

Meningioma Induced by Radiotherapy and a Silicone Foreign Body – Case Report and Literature Review

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Case report

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Abstract

Background: Meningiomas are the most common radiotherapy related brain tumors, their development can also be induced by intracranial foreign bodies like intraventricular drains in mechanism of chronic intracranial inflammation. The authors present casuistic case of intracranial meningioma developed in contact with a silicone intraventricular in patient who had also brain radiotherapy in childhood. In references, there are only two descriptions about meningiomas induced by both radiotherapy and a silicone foreign body.

Case presentation: 30-year-old patient with intracranial meningioma was admitted to neurosurgical department with hemiparesis and severe headaches. Shunt was placed 15 years earlier due to hydrocephalus and the patient had also brain radiation therapy at that time. The neurosurgical tumor removal (Simpson I) was achieved by authors. Shunt was removed during tumor resection but it had to be placed again after few days due to hydrocephalus. During ten years follow-up no tumor recurrence was observed and it can be assessed that the prognosis is favorable.

Conclusions: Combination of these two factors is extremely rare however such case can be significant advice for oncological patients with shunts systems who had undergone brain radiotherapy.

Background

Meningiomas are the most common radiotherapy related brain tumors [1, 3]. Radiotherapy induced meningiomas occur mainly in the younger population [1, 3, 6, 8]. They are most commonly convexity meningiomas [1, 4, 8]. According to Harrison et al. (1991) these meningiomas were apt to be histologically atypical [3]. In turn, Kok et al. (2019) in cohort study concluded that such meningiomas are benign [5]. There are also reports confirming that meningiomas development is induced by intracranial foreign bodies e.g. intraventricular drains or cranial bone prostheses [2, 4, 7]. This mechanism may involve a chronic intracranial inflammatory reaction in the area of the foreign body, which may induce tumor formation [4]. Importantly, radiation induced neoplasms develop much more frequently in inflamed tissue [4]. This increases the risk of meningiomas developing in patients who underwent radiation therapy and have intraventricular drains or other foreign bodies located in the cranial cavity [4, 7].

Case Presentation

30-year-old patient with a large frontal convexity meningioma was treated surgically in 2010 in our department. The meningioma had grown around a 15-year-old silicone drain inserted into lateral ventricle as a part of a ventricular-peritoneal valve. This patient was operated on 15 years earlier due to a teratoma of the pineal region. Postoperative radiotherapy was administered. For 15 years the patient functioned in good overall condition, with no focal symptoms, with a medium degree of cognitive and emotional disorders. Meningioma described in this study was diagnosed in 2010 using computed tomography (CT) (Fig. 1) and magnetic resonance imaging (MRI) (Fig. 2). Symptoms were left-sided hemiparesis and

severe headaches. Tumor was radically resected by frontal craniotomy (Simpson I) and intraventricular drain was removed with the tumor. The bone lobe was restored in place, as no signs of infiltration by the tumor were found. Histopathological examination revealed complex histological structure of meningotheelial and angiomatous meningioma (WHO I) with areas of marked decohesion from cells with eosinophilic cytoplasm with eccentric nuclei. After the surgery clinical state deteriorated and CT revealed severe brain edema (Fig. 3). The patient underwent decompressive craniectomy with good results. After next days, a new ventricular-peritoneal valve was implanted due to progressive hydrocephalus. The persistent emotional disorders and cognitive function impairments also did not disturb in work. After one year cranioplasty using Codubix® bone prosthesis was performed. Neurological condition remained satisfactory, with a slight paresis and persistent emotional and cognitive disorders. In 2020, after 10 years follow up no tumor recurrence has been found in MRI (Fig. 4).

Discussion And Conclusions

In literature review, only two descriptions about meningiomas induced by both radiotherapy and a silicone drain were found. This has made our description the third such case report in available literature (Table 1).

Table 1

Summary of patients with meningiomas induced by radiotherapy and a silicone drains cases

study	patient age	gender	tumor grading	tumor location	time period ^a	outcome
Saleh et al. (1991)	48	male	WHO I	parietal	30	favorable
Holthouse et al. (1999)	25	male	WHO I	parietal	20(10) ^b	favorable
Our (2020)	30	male	WHO I	frontal	15	favorable

^a time period from radiotherapy and shunt implantation to meningioma diagnosis

^b 10 years before the diagnosis of meningioma and 10 years after radiotherapy and first shunt implantation, the patient had drain replaced

First such case was described by Saleh et al. (1991) and the second by Holthouse et al. (1999) [4, 7]. Our patient was treated in 2010, but his case was described in 2020, as a summary of the 10-year follow-up.

Saleh et al. described 48-year-old man with parietal meningioma developed around the intraventricular drain. 30 years earlier he had undergone surgery and 5000 cGy radiotherapy due to pineal tumor and shunt implantation due to hydrocephalus [7]. In description of Saleh tumor was centered around the drain. Meningioma was removed by craniotomy without complications. Shunt and drain were also

removed with the tumor. Histopathological examination revealed fibroblastic meningioma without atypical features [7].

Holthouse et al. described 25-year-old man with parietal meningioma also developed around the intraventricular drain. This patient was treated surgically 20 year earlier due to mixed cerebellar glioma, which was followed by seven cycles of radiotherapy and shunt implantation due to hydrocephalus [4]. 10 years before the diagnosis of meningioma, the patient had drain replaced due to shunt dysfunction and no meningioma was found that time. The tumor was removed by totally. During the procedure, the intraventricular valve drain was left in place, as it was patent and functional and was attached with adhesions of the choroid plexus [4]. Histopathological examination revealed meningotheelial meningioma cells separated by layers of collagen [4].

Based on the references, both Saleh and Holthouse emphasized that the mechanism of such meningiomas development was oncogenesis on the basis of a chronic inflammatory reaction [4, 7]. It has been noted that neoplasms secondary to radiation are more common in chronically inflamed tissues [2, 4]. A similar example has been meningiomas developed in connection with bone prosthesis in patients after cranioplasty [4].

Meningiomas induced by radiotherapy and a silicone foreign body are extremely rare. For last 30 years, only 3 such cases have been reported, including ours in the available literature.

All described cases of such meningiomas presented low malignancy and good prognosis. Our case, however casuistic, can be significant advice for oncological patients with shunts systems who had undergone brain radiotherapy.

Abbreviations

CT - computed tomography

MRI - Magnetic resonance imaging

WHO - World Health Organization

Declarations

- Ethics approval and consent to participate: The experiment was approved by the Bioethics Committee of the Ludwik Rydygier Collegium Medicum in Bydgoszcz (KB 306/2020). Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor of this journal.
- Consent for publication: Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

- Availability of data and materials: All relevant data are within the paper.
- Competing Interests: The authors declare that they have no conflict of interest.
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- Acknowledgements: The authors thank everyone involved in the treatment of described patient
- Authors' contributions: ZS treated this patient, noted the casuistic character of the case and came up with the idea of describing it. ZS analyzed and interpreted the patient's data. ZS and performed manuscript text. ZS was a major contributor in writing the manuscript. ZS, KN and SG reviewed the literature about similar cases. MŚ and DG checked the written manuscript in formal terms. All authors read and approved the final manuscript.

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Figures



Figure 1

CT converted volumetric with tumor and drain within it

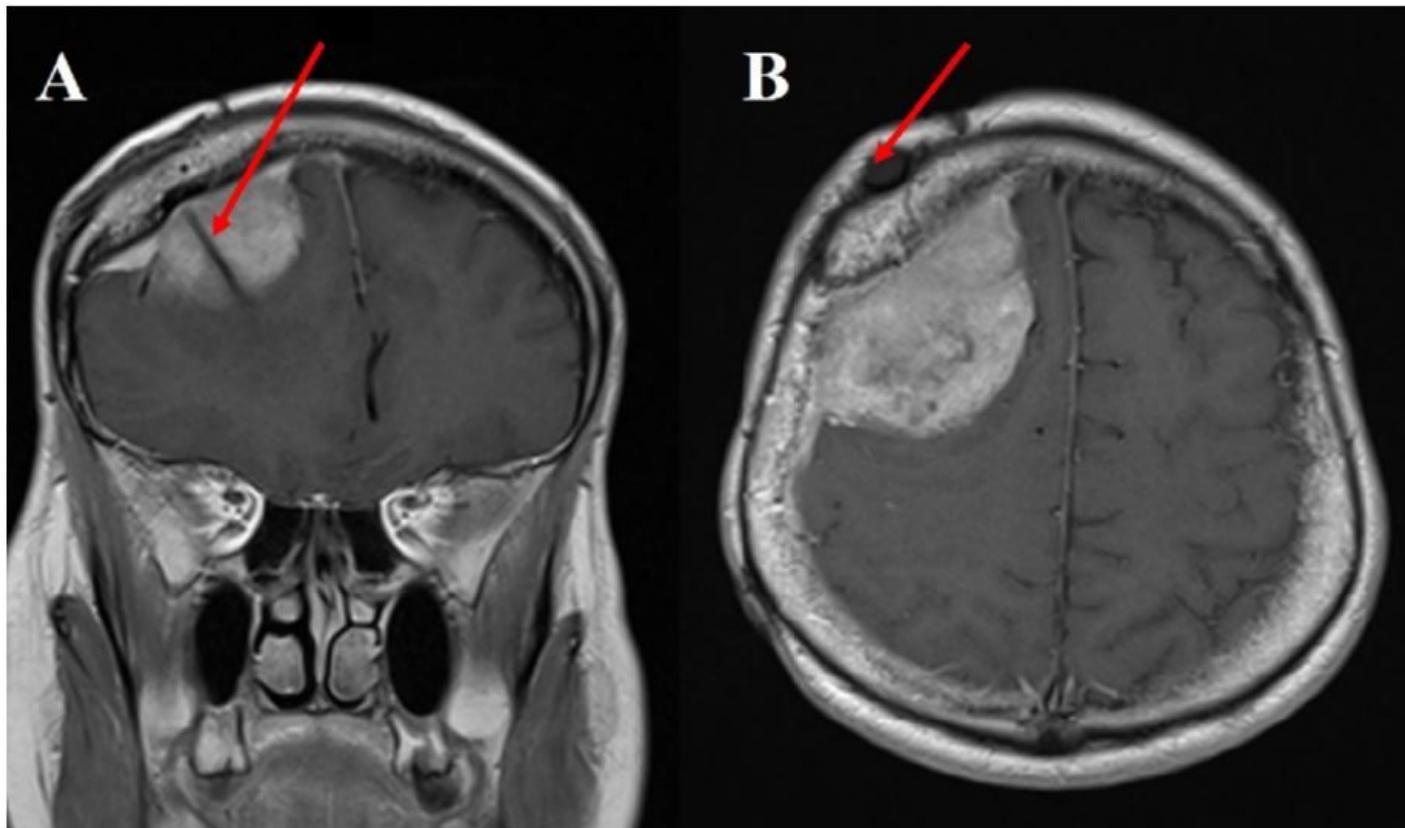


Figure 2

MRI T1 with tumor and shunt, drain (A) and shunt dome (B) marked by author



Figure 3

CT after tumor removal with severe brain edema and shift

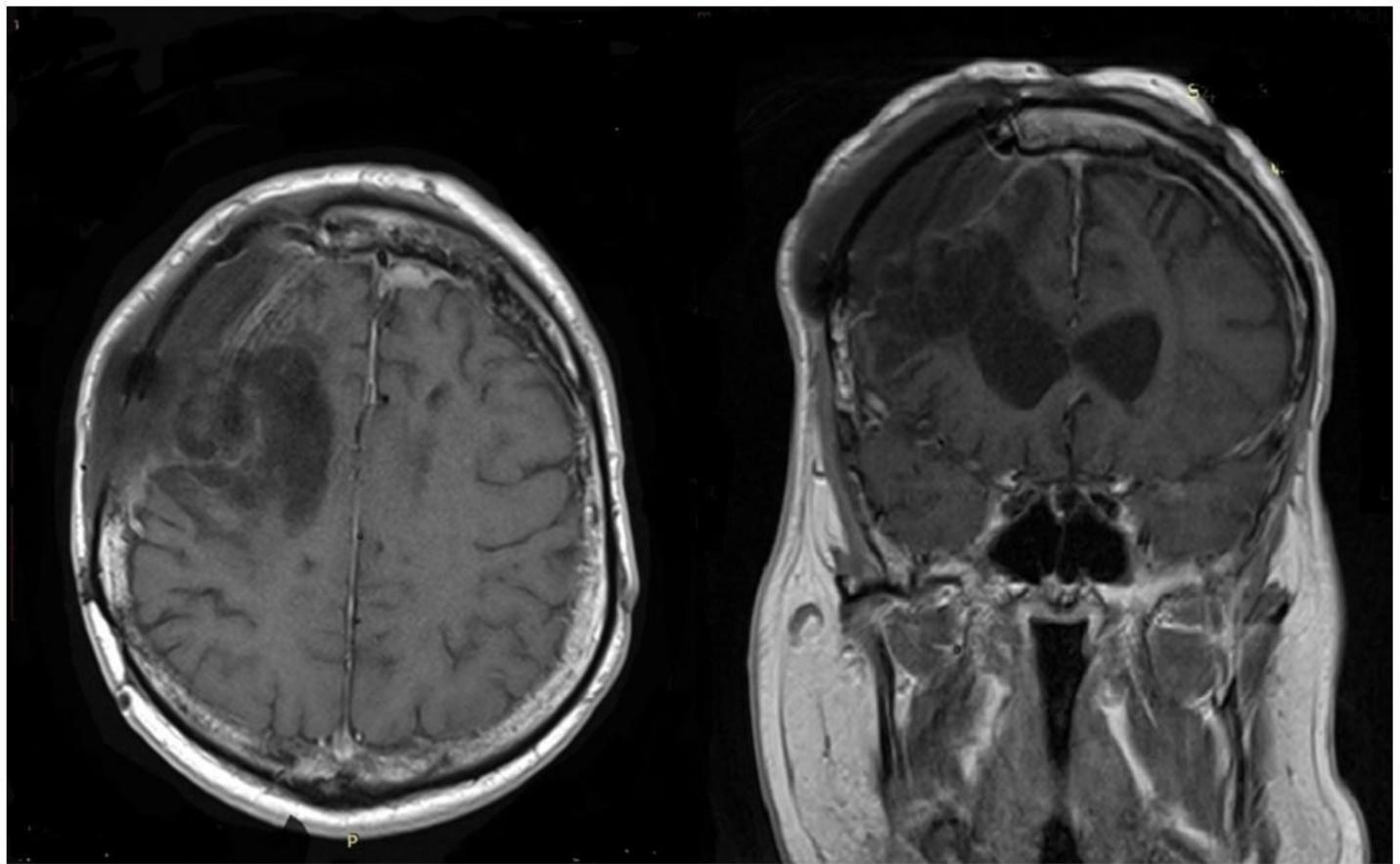


Figure 4

MRI T1 (2020) with no tumor recurrence