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Acute inflammatory reactions to hemostatic materials mimicking post-operative intracranial abscess

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ABSTRACT

Oxidized cellulose can cause acute neurologic worsening in the immediate post-operative period. MRI often shows restricted diffusion around the surgical cavity on the first post-operative MRI. When acute clinical deterioration occurs with the typical MRI findings, the material must be removed surgically.

Introduction

Hemostatic materials are used routinely after intracranial surgery. Oxidized cellulose (SURGICEL, Ethicon 360, Johnson & Johnson, USA) is the most common but any hemostatic material can rarely cause post-operative complications both systemically and intracranially by migration, swelling with compression of adjacent tissues, and radiologic appearances mimicking hematomas, abscesses or recurrent tumor with or without clinical symptoms [1–3]. Most patients with intracranial lesions mimicking abscess or recurrent tumor present months to years after craniotomy [3]. We report four patients with acute post-operative symptomatic lesions related to oxidized cellulose within 16 days of intracranial tumor resection.

Case reports

Case one is a 52-year-old woman with a low grade oligodendroglioma diagnosed 12 years previously and treated with four cycles of procarbazine, CCNU and vincristine 10 years prior, 10 cycles of temozolomide 3 years previously, and radiotherapy 15 months before the current craniotomy. She presented with expansion of an enhancing left frontal lesion which was hypometabolic on PET but continued to grow. On resection it was a mixture of residual low grade oligodendroglioma and treatment effect. Immediate post-operative MRI showed only the expected post-operative changes. The patient was discharged without any neurologic deficit. Five days after her craniotomy she developed a new right hemiparesis and expressive aphasia that worsened over three days. CT showed an increased left frontal cystic lesion and MRI revealed a T1 hypointense cystic lesion with a thin rim of peripheral enhancement and increased edema with areas of restricted diffusion corresponding to the enhancing rim (Fig. 1). She was treated with dexamethasone and mannitol followed by hypertonic saline (2%) without benefit. The patient was taken for surgical exploration where a yellowish inflammatory exudate without hemorrhage was seen. Cultures failed to grow any organism and pathology showed acute inflammation and residual oxidized cellulose material without any identifiable micro-organisms or tumor present (Fig. 1). The cavity was irrigated and the patient recovered over the next four weeks with gradual resolution of the enhancing lesion on MRI. She is alive and well 3½ years later and has required no further treatment.

Case two is a 50-year-old man diagnosed with a low grade glioma 11 months prior that was partially resected and then

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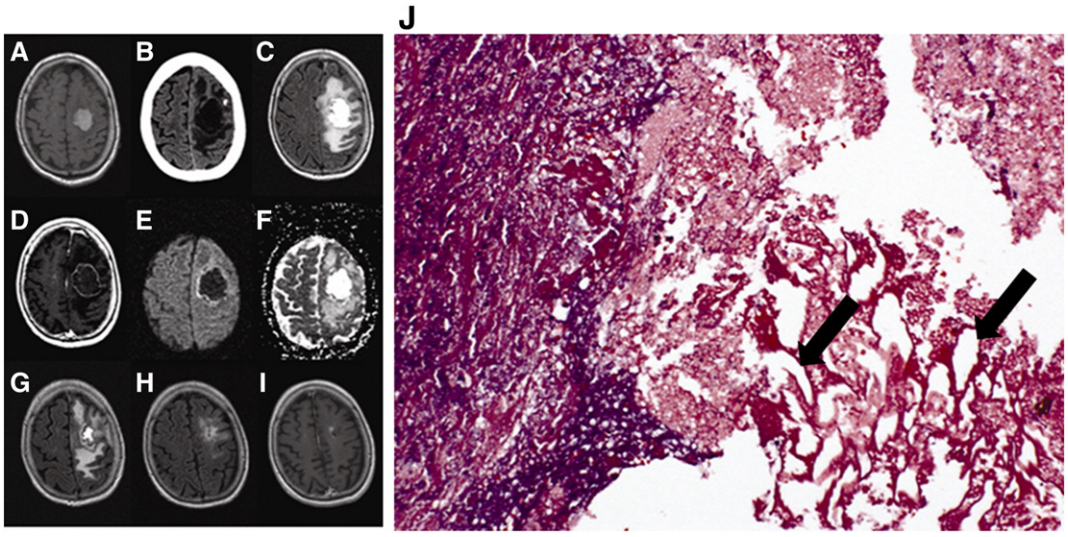

Fig. 1. Case 1: Magnetic resonance imaging (MRI) T1 pre-contrast (A) shows a hyperintense area immediately after resection. Computed tomography (CT) (B) and MRI (C) eight days post-operatively showing larger cystic lesion with surrounding area of edema and mass effect with a thin rim of enhancement on T1 after gadolinium (D) and corresponding areas of restricted diffusion (E,F). MRI FLAIR (G) five days later after interval removal of inflammatory debris, oxidized cellulose and irrigation. Follow up MRI FLAIR (H) and T1 post-contrast (I) four months later show complete resolution. Empty "ghost fiber" profiles typical of Surgicel are present in cellular debris (arrows) (J).

followed. He presented with worsening hemiparesis and seizures over two weeks and had a new enhancing right frontal lesion which was resected with the use of oxidized cellulose and FloSeal as hemostatic agents; pathology revealed glioblastoma. Twelve hours after surgery he experienced worsening left hemiparesis that progressed over the next two days without response to dexamethasone. MRI showed worsening edema around a cystic lesion with rim enhancement and corresponding restricted diffusion. On the fourth post-operative day the patient had re-resection, and the surgical cavity contained a thick exudate, a small amount of residual oxidized cellulose (1 cm patch) and GELFOAM® (Pfizer, New York, NY, USA) (three 8 mm strips). Duragen had been used as a dural substitute, and this was contiguous with the underlying open cavity. Residual foreign materials were removed and the area was irrigated. DuraGuard was used to close the dura and the bone plate was cleaned and secured as per routine craniotomy procedures. Culture of the cyst content failed to grow any microorganisms and pathological examination showed only inflammatory elements bordering aggregated GELFOAM material (Fig. 2). The patient had immediate improvement in strength after surgery and continues to do well six months later after radiation and temozolomide with bevacizumab as part of a clinical trial.

Case three is a 44-year-old woman who underwent resection of a right frontal glioblastoma with lining of the surgical cavity with a single layer of oxidized cellulose for hemostasis. She experienced worsening hemiparesis 16 days later due to an enlarging cystic lesion with a T1 hyperintense and enhancing rim with restricted diffusion and surrounding edema. She did not respond to increased steroids, so surgical exploration was performed which revealed acute inflammation. The patient recovered well and continued therapy.

Case four is a 65-year-old man who presented with memory difficulties and was found to have a left frontal enhancing lesion which was resected; pathology revealed glioblastoma. Microfibrillar collagen AVITENE® (Davol, Inc., Warwick, RI, USA) sheets and FLOSEAL® (Baxter, Fremont, CA, USA) were used to line parts of the cavity for hemostatic control. In the immediate post-operative period

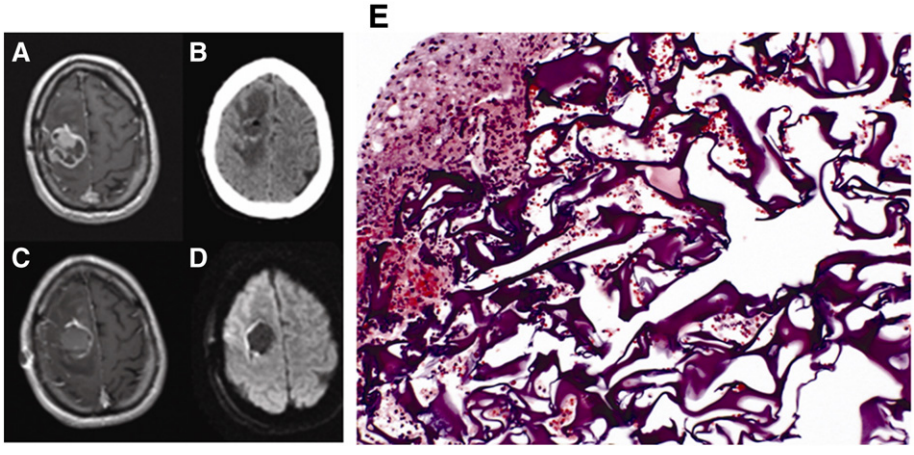

Fig. 2. Case 2: Heterogeneous ring-enhancing lesion on MRI (A) prior to resection. Eight hours post-operative CT (B) showing cystic lesion with small amount of air which increased in size over the next twenty-four hours with a thin rim of peripheral enhancement on MRI (C) and rim of restricted diffusion (D). Gelfoam is evident in the resected material with inflammatory cells seen on the periphery (E).

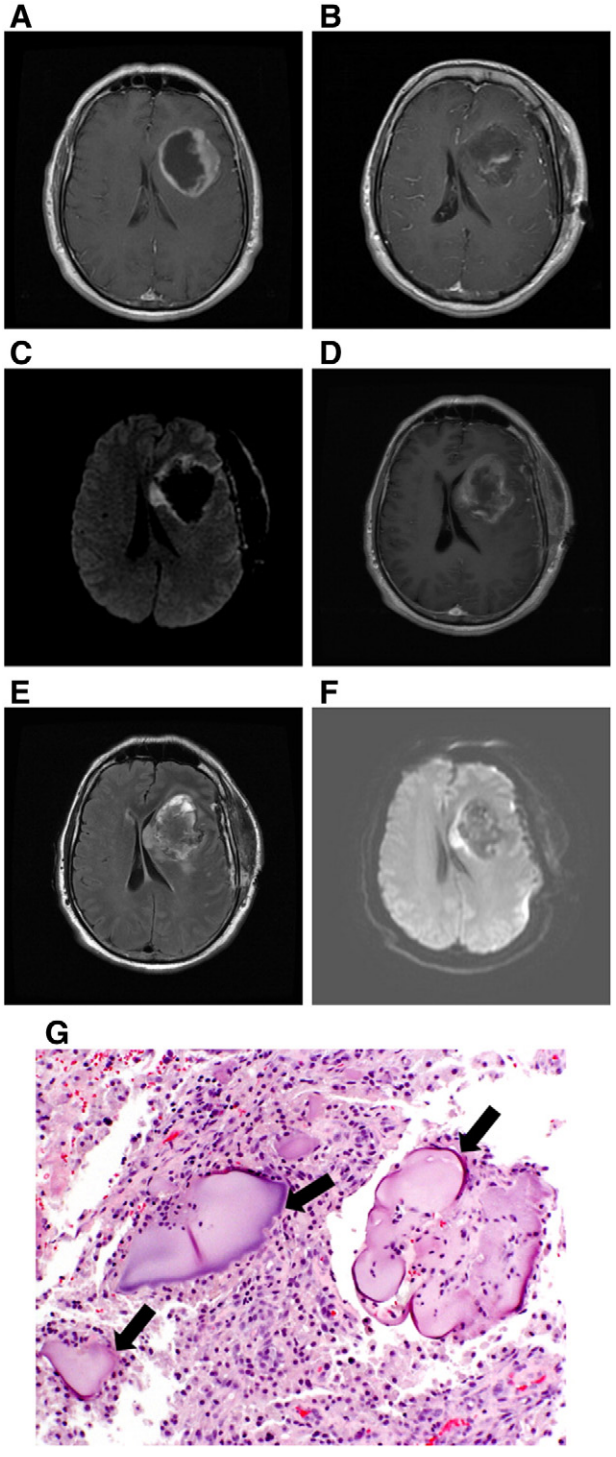

Fig. 3. Case 4: (A) Pre-operative post-gadolinium T_1 MRI showing the left frontal glioblastoma. (B) 48 hour post-operative T_1 contrast enhanced and diffusion (C) MRI demonstrating extensive resection. (D) MRI 11 days after initial resection showing prominent enhancement on post-gadolinium images, little surrounding edema on FLAIR sequence (E) and stable diffusion changes (F). (G) Histology of resected material demonstrating inflammation and a histocytic reaction to the foreign material (arrows).

he had a right hemiparesis and was unable to speak but this improved over several days. However, he had frequent episodes of speech arrest despite adjustment of his anti-epileptics; EEG showed occasional epileptiform spikes in the left parieto-central region. MRI done two days post-operatively revealed expected changes with the resection cavity containing fluid, blood and air with rim enhancement and restricted diffusion (Fig. 3). Despite treatment for seizures, hypertonic saline, mannitol, and high doses of dexamethasone, the patient did not improve. Repeat MRI was unchanged (Fig. 3). The patient returned to the operating room 15 days after the initial resection and surgical exploration showed a thick exudate, degrading hemostatic materials and fluid with blood products, but no blood clot. This was removed and the cavity thoroughly irrigated. On pathology, cellular debris, blood and hemostatic material were identified but no tumor. The patient had an immediate improvement in language function and no further episodes of aphasia. He was tapered down to a single antiepileptic drug and has been doing well for the past four months.

Discussion

Our patients all showed rapidly enlarging cystic lesions hours to 16 days after tumor resection, inconsistent with residual tumor and atypical for infection. Symptoms were delayed by 5–16 days in two of the patients but the other two had symptoms within hours of resection, suggesting this reaction can occur rapidly. Acute inflammation was found on pathologic examination after re-resection, but stains and cultures were all negative. No patient had fever or an elevated peripheral white count post-operatively although a predominance of polymorphonuclear white cells (~90%) was typical. All of our patients had clinical worsening with seizures or lateralizing signs and none responded to high dose dexamethasone. None had a history of allergies or prior exposure to hemostatic materials that we could identify. All required removal of the inciting material and experienced rapid clinical improvement.

On CT, oxidized cellulose can mimic hematoma or abscess with irregular, mixed attenuation lesions, some containing air with surrounding edema. In the brain, a thin rim of enhancement can be seen on MRI and has been reported for CT as well. Marked edema is characteristic and progressive enlargement of the cystic component was also seen. We also observed areas of restricted diffusion corresponding to the rim of enhancement in all of our cases. Unfortunately, most patients did not have sequences most sensitive to blood products.

Though largely considered benign and bioabsorbable, in vitro studies have shown that oxidized cellulose is cytotoxic even at diluted doses [4]. Different hemostatic bioabsorbable materials can be retained for long periods after surgery and can provoke inflammation and granuloma formation [5]. Macrophages are required for clearance and different individuals have a varying propensity for clearing the material versus granuloma formation.

In conclusion, clinicians caring for patients with brain tumors need to be aware of the uncommon occurrence of retained hemostatic material provoking acute inflammatory responses mimicking abscess and recurrent tumor, as immediate improvement occurs with, and requires, removal of the agent.

References

[1] Arat YO, Borotheo EU, Tang RA, et al. Compressive optic neuropathy after use of oxidized regenerated cellulose in orbital surgery. Ophthalmol 2006;113:333–7.
[2] Brodbelt AR, Miles JB, Foy PM, et al. Intraspinal oxidized cellulose (Surgicel) causing delayed paraplegia after thoracotomy. Ann R Coll Surg Engl 2002;84:97–9.
[3] Ribalta T, McCutcheon IE, Neto AG, et al. Textiloma (gossypiboma) mimicking recurrent intracranial tumour. Arch Pathol Lab Med 2004;128:749–58.
[4] Hexig B, Nakaoka R, Tsuchiya T. Safety evaluation of surgical materials by cytotoxicity testing. J Artif Organs 2008;11:204–11.
[5] Ereth MH, Schaff M, Ericson EF, et al. Comparative safety and efficacy of topical hemostatic agents in a rat neurosurgical model. Neurosurgery 2008;63:369–72.