Scalp Metastases of Recurrent Meningiomas: Aggressive Behavior or Surgical Seeding?

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OBJECTIVE: **Scalp metastases of meningiomas seldom have been reported. Here, we report a series of 4 cases of this rare event and discuss the relevant potential risk factors.**

METHODS: **We performed a retrospective review of patients treated for scalp metastases of meningiomas at our institution. A literature review was performed for the terms "scalp meningioma," "cutaneous meningioma," "skin meningioma," "extracranial meningioma," and "subcutaneous meningioma."**

RESULTS: **Four patients showed scalp metastases of recurrent meningiomas with the following associated clinical features: multiple reoperations (n = 4), immunosuppression (n = 2), radiation therapy (n = 3), surgical wound complications with cerebrospinal fluid fistula (n = 2), and histologic grade progression (n = 2). The timescale for development of scalp metastasis was between 5 months and 13 years after intracranial meningioma surgery. In all cases, the metastases were located close to the surgical scalp incision for the craniotomy. Previously, 11 cases of meningioma with scalp metastasis, with similar features to those described here, were reported in the literature.**

CONCLUSIONS: **Spreading of meningioma cells during surgery is a possible mechanism for scalp metastases of recurrent meningiomas. Factors associated with scalp metastases include reoperations, immunosuppression, radiation therapy, torpid course of the surgical wound with cerebrospinal fluid fistula, and histologic progression. Awareness of these features is advisable for neurosurgeons involved in the care of patients with similar profiles.**

INTRODUCTION

Meningiomas are neoplasms arising from meningothelial cells of the arachnoidal layer covering the brain. Despite classification as benign tumors in the majority of cases, meningiomas can produce significant morbidity on the basis of their specific location, the surgical approach, adjuvant therapies, and recurrence rate of the tumor (8). Meningiomas occasionally may involve extracranial tissues such as bone, galea, and skin. Such effects are not necessarily related to malignancy or atypical histologic grades (19, 21). Extracranial extension of intracranial meningiomas, however, usually requires complex approaches for dealing with the tumor, which often are associated with subtotal resections and reoperations (5, 48).

Metastasis of a meningioma is a rare event, having an approximate occurrence rate of less than 1 per 1000 patients (11). Although mainly associated with higher-grade meningiomas, metastases also have been reported in World Health Organization (WHO) grade I meningiomas (6, 14, 37, 42, 43). Similarly, scalp metastasis of a meningioma is a rare and scarcely reported event that may occur in the presence of tumor recurrence or histologic progression. It usually involves the soft tissues near the craniotomy site. The clinical and prognostic significance of scalp metastases are not well-described because of the rarity of this event. We reviewed a series of 4 cases of scalp metastases of intracranial

Key words
- Cutaneous meningioma
- Meningioma
- Scalp meningioma
- Skin meningioma
- Subcutaneous meningioma

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
CT: Computed tomography
MRI: Magnetic resonance imaging
WHO: World Health Organization

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meningiomas and analyzed the possible risk factors that could contribute to this behavior.

PATIENTS AND METHODS

We performed a retrospective review of patients treated for an intracranial meningioma at our center between 1990 and 2011. The preoperative evaluation, imaging studies, and operative notes of the patients were reviewed. Patients who had undergone surgery for an intracranial meningioma without skin or osseous involvement at diagnosis or recurrence, and with metachronous scalp metastases, were included in this study. Demographic and clinical data such as histologic grade, number of reoperations, cerebrospinal fluid (CSF) fistula, surgical wound problems, radiotherapy, number of scalp recurrences, time interval between recurrences, and histologic grade at recurrence were reviewed. MEDLINE was searched for articles published between 1970 and 2011 via an electronic literature search engine (PubMed), with the terms "scalp meningioma," "cutaneous meningioma," "skin meningioma," "extracranial meningioma," and "subcutaneous meningioma"; the same aforementioned inclusion criteria were applied for the cases found in the literature.

RESULTS

We found 4 cases with scalp metastasis of meningioma representing 1.24% of the 323 cases diagnosed with meningioma at our institution between 1990 and 2011 (Table 1). From 1970 to 2012, 11 cases of metachronous scalp metastasis of meningioma were reported in the literature (Table 2).

Case 1

This 44-year-old man presented to the emergency department because of tonic-clonic seizures. Findings of a neurologic examination did not reveal any deficits. Computed tomopgrahy (CT) scan of the brain revealed an extra-axial enhancing mass in the right temporoparietal convexity of the brain. The patient underwent surgical removal of the mass, achieving a Simpson grade I resection. Histopathologic analysis revealed a WHO grade I meningioma with necrosis not fulfilling the criteria for atypical meningioma, and a close follow-up was carried out. Eleven years later, the patient underwent kidney transplantation and immunosuppression. One year later, during a routine evaluation, a magnetic resonance imaging (MRI) scan of the brain showed 3 contrast-enhancing scalp masses located at the craniotomy site, one of them with an "hourglass" configuration with one subgaleal extension measuring 5 cm in diameter and another epidural extension measuring 1 cm in diameter (Figure 1). The other 2 lesions were located in the subcutaneous fat. The patient underwent surgical resection of these scalp masses. During surgery, the mass was found to be infiltrating the subcutaneous tissue, temporalis muscle, and dura mater. Total excision of the masses was performed, with resection of the muscle and dura mater. Histopathologic analysis showed a WHO grade II meningioma with pleomorphism, brain invasion, loss of architecture, and a Ki67 index of 10% (Figure 1). Six years later, during a routine evaluation, an MRI scan of the brain showed a contrast-enhancing intracranial nodule in the right temporal area, with minimal extracranial extension and with no skin invasion. The patient underwent operation, during which

Table 1. Patient, Clinical, and Tumor Features of All Reported Cases of Metachronous Scalp Metastasis of Meningioma in the Literature

Patient	Age, years/Sex	Extent of Resection	Tumor Topography	WHO Grade	Radiotherapy*	Surgical Wound Problems/CSF Fistula	No. Operations	Location of the Scalp Recurrence	Time Interval†	No. Scalp Recurrences	WHO Grade at Scalp Metastasis	Follow-Up	mRS
1	61/M	Simpson I	Convexity	I	No	No	3	Craniotomy site	12 years	2	II	24 years	2
2	64/M	Simpson II	Anterior cranial base	I	No	No	5	Surgical scar	13 years	3	I	19 years	3
3	67/M	Simpson III	Parasagittal	II	Yes	Yes	3	Surgical scar	5 months	1	III	1 year, 6 months	6
4	72/M	Simpson II	Parasagittal	I	Yes	Yes	4	Craniotomy site	7 years	4	III	13 years	6

WHO, World Health Organization; CSF, cerebrospinal fluid; mRS, modified Rankin Score, M, male.
*Before scalp metastasis.
†Time interval between first surgery for meningioma and scalp metastasis.