

Metastatic Gliosarcoma Mass Extension to a Donor Fascia Lata Graft Harvest Site by Tumor Cell Contamination

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■ **BACKGROUND:** Brain glioblastoma multiforme is a malignant and highly aggressive entity that rarely shows extracranial and extraneural invasion. In the past 70 years, only eight cases of subcutaneous metastases have been reported.

■ **CASE DESCRIPTION:** A case of glioblastoma multiforme with extensive local cutaneous and subcutaneous involvement of previous surgical sites and a metastatic mass, which had developed in the graft donor area of the tensor fascia lata tendon used for the reconstruction of dura. According to the excisional biopsy results, the developed mass was defined as a gliosarcoma carrying the exact characteristics of the primary tumor.

■ **CONCLUSIONS:** Contaminated surgical tools and instruments can facilitate the distant spread of tumor cells. Therefore, the renewal of the surgical tools and instruments and irrigation of the surgical area after primary tumor resection is emphasized.

INTRODUCTION

Although primary brain tumors are responsible for a small number of cancer patient deaths, they dramatically reduce the quality of life because the tumors affect the patients in their prime of life. The disability and the burden of death due to primary brain neoplasms are substantial (12).

Gliosarcoma is a very rare type (1.8% to

2.4%) of glioblastoma, a malignant cancer of the central nervous system (7, 15). Previously it was defined as a glioblastoma consisting of gliomatous and sarcomatous components, but it is now defined as gliosarcoma by the World Health Organization (11).

When there is dural involvement, the defect occurs after intracranial tumor surgery. The dura is an anatomic structure that has to be restored to prevent the loss of cerebrospinal fluid, the formation of an encephalocele, and infection. This restoration can be handled with synthetic and autologous materials. This case report presents a patient with gliosarcoma who had metastasis in the grafted area due to the implantation of tensor fascia lata (TFL) for the restoration of dura defect.

CASE REPORT

In 2007, a 52-year-old man was admitted to another hospital with complaints of seizure. A subtotal resection of the mass in the right frontal region was done. Histopathologic evaluation of the tumor identified it as a glioblastoma multiforme (GBM). Postoperatively the patient was treated with a total of 6000 cGy of external beam radiation but no chemotherapy. Four months after the operation, however, the patient was admitted to the emergency department of our University Hospital

with complaints of headache and weakness in the left side. His physical examination was normal. The neurological examination revealed somnolence and hemiparesis on the left side. The magnetic resonance imaging (MRI) revealed an enhancing cystic lesion in the right frontal lobe. The 5 × 4 × 3 cm mass with a heterogeneous signal pattern surrounded by edema was visualized. This revealed a shift of 1 cm in the midline (Figure 1A).

Macroscopic total resections were performed in April 2007 and in January 2008. The histopathologic evaluation confirmed the diagnosis of GBM. The immunohistochemical results showed positive staining for glial fibrillar acidic protein (Figure 1B, C, D).

During follow-up, the patient displayed no neurological deficits and his seizures were controlled with antiepileptic medications. He was medicated with temozolamide (150 mg/kg) for 7 months.

Five months later, after the second operation, the patient returned to our hospital with complaints of headache and seizures. Physical examination at this time revealed a subcutaneous mass at the frontal scalp, approximately 2.0 cm from the closest postoperative scar. The MRI showed tumor recurrence in the right frontal lobe with necrosis in the middle part. Post-gadolinium MRI revealed an enhancing mass that had reached the scalp after infiltrating the periosteum, as well as a subcutaneous mass in the frontal region. The mass was resected completely, macroscopically. The resected lesions included frontal tumor, infiltrated dura and periosteum, and subcutaneous mass, but not the infiltrated scalp. The dural defect that occurred as a result of the total resection was restored with a TFL graft taken from the right upper leg. The cranioplasty is performed with three high-density porous polyethylene (Metpor, Newnan, GA, USA).

Two months later, the patient returned to the hospital and presented with a 5.0-cm subcutaneous mass infiltrating the skin in the frontal scalp and a 2.0-cm subcutaneous mass in the right temporal scalp. A 10.0-cm subcutaneous mass under the previous inci-

Key words

- Fascia lata metastasis
- Glioblastoma multiforme
- Gliosarcoma
- Metastases in the donor area
- Subcutaneous metastasis

Abbreviations and Acronyms

GBM: Glioblastoma multiforme
MRI: Magnetic resonance imaging
TFL: Tensor fascia lata



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 Citation: World Neurosurg. (2010) 73, 6:719-721.
 DOI: 10.1016/j.wneu.2010.03.015

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

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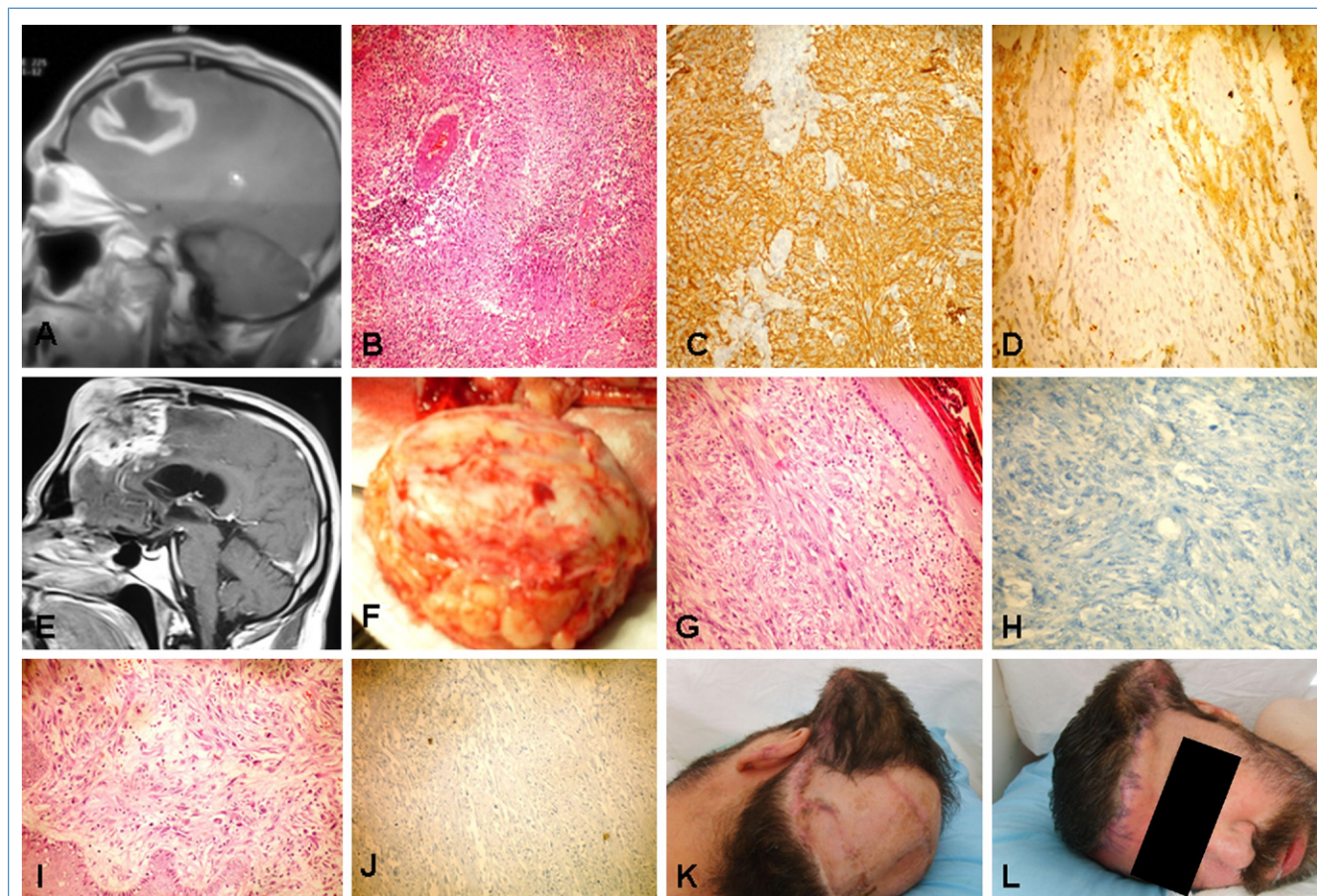


Figure 1. (A) Post-gadolinium axial sagittal magnetic resonance imaging from April 2007 revealed an enhancing cystic lesion in the right frontal lobe. The mass measured $5 \times 4 \times 3$ cm and had a heterogeneous signal pattern surrounded by edema. (B) Histopathologic evaluation confirmed the diagnosis of GBM. Hematoxylin-eosin stain (original magnification, $\times 100$). (C) Positive GBM cell staining with glial fibrillar acidic protein (GFAP) stain (original magnification, $\times 100$). (D) Negative sarcomatous cell staining with GFAP stain (original magnification, $\times 100$). (E) Post-gadolinium sagittal magnetic resonance imaging obtained in July 2008 showed an enhanced mass covering the entire right frontal lobe, which had infiltrated the periosteum and breached the scalp. (F) Intraoperative photograph obtained

in July 2008 shows a 10×10 cm subcutaneous mass that was removed from the right upper leg. (G) Histopathologic evaluation of the mass that was removed from the right leg shows positive sarcomatous cell staining with hematoxylin-eosin (original magnification, $\times 100$). (H) Histopathologic evaluation of the mass that was removed from the right leg shows negative sarcomatous cell staining with GFAP stain (original magnification, $\times 100$). (I) Pathologic examination of infiltrated frontal skin shows positive sarcomatous cell staining with hematoxylin-eosin stain (original magnification, $\times 100$). (J) Negative sarcomatous cell staining with GFAP stain (original magnification, $\times 100$). (K, L) Two months later, the patient died with multiple subcutaneous masses that had invaded the scalp.

sion scar in the right upper leg was detected during the physical examination.

Neurological examination revealed somnolence and severe hemiparesis on the left side. The MRI showed a frontal mass. Post-gadolinium MRI showed an enhancing mass infiltrating the periosteum and reaching the scalp by invading almost the entire frontal and temporal scalp (Figure 1E). The scalp including infiltrated periosteum, frontal skin, as well as both temporal and frontal subcutaneous masses, was excised as a single unit. The scalp defect area was covered with a parieto-occipital scalp flap.

The area of the subcutaneous mass under the previous incision scar in the right upper

leg matched with the donor area of the TFL graft used to restore the dura defect. The mass was resected together with the skin and the fascia underneath as a single unit (Figure 1F). The defect area was covered with a skin graft.

Pathologic examination of the excised lesions, including infiltrated periosteum, frontal skin, both temporal and frontal subcutaneous masses, and the femoral mass, identified these as the primary tumor mass (Figure 1G, H–J). The tumor was a sarcomatous GBM including fusiform cells. Two months later the patient was dead with multiple subcutaneous masses all over the scalp (Figure 1K, L).

DISCUSSION

Glioblastoma multiforme diffusely infiltrates the surrounding brain matter, but does not typically invade blood vessels and rarely metastasizes outside of the central nervous system. In fact, metastasis is exceedingly rare and is present in less than 2% of cases (9). When extracranial spread of a GBM is present, it is almost always preceded by an invasive intracranial procedure, resulting in either hematogenous dissemination or direct extension of the tumor (10). During the past 70 years, more than 250 extracranial metastases have been reported. Among these cases only eight are cutaneous–subcutaneous me-

tastases (2, 16, 18, 22). In all eight cases, the metastatic area was the one sectioned by scalpel during surgery (17). In the patient in the present case report, rapid gliosarcoma metastasis in the cutaneous-subcutaneous femur section due to implantation was identified. This represents the first such case reported in the literature.

Whether the initial glioblastoma contained sarcomatous elements that were overlooked at histologic analysis or the gliosarcoma developed de novo from the metaplastic transformation of the initial glioblastoma facilitated by radiotherapy remains elusive (2).

Although the exact mechanism of extraneural spread of GBM is not known there are other possible hypotheses such as the lymphatics, blood vessels, and through artificial shunts (5). Furthermore, we still need to know about potential markers that could indicate a specific tropism and adhesiveness of glioblastoma cells to mesenchymal or epithelial structures.

The TFL tendon graft is used for the restoration of dura defects due to its similarity in terms of structure, accessibility, and autology (13, 21). In this case report, TFL taken from the right upper leg is used as a graft for the dura defect that occurred after resection of the intracranial tumor. The mass, which grew in the graft donor area within 2 months after surgery, was resected and its pathologic diagnosis was sarcomatous glioblastoma.

In surgery, insufficient excision of the tumor, iatrogenic rupture of the tumor and its spread through the surgery area, or the implantation of tumor cells at distant points through the use of contaminated surgical tools used for tumor resection was identified as being responsible for the development of local and regional recurrences. This spread is also necessary for recurrences in the donor area, which are required for reconstruction after tumor resection (3, 4, 14, 23).

The activity and the implantation ability of tumor cells are proven by tumor cell cultures deriving from surgery section hemorrhage (20). The implantation ability of tumor cells is facilitated by the use of contaminated surgical tools. Tumor spread depends on three factors (8): 1) implantation ability is strengthened by weak contact inhibition, 2) substantial hemorrhage, and 3) a sufficient quantity of cells.

The possibility of accumulating and developing a clinical recurrence of tumor cells spreading through the surgery area is dependent on the initial bonding of tissue

structure at lower layers. Cell adhesion is a dynamic process that includes the specific adhesive interaction between the cell and extracellular matrix (1, 6, 19).

The implantation ability of highly malignant tumor cells by means of contaminated surgical tools is reported at 87%. This figure can rise to 100% in the context of malignant melanoma culture, as proven by tests on animals (23).

Finally, the primary precaution to prevent iatrogenic access of the cells to other surgical sections or the reconstruction area involves preventing the reuse of contaminated surgical tools after tumor resection, the use of fresh medical gloves, as well as sterile cover and irrigation of the operation field.

ACKNOWLEDGMENTS

We would like to thank Hasan Kocaeli, M.D., for his help in revising our article.

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received 20 August 2009; accepted 13 March 2010

Citation: *World Neurosurg.* (2010) 73, 6:719-721.

DOI: 10.1016/j.wneu.2010.03.015

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