VOLUME 3, 2012

COMPREHENSIVE TREATMENT FOR BRAIN MENINGIOMAS AND THEIR RECURRENCES USING PROTON THERAPY

JAMSHIDJON ALIMOV, RUSTAMJON ALIMOV

Republican Scientific Neurosurgery Center, Tashkent, Uzbekistan

ABSTRACT

This article presents results of using proton therapy after operation of patient with brain meningioma. After operation brain meningiomas is known to not rarely recur due to certain localization and growth of tumor into main cerebral vessels, nerves and other main brain structures. This creates certain difficulties in operative access and surgical intervention, i.e. tumor resection. Proton therapy sharply reduces complications and improves the quality of life of patients.

UDC CODE & KEYWORDS

■ UDC: 616.831-006, 615.849.2-08 ■ Neurosurgery ■ Neurooncology ■ Meningiomas ■ Recurrences of Meningiomas ■ Operation ■ ■ Proton Therapy ■

INTRODUCTION

According to MacCarty (1979), meningiomas account for approximately 15% of brain tumors. Simpson (1997) defined brain meningioma as benign tumor in 97% of cases and only 3% is malignant. Most meningiomas grow slowly and have long been undiagnosed. They manifest themselves only when neurological symptoms appear as headaches, seizures or other conditions associated with the compression of certain brain structures (Imes et al., 1985). There are several cases when meningiomas remain undiagnosed for 5-10 years. Cooling et al. (1979) observed meningiomas to develop often in women, the peak incidence occurs between the ages of 50 to 70 years old.

Surgical removal is believed by Erzurum et al. (1970) to be a classic treatment for meningiomas. Perevodchikova (2007) noted that if the tumor was completely removed, and obtained histology confirmed its benignity, so the possibility of recurrence will be very low. The disadvantages of surgical methods, according to Stupak et al. (2003), are the risks associated with open intervention - bleeding, poor circulation, development of neurological disorders, and infections. Complication rates are higher in meningiomas of the skull base. Additionally, radical resection of tumor of this localization is not possible, and unremoved residuals are the sources for continuing growth of the tumor (Shakirov, 2009). De Monte et al. (1993) observed that, in fact, radical removal of meningiomas provides a "cure" or reduces the risk of tumor recurrence practically to "zero" in most cases.

A small category of meningiomas with a malignant character is prone to rapid recurrence, requiring reoperation (Rohringer et al., 1989). Moreover, despite the use of modern diagnostic techniques such as MRI, MSCT, a large number of patients admit to hospitals with big and giant tumors when their radical removal is difficult and problematic. This is because of slow tumor growth, long asymptomatic course and late examination of patient (Henderson et al., 1980). The recurrence rate is often correlated with the histological structure of meningiomas. Thus, Cristallini et al. (1990) observed continued growth of typical tumors in 11%, atypical ones in 35%, and anaplastic tumors in 100% of cases.

As Mattos Primenta (1981) noted, proton therapy is an effective treatment for brain meningiomas. Savello et al. (2002) defined proton therapy as a method of treating oncological diseases using radiation with nuclear substances (protons). Protons reduce radiation exposure on normal tissue surrounding tumor in 2-3 times, in comparison with gamma-rays (Hannesson, 1971). The method of proton therapy can influence even on the deep-located brain tumors, with minimal impact on healthy tissues (Tastanbekov et al., 2002). Desgeorges et al. (1992) recommended this therapy both independently and in combination with other treatments (e.g. surgery and radiotherapy) for 50-70% of cases, mainly after surgery to reduce the risk of recurrence and irradiation of a part of tumor which could not be removed by surgical intervention. Hart et al. (1980) applied proton therapy also for tumors of large sizes, and after one or several procedures observed stop of growth of about 95% of meningiomas treated by this way. As any surgical method of treatment, proton therapy has its own risks. Among them, Bartal et al. (1982) noted continued tumor growth and radiation damage of adjacent structures which are usually minimal and occur in fewer cases than after traditional surgery.

The purpose of our study was to improve clinical outcomes of surgical treatment of patients with brain meningiomas with subsequent use of proton therapy to prevent their recurrence.

Materials and methods

We investigated 10 patients with brain meningiomas and their recurrences who had been hospitalized and treated in the Republican Scientific Center of Neurosurgery (RSCN). 5 (50%) of them were primarily admitted and operated patients, whereas 3 (30%) patients were re-operated for recurrent brain meningiomas. 2 (20%) patients with recurrent meningiomas had not repeated surgery. All the patients had a course of proton therapy in the Scientific Practical Center of Proton X-ray Therapy and Radiosurgery (Moscow-Dubna, Russia).

After conducting X-ray therapy, patients with meningiomas and their recurrences noted significant improvement in quality of life, such symptoms as headache, nausea, vomiting, and diplopia were regressed, and control CT and MRI studies revealed a positive trend. We studied the dynamics of neurological disorders, quality of life, the percentage of disability of

■ European Medical, Health and Pharmaceutical Journal ■ ISSN 1804-5804 ■

■ European Medical, Health and Pharmaceutical Journal ■ ISSN 1804-5804 ■

these patients, and the incidence of recurrence and continued growth, in comparison with patients operated by traditional methods. The results of our long-term observations confirm the high efficiency of these technologies of treatment.

Inclusion of proton therapy into surgical intervention improved the parameters of recurrence-free survival only in the first years after treatment of recurrent brain meningiomas. Proton therapy confirmed an advantage provided almost 50% of chance for cure. Conduction of incomplete X-ray therapy results in an earlier progression of the process. Delayed conduction of proton therapy after surgery increases the risk of death at 2% per day without treatment.

We result a case report of brain meningioma.

A 57-year-old woman from Tashkent city (Uzbekistan) was treated in the Department of Neurooncology of the RSCN for 42 days in summer, 1998, and was making a diagnosis at admission: Tumor in the left brain parieto-occipital region.

On admission time she complained of headache, dizziness, common weakness, weakness in the right limbs and speech disorder.

The patient's past medical history was significant for sudden weakness in the right limbs during 6 months. Because of that, she was treated by neuropathologist for disturbance of cerebral circulation and had insignificant improvement. Over the past 10 days she re-marked weakness in the right extremities and difficulty in speech. Then she was referred to the RSCN and was hospitalized for further examination and treatment in the Department of Neurooncology.

Physical examination revealed that general condition of the patient on admission time was moderate severity. In the neurological status the patient was conscious, but elements of motor aphasia were marked. Acuity of sight was saved. Pupils were round, symmetric and reactive. Movement of eye apples was in complete volume. Photoreaction was saved. Valle points were painless. Face was asymmetric: peripheral paresis of facial nerve. Her phonation and swallowing were not disturbed. Her tongue in the mouth was in the midline. No rough meningeal signs. She had left-side central type hemiparesis. In the Romberg test she was unstable. Coordinatory tests were conducted with intention in right side.

The patient had examinations: EchoEG revealed shift of M-echo from left to right on 13 mm. Oculist: Visus=0.9; in eyegrounds was determined initial optic disk congestion.

At the 18th day of hospitalization, the patient was operated: craniotomy in the left parieto-occipital region with tumor removal. Histology revealed meningioma. She received a course of intensive therapy and was discharged with improvement for further observation by neurologist and neurosurgeon at the place of her living.

The patient has been periodically examined, repeatedly hospitalized and received conservative treatment in the RSCN.

12 years later, in spring, 2010, she had series of clonic-tonic seizures with loss of consciousness with duration of 5 minutes. In dynamics, her brain CT study detected tumor recurrence in the left parieto-occipital region with sizes of 45x65x60 mm. She re-referred to the RSCN and was re-hospitalized in the Department of Neurooncology.

The examinations during hospital care were the following: EchoEG: no shift of M-echo. Psychiatrist: no acute psychiatric disorders. ECG: sinus and regular rhythm; heart rate 67 beats/minute. Therapist: Arterial hypertension. Oculist: Visus=0.5/0.6; in eyegrounds retinal angiopathy. REG: spasm of the arterioles with venous stasis. EEG: common cerebral changes with epileptic focus in the left parieto-temporal leads. Otoneurologist: left-side sensorineural hearing loss. Transcranial Doppler study: signs of relative hypoperfusion in the left middle cerebral artery on a background of increased cerebral vascular tone.

The patient's state was discussed in the department morning round and was making a clinical diagnosis: Recurrent tumor in the left brain parieto-occipital region. Condition after surgery with removal of meningioma in the left brain parieto-occipital region. Associated disease: Convulsive syndrome (symptomatic epilepsy).

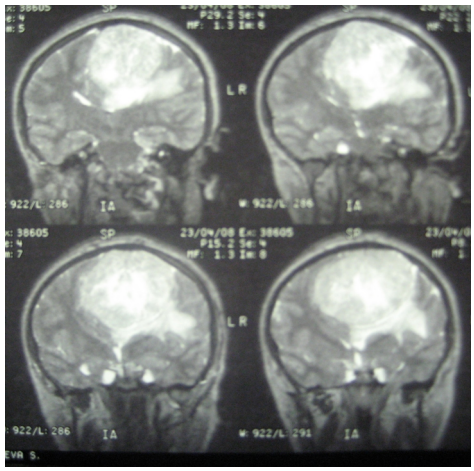
Taking into account the tumor recurrence and increase of neurological symptoms, as well as difficulties in complete tumor excision, the patient was immediately (within 20 days after discharge from the hospital) sent to the Scientific Practical Center of Proton X-ray Therapy and Radiosurgery in Moscow-Dubna (Russia) for proton X-ray therapy. During further 38 days (spring-summer, 2010), she had a course of proton X-ray therapy for tumor: 63 G-eq. for total 28 sessions - under control brain MRI (Figures 1, 2). The patient felt herself after proton X-ray therapy satisfactorily, weakness in the right extremities disappeared, attacks of seizures with loss of consciousness were stopped, headaches decreased. The patient becomes active. She was discharged for further observation by neurosurgeon at the place of her living.

After 2 and 4 months, she re-referred to the RSCN. In dynamics we carried out brain MRI (Figure 3) which has detected decrease of the tumor in sizes of 28x43x43 mm. There was determined porencephalic cyst with the sizes 49x61x49 mm in the postoperative tumor bed. Medial structures were not biased; the lateral ventricles were symmetrical, not expanded. Taking into account the positive trend in improvement of general condition of the patient, as well as decrease of tumor size in control brain MRI, we recommended monitoring by neurosurgeon in dynamics and repeated consultation in 3-4 months. Now, she continues receiving anticonvulsants.

Results and discussion

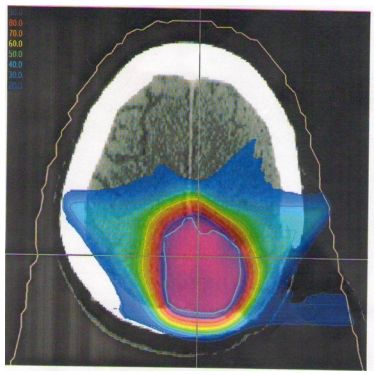
At the present time, despite significant advances in surgery of recurrent brain tumors, the problem of removal of meningiomas, especially giant and deep-localized ones, is one of the most difficult and far from being resolved. The main principles in achieving favorable outcomes for brain meningiomas are the use of microsurgical techniques, neurosonography, increase of the level of radicalism of tumor resection, reduction of the volume of blood loss, decrease of traumatization of the brain structures, preservation of functionally important veins, as well as reduction of the frequency of relapses and mortality. Proton therapy is a widely used method of treatment for malignant meningiomas with diffuse pattern of growth and inaccessible localization or in the case when the size of tumor is large for X-ray therapy. Based on the abovementioned, it is necessary to find new treatments to prevent the continued growth of atypical meningiomas using proton therapy.

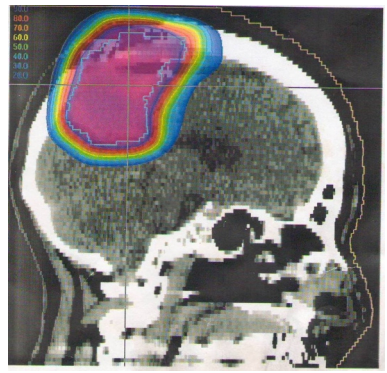
Figure 1. MRI of the left anterior cranial fossa in patient with meningioma before conducting proton therapy.

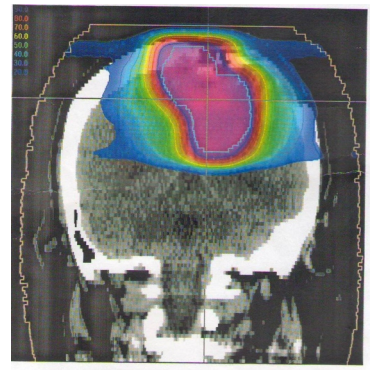


Source: Authors

Figure 2. MRI of this patient, the target for irradiation was a zone of visible pathological changes.

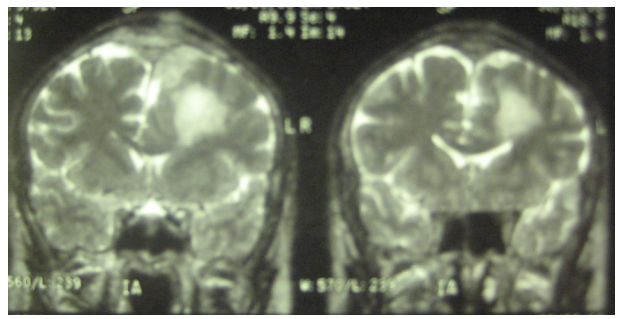


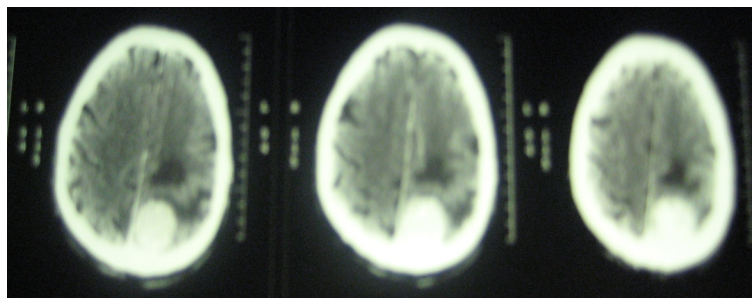




Source: Authors

Figure 3. MRI of this patient 4 months later after proton therapy, significant decrease of the tumor.





Source: Authors

Conclusion

Despite the radical removal, recurrent benign meningiomas are found in approximately 28% of patients for up to 15 years. Even in cases when the operation was successful and was not accompanied by complications, these tumors represent a danger to patients in the later stages of disease because of their ability to recur. Proton therapy is one of the main methods of treatment for incompletely removed meningiomas. However, the conducting therapy only slows the continued growth of tumors or their recurrence just for a few years.

This study was aimed at studying the dependence of the quality of life after surgery with subsequent receiving proton therapy in patients with meningiomas of high-grade malignancy.

Conduction of elective irradiation for atypical meningiomas prolongs the life of patients, stops tumor growth, and substantially do not deteriorates the quality of life. In this regard, in the treatment of brain meningiomas, independently on histological structures, we can recommend proton therapy in the early stage, especially after partial surgical intervention, with the purpose to reduce recurrence and malignization of the tumors.

Acknowledgment

After considering article of D.R. Aimov and R.A. Alimov, where the authors present a case report of woman with brain meningioma, who had operated and then received proton therapy, experts of the Ethical Committee of Uzbekistan concluded that this is a satisfactory result of treatment for such pathology, thus, is recommended for open publication. The patient has also allowed publishing her medical history.

References

Bartal, A.D. [et al.], 1982. "Carbon dioxide laser surgery of basal meningiomas", Surg. Neurol., Vol. 17, No. 2, pp. 90-95.

Cooling, R., Wright, J., 1979. "Arachnoid hyperplasia in optic nerve glioma: confusion with orbital meningioma", Br. J. Ophtalmol., Vol. 63, No. 6, pp. 596-599.

Cristallini, E., Bolis, G., Ottaviano, P., 1990. "Fine needle aspiration of orbital meningioma", Acta Cytol., Vol. 34, No. 2, pp. 236-238.

De Monte, F., Al-Mefty, O., 1993. "Anterior clinoidal meningiomas", Neurosurgical operative atlas, Vol. 3, Baltimore: Wiliams & Wilkins, pp. 49-61.

Desgeorges, M. [et al.], 1992. "Laser microsurgery of meningioma: An analysis of continuous series of 164 cases treated surgically by using different lasers", Neurochirurgie, in French, pp. 217-225.

Erzurum, S., Melen, O., Lissner, S., 1970. "Orbital malignant nerve sheath tumors. Treatment with surgical resection and radiation therapy", Can. J. Ophtalmol., No. 5, pp. 381-385.

Hannesson, O., 1971. "Primary meningioma of the orbit invading the Choroid. Report of a case", Acta Ophtalmol. (Kbh)., Vol. 49, No. 5, pp. 622-632.

Hart, N., Burde, R., Klingele, T., 1980. "Bilateral optic nerve sheath meningiomas", Arch. Ophthalmol., Vol. 98, No. 1, pp. 149-151.

Henderson, J., Farrow, G., 1980. "Orbital tumors", 2nd ed., New-York, USA, pp. 472-496.

Imes, R., Schatz, H., Hoyt, W., 1985. "Evolution optociliary veins in optic nerve sheath meningioma", Arch. Ophthalmol., Vol. 103, No. 1, pp. 50-60.

MacCarty, C.S., Taylor, W.F., 1979. "Intracranial meningiomas: experiences at the Mayo Clinic", Neurol. Med. Chir. (Tokyo), No. 19, pp. 569- 574.

Mattos Primenta, L.H., Mattos Primenta, A., Martins, J.L., 1981. "The use of the CO2-laser for the removal of awkwardly situated meningiomas", Neurosurg. Rev., Vol. 4, No. 1, pp. 53-55.

Perevodchikova, N.I., 2007. "Antitumor chemotherapy", [Protivoopuholevaya himioterapiya], in Russian, Moscow, 224 p.

Rohringer M. [et al.], 1989. "Incidens and clinicopathological features of meningioma", Neurosurg., Vol. 71, pp. 665-672.

Savello, A.V., Svistov, D.V., Parfyonov, V.E., Martynov, B.V., Kandyba, D.V. [et al.], 2002. "Superselective intraarterial chemotherapy in the treatment of intracranial tumors", [Polenovskiye Chteniya], Proceedings of the 3rd Congress of Neurosurgeons of Russia, St. Petersburg, in Russian, pp. 147.

Shakirov, R.R., 2009. "Complex treatment of patients with brain tumors of high-grade malignancy", Synopsis of PhD dissertation, Ufa, Russia, in Russian.

Simpson, D., 1997. "The recurrence of intracranial meningiomas after surgical treatment", Neurol. Neurosurg. Psychiat., Vol. 20, pp. 22-39.

Stupak, V.V., Mayorov, A.P., Struts, S.G., Pendyurin, I.V., Kalinowski, A.V., Muradov, J.M., 2006. "New laser technology in surgical treatment for brain meningiomas", [Polenovskiye Chteniya], Proceedings of the 3rd Congress of Neurosurgeons of Russia, St. Petersburg, in Russian, pp. 227-228.

Tastanbekov, M.M., Tigliyev, G.S., Olyushin, V.E., Ulitin, A.Y, Gulyaev, D.A., 2002. "Continued growth and recurrence of brain meningiomas: the causes of development and ways to reduce their frequency", [Polenovskiye Chteniya], Proceedings of the 3rd Congress of Neurosurgeons of Russia, St. Petersburg, in Russian, pp.157-158.