherapy was performed in 23 patients aged from 5 to 12 years who had a relapse of a BST in terms from 4 months to 4 years after the first curses radiation treatment in doses of 54-55Gy. In the case of re-irradiation, single fractions of 1.5-1.8Gy were used, five times a week, to total doses from 15 to 45Gy.

Results: The tolerability of repeated irradiation was satisfactory. Improvement of the condition of the patients was achieved in 18 (78.3%), the condition of the three patients (13,0%) did not change and the two (8,7%) worsened, which caused the interruption of treatment at a dose of 10 and 15Gy. On further observation 16 children died of progression of the tumor in a period of 3 to 14 months, their median life expectancy was 6 months. Three patients dropped out of observation and two were alive for 5 years and 18 years after re-irradiation with residual neurologic disorders, with the tumor residue detected on the MRI, without signs of radiation necrosis. Both had a pilocitic astrocytoma.

Conclusion: Repeated radiotherapy for the relapse of BST can improve the quality of life for most children and provide a long-term stabilization of tumor growth in low-grade gliomas.

Volume 5 Issue 4 - 2018

Oleg Shcherbenko, Olga Regentova
Children Oncology Department Russian Scientific Center for Radiology of the Ministry of Health of the Russian Federation, Russia

Correspondence: Oleg Shcherbenko, Russian Scientific Center for Radiology of the Ministry of Health of the Russian Federation, 117997, Moskow, Profsoysnaj str. H86, Russia, Tel +7(916)573 42 72, Emailsherbenko@mail.ru

Received: July 28, 2018 | **Published:** August 28, 2018

Introduction

BST accounts for about a quarter of all tumors of the posterior cranial fossa in children. About 80% of these tumors are diffusely growing gliomas of varying degrees of malignancy.[1] Since partial removal of these tumors is possible only in 10-15% of patients, who have predominant exophytic growth, for the overwhelming majority of patients, the only primary care method remains radiation therapy, which allow for the majority of children to reduce the severity of neurological disorders and improve the quality of life. However, this effect is temporary and after various periods of tumor growth resumes, which leads to death. The life expectancy of such patients rarely exceeds 12 months. These tumors are relatively rare metastasizes,[2] but this is most likely due to too short a lifetime in which patients do not survive to detect metastases.

In a situation of tumor recurrence after an impressive symptomatic effect of the first treatment, the doctor must decide on a possible option for care. However, the choice is small: effective chemotherapy is not yet available, hormone therapy with corticosteroid drugs, at best, will have an effect for several weeks and will be complicated by severe symptoms of hypercorticism, RRT after brainstem irradiation at a dose of 50-70Gy theoretically is associated with a risk of fatal injuries the structures of the stem. Apparently therefore, the number of publications devoted to RRT is small and they are based on a small number of observations. Vanan MI et al.,[3] was performed RRT of 10 children with relapses BST. The duration of the first remission ranged from 4 to 37 months. With RRT fractions of 1.8Gy and TD from 21.6 to 36Gy were used. One patient even underwent a third course of radiation therapy at the TD of 21.6Gy at 6 months after repeated irradiation. In 9 re-irradiated children, the result was the decrease in the severity of neurological disorders. The median lifespan of re-irradiated children was 171 days, while for 46 patients with a relapses of BST, who did not receive repeated radiation treatment, this indicator was 91 days. The authors did not observe heavy radiation damage and made the conclusion, that RRT in a TD of 30-36Gy by fractions of 1,8Gy was worthwhile.[3]

To the same conclusion came also Fontanilla HP et al.,[4] which used RRT in 6 patients with a relapse of BST in 8-28 months after the first curses. TD at the first irradiation was 54-55.8Gy. RRT was performed in TD 20Gy at 4 patients and 18Gy at 1. In 4 patients the reduction in the severity of neurologic disorders was achieved, the condition of one patient deteriorated after the first fraction of 2Gy. With MRI in 4 patients, a decrease in the tumor was observed. Median duration of remission after RRT was 5 months. The authors noted the best effect in patients who had a longer remission after the first course.[4]

Considering the palliative nature of RRT, some authors used hypofractionated variants. Waxweiler TV et al.,[5] in 23 children with OSM, repeated irradiation was performed in TD 24Gy for 3 fractions or 25Gy for 5 fractions. With a median follow-up of 12.8 months, the median tumor stabilization was 10.5 months. At 8 patients there was again continued growth of tumors. In 5 patients, irradiated with fractions of 8Gy, symptoms of brain stem necrosis were observed. The authors made a conclusion about the expediency of using RRT with fractions of 5Gy to TD 25Gy.

Material and methods

In 1990-2013, RRT was performed in 23 patients 5-12 years old with a recurrent tumor of BST. Relapse occurred within the time from 4 months to 4 years after the first course of radiation therapy in TD

54-55Gy. RRT performed by traditional version of fractionation of 1.5-1.8Gy, five days in week. TD of RRT was from 15 to 45Gy.

Results

In 18 children (78,3%), RRT in combination with dexazone hormone therapy led to a decrease in the severity of neurologic disorders, improving the quality of life . The condition of the three children (13,0%) did not change and the condition of the two patients (8,7%) worsened, which caused the interruption of treatment at doses of 10 and 15Gy. Both last patients before RRT were in a bad condition (less than 50 points on the Karnovsky scale), the duration of the first remission was less than 4 months and on MRI were signs of tumor destruction with the formation of cysts. They died in 4 and 5 weeks after treatment. Three patients dropped out of the observation.

Sixteen children died in terms of 3 to 14 months after repeated treatment under tumor progression, their median life expectancy was 6 months. Life expectancy was longer for patients who had dense tumors without MRI signs of destruction and the duration of the first remission for more than 6 months.

Two patients are alive during 5 years and 18 years after RRT with residual neurologic disorders, rest tumor on MRT and no signs of necrosis, although the in the first treatment used dose of 55Gy, and re-irradiation doses 45Gy. Both had an interval between the first course of radiation therapy and re-irradiation about 4 years. Both patients initially on MRI had an exophytic component of relapse of the tumors, which was removed and a morphological examination showed the picture of a pilocitic astrocytoma.

Discussion

BST belong to the category of the most severe and in most cases fatal diseases in childhood. Although with the help of radiation therapy it is possible to improve the quality of life for most children, but this effect is temporary, the growth of the tumor soon resumes with further progressive deterioration of patient condition and death. In each such case, the doctor must decide whether it is possible to help the child, improve the quality of his life and increase its duration, or the only option is symptomatic therapy. Radiologists often refuse to repeat radiation for fear of radiation damage. This study shows that for a certain category of children with recurrent BST the risk of clinically significant radiation damage after repeated exposure to a TD of up to 45Gy is negligible compared to the risk of inevitable and painful death from a progressive tumor. For most patients with relapse of BST RRT improves the quality of life and increases its duration, what is very important for patients and their parents. In the cases of low-grade gliomas, RRT allows to obtain long-term remission, although complete regression of the tumor is not achieved.

Conclusion

In case of recurrence of BST in children, RRT in the rhythm of traditional fractionation by 1.5-1.8Gy 5 days a week, to a total dose of 45Gy, is indicated for the patient, who had duration of the first remission for more than 4 months, the absence of signs of tumor destruction on MRI and a satisfactory condition. To improve the tolerability of RRT, it is advisable to carry it out accompanied by hormone therapy with dexazone. Duration of remission after repeated exposure mainly depends on the degree of malignancy of the tumor: in low-grade gliomas, the duration of tumor growth stabilization is much longer than in high-grade gliomas.

Acknowledgements

None.

Conflict of interest

The author declares that there is no conflict of interest.

References

1. Puget S, Beccaria K, Blauwblomme T, et al. Biopsy in a series of 130 pediatric diffuse intrinsic Pontine gliomas. *Childs Nerv Syst*. 2015;31:(10):1773–1780.
2. Wagner S, Benesch M, Berthold F, et al. Secondary dissemination in children with high–grade malignant gliomas and diffuse intrinsic pontine gliomas. *Br J Cancer*. 2006;95(8):991–997.
3. Vanan MI, Eisenstat DD. DIPG in Children – What Can We Learn from the Past? *Front Oncol*. 2015;5:237.
4. Fontanilla HP, Pinnix CC, Ketonen LM, et al. Palliative reirradiation for progressive diffuse intrinsic pontine glioma. *Am J Clin Oncol*. 2012;35(1):51–57.
5. Waxweiler TV, Amini A, Vinogradskiy Y, et al. Hypofractionated re–irradiation to the brainstem in children with recurrent brain tumors. *Pediatr Blood Cancer*. 2017;64(5):e26341.