Surgical treatment of rare giant malignant tumors of the scalp: A report of 3 cases with different tumor types

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Abstract. The scalp is the most frequent site of occurrence of malignant tumors. As an area that is generally neglected by the patient and not closely monitored during physical examinations, scalp tumors can go unnoticed until they become malignant. The present study reports 3 cases of rare giant malignant tumors of the scalp, namely a peripheral nerve sheath tumor, a fibrous tumor and a malignant proliferating trichilemmal tumor, that were treated at The First Bethune Hospital of Jilin University (Changchun, China). Vascularized free anterolateral thigh flap surgery was performed in 2 of the 3 cases. A local flap repair was applied to the third case. The implanted skin grafts remained viable post-operatively and wound repair was uneventful. No signs of malignancy were detected on the edge of the pathological section upon closer pathological examination. In the follow-up period, no recurrence was detected in any of the cases.

Introduction

The scalp is the most frequent site of occurrence of malignant tumors (1). The incidence of malignant peripheral nerve sheath tumors (MPNST), which is equal in males and females, is <0.001% (2). MPNST typically presents between the ages of 20 and 50 years, and usually starts as a small tumor that grows in size. In the early course of MPNST, there are no pain symptoms; however, if the tumor continues to grow, the patient shows symptoms of oppression of the brain. Pain initially appears in the nerve-dominated areas associated with malignant transformation and erosion of the nerves and surrounding tissues by the tumor mass. In addition, patients with MPNST experience neurological dysfunction, including feeling numb and presenting with decreased muscle strength, muscle weakness and paralysis. MPNST may be diagnosed by ultrasound, magnetic resonance imaging (MRI), positron emission tomography-computed tomography (CT), CT, bone scans, fine needle aspiration biopsies and pathological analyses (3). Therapeutic strategies include surgery, radiotherapy and chemotherapy. The 5- and 10-year survival rates of patients with MPNST are 34-52% and 23-34%, respectively. The local recurrence rate is 40-65% and the distant metastasis rate is 40-68% (4).

Adult-type fibrosarcoma (AFS) represents 1-3% of total sarcoma cases in the world, and has an average disease course of ~3.5 years (5). AFS is more common in males than in females, and usually presents between the ages of 30 and 55 years (5,6). AFS typically develops slowly from highly vascularized, painless tumors that have clear-borders and are small in size, with localized ulcers and hemorrhaging (7). A typical AFS tumor has V-shaped bundle formation and a herringbone pattern under a microscope (8). Comparative genomic hybridization has demonstrated that chromosome 12q is frequently amplified in patients with AFS (9). Surgical intervention followed by chemo-radiotherapy remains the first-line treatment option for patients with AFS, who have a 5-year survival rate of 39-54.4% (10).

Malignant proliferating trichilemmal tumor (MPTT) usually presents between the ages of 60 and 70 years, and 80% of all patients are female (11). MPTTs grow slowly and have a long disease duration; they become malignant when the cell growth rate increases, at which point the tumor surface ulcerates, bleeds and exhibits necrosis. The tumor usually has a diameter of <2 cm (12). An accurate diagnosis of MPTT relies on a pathological examination, and therapeutic strategies include surgery, radiotherapy, chemotherapy and cryotherapy (13-17).

Insufficient monitoring by patients or physicians during physical examinations facilitates the development of malignant tumors in the scalp. The present study reports 3 cases of different types of rare giant malignant tumors of the scalp: A peripheral nerve sheath tumor, a fibrous tumor and an MPTT. These types of tumor are rarely observed (2,18,19), particularly in the scalp. Information regarding the surgical treatments performed for each case is provided, and written informed consent was obtained from all patients.

Case report

Case 1. A 52-year-old man presented at The First Bethune Hospital of Jilin University (Changchun, China) in

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December 2009 with a 5-year history of scalp tumors in the right forehead. The tumors were originally small and had been growing slowly. The tumors had previously been removed in August 2009 at a local hospital and diagnosed as solitary fibrous tumors of the nervous system. The tumors recurred and grew rapidly giving rise to an ulcer. Physical examination revealed no nerve damage. The tumors had unequal coffee spots with clear boundaries and diffused unequal oval nodules. Nodular red-brown tumors, 28x25x10 cm in size, were found in the right forehead and temporal and occipital bones. Tumors were characterized by a clear boundary and medium solidity, but lacked compression pain, sense of volatility and vessel noise (Fig. 1A). MRI scans indicated extensive growth of spots or lichen-like tumors outside of the right frontal, temporal and occipital bones. In addition, the hat-like aponeurosis was independent and separated from the skull plate (Fig. 1B). The lesion in the right forehead invaded the intracranial region compressing the associated brain tissue and destroying the skull bone tissue. Clinical examination of the solitary fibrous tumor of the nervous system in the right forehead indicated malignant transformation. During the surgery, the tumors and lesion areas of the skull were completely removed, after which the local skull deficiency was repaired using a titanium plate and a microvascular anastomotic anterolateral thigh flap was transplanted to cover the large scalp defect.

A post-operative pathological examination showed that the cellular morphology of the tumors was non-uniform. Tumor cells exhibited a fusiform morphology with an oval nucleus. Fusiform tumor cells were mitotic and exhibited uniform arrangement in bundles [Fig. 1C; hematoxylin and eosin (HE) staining]. Immunochemistry showed positive staining for S-100 [Fig. 1D; anti-S-100 monoclonal antibody (mAb); cat. no. 16/f5; Fuzhou Maixin Biotech., Co., Ltd., Fuzhou, China] and cluster of differentiation (CD)34 (anti-CD34 mAb; cat. no. QBEnd/10; Fuzhou Maixin Biotech.), and negative staining for CD68 (anti-CD68 mAb; cat. no. KP1; Fuzhou Maixin Biotech.) and desmin (anti-desmin mAb; cat. no. D33; Fuzhou Maixin Biotech.). The tumors were classified as grade 2 with a score of 4 based on the French Federation of Cancer Centers Sarcoma Group grading system (20). The diagnosis was of a malignant peripheral nerve sheath tumors. The patient was hospitalized for 18 days without chemotherapy and the transplanted flap survived (Fig. 1E). No recurrence was observed in the 5-year follow-up.

Case 2. A 35-year-old man presented at The First Bethune Hospital of Jilin University in January 2012 with a 3-year history of a scalp tumor on the top of the head. The patient had previously been admitted to The Central Hospital of Changchun, China in November 2011, where the tumor had been identified. The tumor was excised and diagnosed as a solitary fibrous tumor in February 2012. The tumor recurred in May 2012. There was no head trauma or history of radioactive disease. A neuronal evaluation performed did not reveal any abnormalities. A tough tumor (28x25x10 cm) with a clear boundary was identified on the top of the occipital lobe (Fig. 2A). The tumor was non-movable. MRI revealed that the tumor had an irregular surface, as shown by gadolinium-diethylenetriamine penta-acetic acid images, and that it was hypointense on T1-weighted imaging (Fig. 2B). Clinical diagnosis identified the recurrence of the fibrous tumor in the scalp. The scalp tumor and lesions were surgically removed, and local deficiencies and large-scale defects were repaired using titanium plates and a microvascular anastomotic anterolateral thigh flap. Tumor cells were found to be fusiform with oval nuclei. Fusiform tumor cells were mitotic and exhibited a uniform arrangement in bundles (Fig. 2C; HE staining). Immunochemistry identified the positive expression of CD99 (Fig. 2D; anti-CD99 mAb; cat. no. O13; Fuzhou Maixin Biotech.), vimentin (Fig. 2E; anti-vimentin mAb; cat. no. V9; Fuzhou Maixin Biotech.) and cytokeratin (anti-cytokeratin mAb; cat. no. AE1/AE3; Fuzhou Maixin Biotech.). No expression was noted for S-100, CD34, desmin, smooth muscle actin (anti-SMA mAb; cat. no. 1A4; Fuzhou Maixin Biotech.), epithelial membrane antigen (anti-EMA mAb; cat. no. E29; Fuzhou Maixin Biotech.), B-cell lymphoma 2 (anti-Bcl-2 mAb; cat. no. SP66; Fuzhou Maixin Biotech.) and calponin (anti-calponin mAb; cat. no. SP13; Fuzhou Maixin Biotech.). Correspondingly, the tumor was diagnosed as an AFS with moderate differentiation. The patient remained hospitalized for 18 days, but did not receive chemotherapy. The transplanted flap survived (Fig. 2F) and no recurrence was observed in the 3-year follow-up.

Case 3. A 42-year-old man presented at The First Bethune Hospital of Jilin University in November 2012 with an 11-year history of scalp tumors on the top of the occipital lobe. The patient had been hospitalized earlier in the month and the tumors had been surgically removed. The post-operative pathological findings were inconclusive. The tumors recurred 1 month later, and grew rapidly and became ulcerated. No nerve damage was detected and the tumors were diagnosed as solitary fibrous tumors. The tumors had recurred in the same location as previously. There was no head trauma or radioactive disease history, and no nerve damage was observed. The tumors (22x17x19 cm) were located in the top occipital region and had a clear boundary (Fig. 3A). A head computed tomography scan revealed sheet-like, irregular giant malignant tumors (Fig. 3B) and suggested the diagnosis of solitary fibrous tumors of the nervous system. Five tumors were surgically excised and local skull deficiencies were repaired using titanium plates and local skin flaps. Post-operative pathological examination revealed regions of basal cells surrounding the tumors in a palisade arrangement. A keratosis sheath of the outer hair root, and cell atypia and mitosis were observed (Fig. 3C; HE staining). The tumor cells stained positively for CD34 (Fig. 3D). The tumor was diagnosed as an MPTT. The patient was hospitalized for 25 days and the transplanted flap survived (Fig. 3E). No recurrence was observed in the 28-month follow-up.

Discussion

MPNST are rare nerve malignancies that exhibit an incidence of <0.001% (2). These tumors occur in the peripheral, cranial and sympathetic nerves and account for 3-10% of soft-tissue tumors. The tumors occur mainly in the buttocks, thighs and paraspinal region, but rarely on the top of the head (21). It has

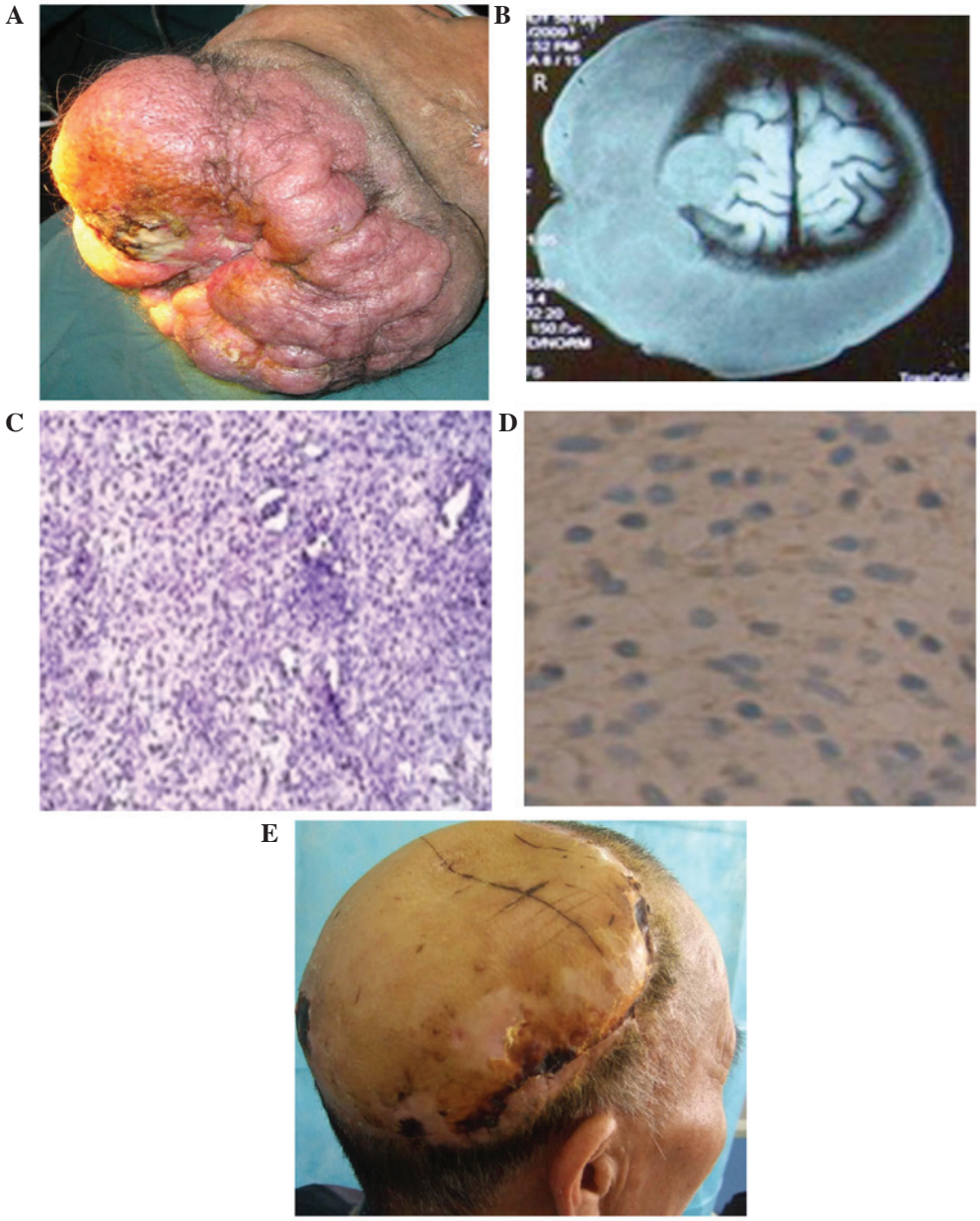

Figure 1. Case 1: Peripheral nerve sheath tumor. (A) Tumors were characterized by reddish-brown mass spots and a clear boundary, and were located in the right forehead, temporal and occipital bones. (B) A magnetic resonance imaging scan revealed extensive growth of spots or lichen-like tumors outside of the right frontal, temporal and occipital bones. (C) The cellular morphology was non-uniform and tumor cells were fusiform with oval nuclei and a uniform arrangement in bundles. Mitotis was also observed (hematoxylin and eosin staining; magnification, x200); (D) Immunohistochemical staining for S-100 was positive (magnification, x200). (E) The flap had survived at 4 months postoperatively.

recently been reported that 2-29% of solitary fibrous tumors of the nervous system will transform into MPNSTs (22). Malignancy is marked by rapid cell growth and an increase in tumor volume, with symptoms of unbearable pain, a tough tumor surface, nerve function loss and sphincter disorders (22). Surgical resection is an available therapeutic option; however, tumors with a tight correlation to a cranial nerve are difficult to resect (23) and have a less favorable prognosis (24,25). The prognosis of MPNST is associated with the tumor's size, location, biological behaviour and history of radiation exposure (26). MPNST can metastasize to the adjacent tissues or distant organs, including the lungs and bones; therefore, the 5-year survival rate is <20%, and 50% of patients experience recurrence (27).

There are two types of fibrosarcoma, adult and infantile, both of which are rare. AFS accounts for 1-3% of adult soft-tissue sarcomas, with the peak incidence between the ages of 30 and 55 years in male patients. This type of tumor, which is mostly localized in the limbs and the torso, and rarely in the head or face, has a high recurrence rate (18,28). Risk factors include oxidative stress, pollution, chemical reactions and high-calorie diets (29-31). The early phase of the disease is characterized by painless nodules that gradually increase in size and become visible on the surface of the skin with a medium solidity (32). In the late phases, the tumor grows fast, giving rise to pain and partial ulceration. If the tumor is not removed it will become malignant. Histological indicators of poor prognosis include tumor grade, density of cell growth,

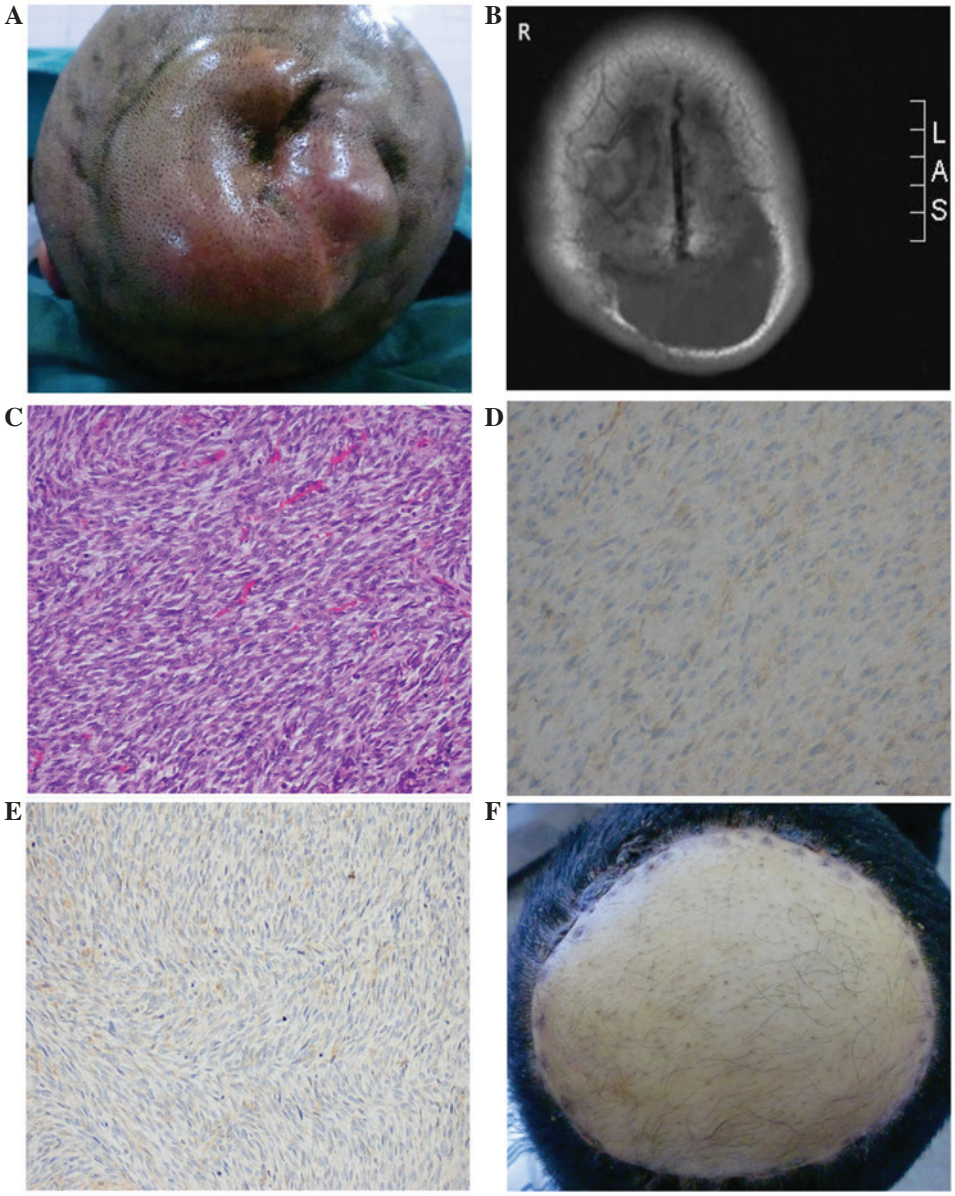

Figure 2. Case 2: Fibrous tumor. (A) Tough tumors were located on top of the occipital lobe with a clear boundary. (B) The magnetic resonance imaging scan revealed irregular tumors with a wide base. (C) Hematoxylin and eosin staining showed that the tumor cells were fusiform with oval nuclei; mitosis was also observed (magnification, x200); (D and E) Immunohistochemical staining for (D) cluster of differentiation 99 and (E) vimentin was positive (magnification, x200). (F) The flap had survived at 3 months postoperatively.

low levels of collagen, necrosis and a mitotic index >20. Fibrosarcoma in the head and neck should be distinguished from spindle cell tumors that occur in different tissues such as the thyroid, salivary glands and lymph nodes (32). The 5-year survival rate for AFS is 39-54.4%, which is closely associated with the prognosis and histological grade of the tumor. In essence, low-level tumor grades have a 5-year survival rate of 58%, while high-level tumor grades have a 5-year survival rate of 21-34%. The occurrence rate of blood metastasis is ≤17.8% in the case of fibrosarcoma with a lymphatic metastasis rate of 2% (33).

MPTT is a rare type of malignant tumor that originates from the outer root sheath of a hair follicle. It is mainly observed in the scalp and face of 60- to 70-year-old female patients (19,34). The majority of these tumors display isolated characteristics. Tumors grow slowly and have a long disease duration; they become malignant when the cell growth rate increases, at which point the tumor surface ulcerates, bleeds and exhibits necrosis (35). An accurate diagnosis relies on the pathological examination. The differential diagnosis of MPTT includes skin squamous cell carcinoma, outer root sheath cancer, metastatic renal cell carcinoma and clear cell carcinoma of the sweat glands (12,36). MPTTs can ulcerate and display symptoms similar to those of squamous cell carcinoma (12). MPTTs transform into multiple tumors and invade the cranial cavity. In certain cases, these tumors may transfer to the ipsilateral lymph nodes and, at the later phases, systemic metastases may occur.

The best treatment for giant malignant tumors of the scalp is surgical resection; therefore, a complete resection is critical. Chemotherapy following resection does not appear to have an added benefit for disease-free recovery. In the

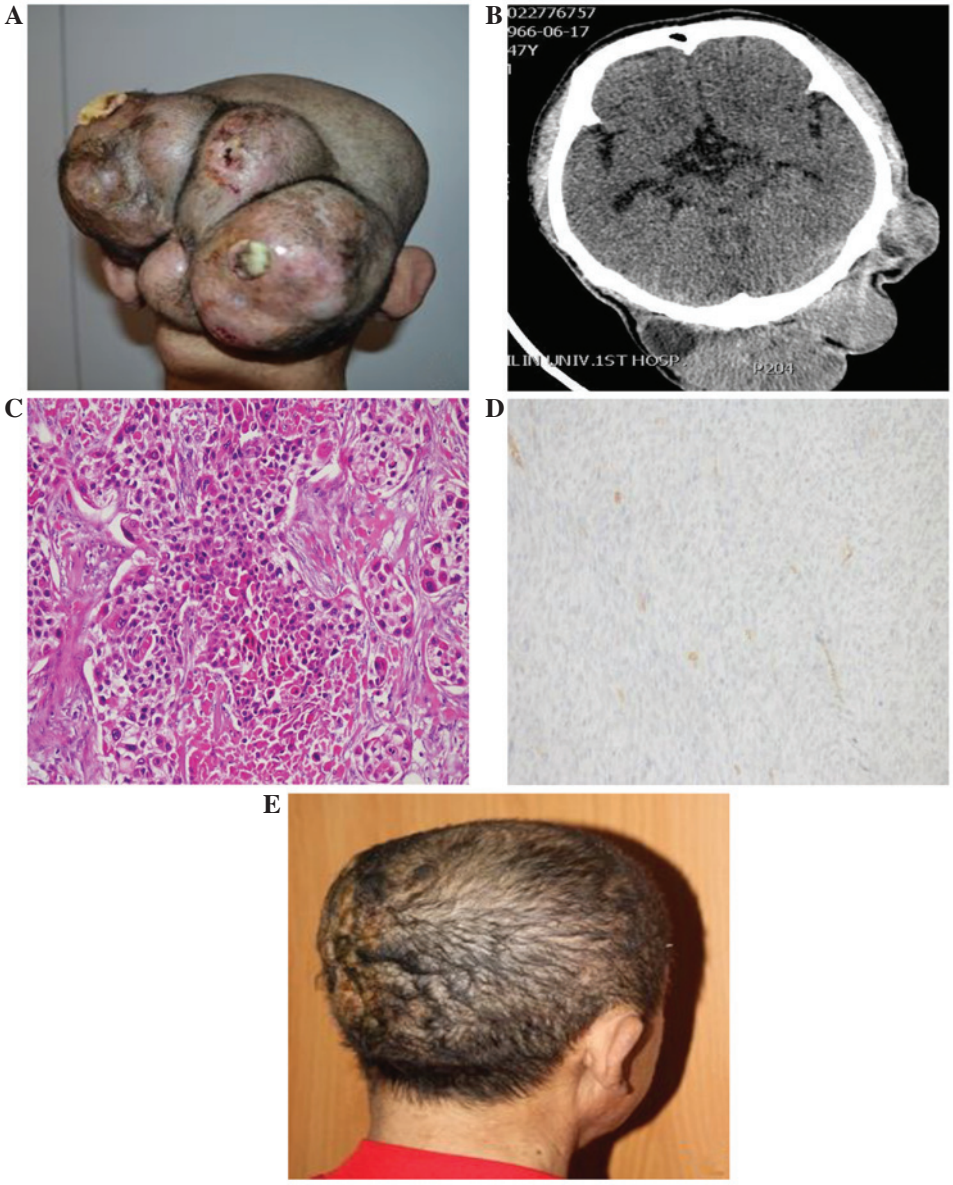

Figure 3. Case 3: Malignant proliferating trichilemmal tumor. (A) A tough tumor with a clear boundary was found to be located on the top of the occipital lobe. (B) A head computed tomography scan revealed a lichen-like irregular giant malignant tumor. (C) The tumor cells had an irregular arrangement with numerous transparent cells. Regions of the basal cells around the tumor exhibited a palisade arrangement. Keratosis sheath of outer hair root and cell atypia were observed. Mitotis was also observed (hematoxylin and eosin staining; magnification, x200). (D) Immunohistochemical staining for cluster of differentiation 34 was positive. (E) The flap had survived at 4 months postoperatively.

present study, 3 rare cases of giant malignant tumors with similar surgical requirements were discussed. The treatment plan includes a careful and specific diagnosis, maintenance of the blood supply during surgery and the reduction of intraoperative bleeding, maintenance of hemodynamic stability during surgery using controlled hypotension and artificial hypothermia anesthesia, and surgical resection, which should remove the tumor with a 3-cm margin. If the tumor invades the skull, the tumor base should be resected. During the operation, the method of incision, hemostasis and edge separation should be applied. The resection should start from the lower galeal and snake in the direction of the normal scalp. Isolating tumor depth surface is not recommended, as it can lead to uncontrollable bleeding.

The repair of large areas of scalp deficiency is a post-operative challenge. Clinical methods such as use of localized flaps, scalp expansion, free skin, pedicle (free) flaps or muscle flap repair are recommended to promote recovery. In our opinion the anterolateral thigh flap has certain advantages, such as not sacrificing the main vessel to provide a sufficiently large flap, the consistent anatomical location of the blood vessels that supply blood for the flap, and a large enough blood vessel and vascular pedicle.

In the present study, vascularized free anterolateral thigh flap surgery was applied in 2 cases of scalp giant malignant tumors. The third case employed a local flap to repair a large defect of the scalp. Post-operatively, the skin grafts survived and pathological examination did not identify any tumor cells. Chemotherapy was not administered in any of the 3 cases and no recurrence was observed at the 5-year, 3-year and 28-month follow-ups, respectively. The patients remain under periodical follow-up to monitor their health status.

References

1. Richmond HM, Duvic M and Macfarlane DF: Primary and metastatic malignant tumors of the scalp: An update. Am J Clin Dermatol 11: 233-246, 2010.
2. Hajdu SI: Peripheral nerve sheath tumors. Histogenesis, classification, and prognosis. Cancer 72: 3549-3552, 1993.
3. Jia X and Yang J: Progress of malignant peripheral nerve sheath tumors study. Int J Orthop 35: 164-166, 2014.
4. Gousias K, Boström J, Kovacs A, Niehusmann P, Wagner I and Kristof R: Factors of influence upon overall survival in the treatment of intracranial MPNSTs: Review of the literature and report of a case. Radiat Oncol 5: 114, 2010.
5. Fletcher CDM, Unni KK and Mertens F (eds): World Health Organization Classification of Tumours. Pathology and Genetics of Tumours of Soft Tissue and Bone. IARC Press, Lyon, 2002.
6. Fisher C: The value of electronmicroscopy and immunohistochemistry in the diagnosis of soft tissue sarcomas: A study of 200 cases. Histopathology 16: 441, 1990.
7. Weiss SW and Goldblum JR (eds): Fibrosarcoma. In: Enzinger and Weiss's Soft Tissue Tumors. 4th edition. Mosby, St. Louis, MO, 409-418, 2001.
8. Stout AP: Fibrosarcoma. The malignant tumor of fibroblasts. Cancer 1: 30-63, 1948.
9. Schmidt H, Taubert H, Würl P, Kappler M, Lange H, Bartel F, Bache M, Holzhausen HJ and Hinze R: Gains of 12q are the most frequent genomic imbalances in adult fibrosarcoma and are correlated with a poor outcome. Genes Chromosomes Cancer 34: 69-77, 2002.
10. Pritchard DJ, Soule EH, Taylor WF and Ivins JC: Fibrosarcoma - a clinicopathologic and statistical study of 199 tumors of the soft tissues of the extremities and trunk. Cancer 33: 888-897, 1974.
11. Sethi S and Singh UR: Proliferating trichilemmal cyst: Report of two cases, one benign and the other malignant. J Dermatol 29: 214-220, 2002.
12. Cao YT, Wang XY, Xuan M and Gao QH: Facial multiple malignant proliferating tricholemmoma: A case report. Hua Xi Kou Qiang Yi Xue Za Zhi 27: 466-468, 2009 (In Chinese).
13. Takenaka H, Kishimoto S, Shibagaki R, Nagata M, Noda Y and Yasuno H: Recurrent malignant proliferating trichilemmal tumor: Local management with ethanol injection. Br J Dermatol 139: 726-729, 1998.
14. Arico M, La Rocca E, Noto G, Pravata G and Rodolico V: Proliferating tricholemmal tumor with lymph node metastasis. Br J Dermatol 121: 793-797, 1989.
15. Park BS, Yang SG and Cho KH: Malignant proliferating trichilemmal tumor showing distant metastasis. Am J Dermatopathol 19: 536-539, 1997.
16. Saida T, Oohara K, Hori Y and Tsuchiya S: Development of a malignant proliferating trichilemmal cyst in a patient with multiple trichilemmal cysts. Dermatologica 166: 203-208, 1983.
17. Yoleri L, Baŝer NT and Kandiloğlu AR: Malignant proliferating trichilemmal tumor arising in multiple trichilemmal cysts. Ann Plast Surg 43: 575-576, 1999.
18. Bahrami A and Folpe AL: Adult-type fibrosarcoma: A reevaluation of 163 putative cases diagnosed at a single institution over a 48-year period. Am J Surg Pathol 34: 1504-1513, 2010.
19. Brownstein MH and Arluk DJ: Proliferating trichilemmal cyst: A simulant of squamous cell carcinoma. Cancer 48: 1207-1214, 1981.
20. Trojani M, Contesso G, Coindre JM, Rouesse J, Bui NB, de Mascarel A, Goussot JF, David M, Bonichon F and Lagarde C: Soft tissue sarcomas of adults; study of pathological prognostic variables and definition of a histopathological grading system. Int J Cancer 33: 37-42, 1984.
21. González-Orús Álvarez-Morujo R, García Leal R, Lasso Vázquez JM and Scola Yurrita B: Malignant peripheral nerve sheath tumour of the infra-orbital nerve. Neurocirugia (Astur) 25: 240-243, 2014.
22. Wick MR, Swanson PE, Scheithauer BW and Manivel JC: Malignant peripheral nerve sheath tumor. An immunohistochemical study of 62 cases. Am J Clin Pathol 87: 425-433, 1987.
23. Chen L, Mao Y, Chen H and Zhou LF: Diagnosis and management of intracranial malignant peripheral nerve sheath tumors. Neurosurgery 62: 825-832; discussion 832, 2008.
24. Anghileri M, Miceli R, Fiore M, Mariani L, Ferrari A, Mussi C, Lozza L, Collini P, Olmi P, Casali PG, *et al*: Malignant peripheral nerve sheath tumors: Prognostic factors and survival in a series of patients treated at a single institution. Cancer 107: 1065-1074, 2006.
25. Zou C, Smith KD, Liu J, Lahat G, Myers S, Wang WL, Zhang W, McCutcheon IE, Slopis JM, Lazar AJ, *et al*: Clinical, pathological, and molecular variables predictive of malignant peripheral nerve sheath tumor outcome. Ann Surg 249: 1014-1022, 2009.
26. L'heureux-Lebeau B and Saliba I: Updates on the diagnosis and treatment of intracranial nerve malignant peripheral nerve sheath tumors. Onco Targets Ther 6: 459-470, 2013.
27. Aydin MD, Yildirim U, Gundogdu C, Dursun O, Uysal HH and Ozdikici M: Malignant peripheral nerve sheath tumor of the orbit: Case report and literature review. Skull Base 14: 109-113; discussion 113-114, 2004.
28. Plaza G, Ferrando J and Pinedo F: Sinonasal fibrosarcoma: A case report. Eur Arch Otorhinolaryngol 263: 641-643, 2006.
29. Cattaneo F, Iaccio A, Guerra G, Montagnani S and Ammendola R: NADPH-oxidase-dependent reactive oxygen species mediate EGFR transactivation by FPRL1 in WKYMVm-stimulated human lung cancer cells. Free Radic Biol Med 51: 1126-1136, 2011.
30. Testa D, Guerra G, Marcuccio G, Landolfo PG and Motta G: Oxidative stress in chronic otitis media with effusion. Acta Otolaryngol 132: 834-837, 2012.
31. Conti V, Russomanno G, Corbi G, Guerra G, Grasso C, Filippelli W, Paribello V, Ferrara N and Filippelli A: Aerobic training workload affects human endothelial cells redox homeostasis. Med Sci Sports Exerc 45: 644-653, 2013.
32. Cozzolino I, Caleo A, Di Crescenzo V, Cinelli M, Carlomagno C, Garzi A and Vitale M: Cytological diagnosis of adult-type fibrosarcoma of the neck in an elderly patient. Report of one case and review of the literature. BMC Surg 13 (Suppl 2): S42, 2013.
33. Orbach D, Rey A, Cecchetto G, Oberlin O, Casanova M, Thebaud E, Scopinaro M, Bisogno G, Carli M and Ferrari A: Infantile fibrosarcoma: Management based on the European experience. J Clin Oncol 28: 318-323, 2010.
34. Markal N, Kurtay A, Velidedeoğlu H and Hücümenoğlu S: Malignant transformation of a giant proliferating trichilemmal tumor of the scalp: Patient report and literature review. Ann Plast Surg 41: 314-316, 1998.
35. Uchida N, Tsuzuki Y, Ando T, Mochida Y, Yoshikawa M, Sekihara M, Kobayashi M, Ide M, Ohno Y and Kuwano H: Malignant proliferating trichilemmal tumor in the skin over the breast: A case report. Breast Cancer 7: 79-82, 2000.
36. Chaichamnan K, Satayasoontorn K, Puttanupaab S and Attainsee A: Malignant proliferating trichilemmal tumors with CD34 expression. J Med Assoc Thai 93 (Suppl 6): S28-S34, 2010.