

Case Report

Intracranial foreign body granuloma caused by gelatin sponge: a case report and literature review

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Abstract: Background: Intracranial foreign body granuloma is an uncommon clinical entity; and the disease induced by gelatin sponge is extremely rare. The clinical and radiological manifestations, treatment and prognosis of gelatin sponge-induced foreign body granuloma are not well-characterized. Case report: We present a case of intracranial foreign body granuloma in a 25-year-old male patient who presented 40 days after craniectomy for closed cerebral trauma. The patient presented with aphasia and weakness in the right extremities. Brain magnetic resonance imaging showed an oval mass in the left frontal lobe. Surgical resection was performed, and the diagnosis of foreign body granuloma induced by gelatin sponge confirmed on histopathology. Additionally, based on a review of published literature, a summary of the etiology, radiological characteristics, and treatment of gel foam-induced foreign body granuloma is presented. Conclusion: Gel foam-induced foreign body granuloma is an extremely rare entity, which is liable to be misdiagnosed as an intracranial recurrent tumor or abscess. Magnetic resonance imaging is the diagnostic modality of first-choice. Surgical resection should be recommended for these patients, and the prognosis is favorable.

Keywords: Foreign body granuloma, gelatin sponge, case report

Introduction

Foreign body granuloma is a non-immune, chronic inflammatory reaction to exogenous materials (such as suture material, hemostatic agents, talc, parasites, oil droplets, wood, metals, silica, silicon) or endogenous (hair shafts, keratin, cholesterol, urates) [1-3]. This entity is characterized by a foreign body-centered nodular lesion surrounded by inflammatory cell-infiltration that typically includes macrophages, multinucleated giant cells, lymphocytes and fibroblasts. Gelatin sponge (Gelfoam™) has been widely used as a hemostatic agent during neurosurgical procedures [4, 5]. Intracranial foreign body granuloma induced by gelatin sponge is extremely rare. The clinical and radiological manifestations, treatment and prognosis of this entity are not well-characterized. Herein, we describe a patient with gel foam-induced foreign body granuloma. Based on a review of published literature [3-5], a summary of the etiology, radiological characteristics, and treatment of gel foam-induced foreign body granulomas is presented.

Case description

A 25-year-old man presented with a 10-day history of aphasia and weakness in the right extremities. Forty days prior to admission, he underwent left frontotemporal decompressive craniectomy for bilateral subdural hematoma in the frontotemporal lobes. Intraoperatively, gelatin sponge was used for hemostasis. The immediate postoperative course was uneventful. On the 17th postoperative day, he experienced an episode of epileptic seizure. Physical examination showed fever (axillary temperature 38.7°C); neurological examination was unremarkable. Brain computed tomography (CT) showed an oval hypodense mass in the left frontal lobe.

On the 30th postoperative day, physical examination showed axillary temperature of 38.4°C, aphasia, neck rigidity, and weakness in the right extremities (muscle strength: grade 3/5). On repeat brain CT, the hypodense mass in the left frontal lobe was more remarkable. On the 42nd postoperative day, the symptoms remained unchanged, and he was readmitted to our

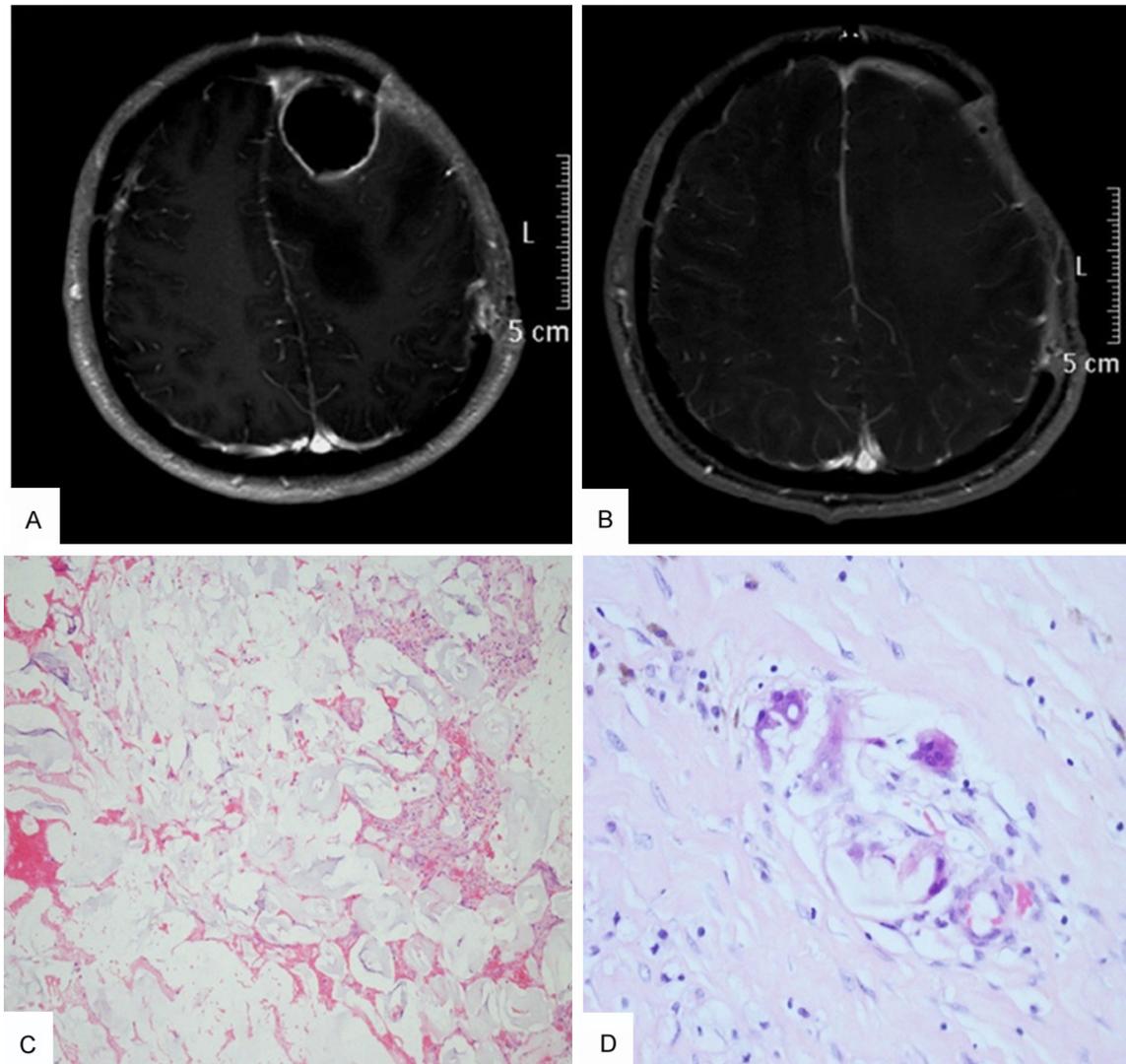


Figure 1. (A). Preoperative brain magnetic resonance contrasted T1-weighted imaging showing a 3.5 cm × 3.0 cm oval mass in the left frontal lobe. Remarkable ring enhancement, peripheral edema and midline shift are visible. (B). Postoperative magnetic resonance contrasted T1-weighted imaging confirms a subtotal resection. (C, × 100; D, × 400) Histopathological examination reveals gelatin sponge (C) surrounded by multinucleated giant cells and fibroplasia (D).

department. Brain magnetic resonance imaging (MRI) showed a 3.5 cm × 3.0 cm oval mass in the left frontal lobe (**Figure 1A**). The mass was hypointense on T1-weighted images and hyperintense on T2-weighted images, with a remarkable ring enhancement; peripheral edema and midline shift were visible. A provisional diagnosis of brain abscess with envelope formation was made, and a surgical resection of the lesion performed.

Intraoperatively, we noted an oval, grey-white, hard mass in the left frontal lobe, which was poorly demarcated and tightly attached to the

dura mater. The lesion was incised, and a cystic component was found. The hazel jelly-like cyst fluid with glom-like foreign body was collected for pathological examination and bacterial culture. The lesion was subtotally resected, which was confirmed on postoperative MRI (**Figure 1B**). The postoperative course was uneventful.

Histopathological examination revealed gelatin sponge (**Figure 1C**) surrounded by multinucleated giant cells and fibroplasia (**Figure 1D**), which was consistent with a diagnosis of foreign body granuloma induced by gelatin sponge. The bacterial culture was negative.

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Table 1. Clinicoradiological profile of intracranial foreign body granulomas caused by gelatin sponge

No.	Author/year	Age/Sex	Symptom duration	Primary diagnosis	Location	Symptoms	Radiological characteristics	Treatment	Outcome
1	Knowlson/1974 [4]	42/Male	3 weeks	Oligodendroglioma	Frontal lobe	Intracranial hypertension, and somnolence	Not available	Total resection	Not available
2	Guerin/1990 [5]	29/Female	15 days	Aneurysm	Sylvian fissure	Mild headache	CT: ring enhancement	Partial resection	Favorable
3	Kothbauer/2001 [3]	6/Male	2 months	Primitive neuroectodermal tumor	Cerebella	Intracranial hypertension	MRI: ring enhancement	Total resection	Favorable
4	Present Case	25/Male	40 days	Closed cerebral trauma	Frontal lobe	Fever, aphasia, neck rigidity, and weakness in the right extremities	MRI: hypointense on T1-weighted images and hyperintense on T2-weighted images, with a remarkable ring enhancement; peripheral edema and midline shift.	Subtotal resection	Favorable

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Twenty days after operation, he was discharged with completely intact neurological functions. Over a follow-up period of 4 months, no recurrence was observed.

Literature review

We searched the MEDLINE database for articles related to foreign body granuloma caused by gelatin sponge published between 1945 and 2015. A total of three publications reporting on three patients were retrieved [3-5]. The clinicoradiological profiles are summarized in **Table 1**.

Discussion

Intracranial foreign body granuloma induced by gelatin sponge is exceedingly rare. This entity was first described by Knowlson *et al.* in 1974 [4]. Histopathological findings were consistent with a chronic inflammation reaction to exogenous gelatin sponge [6, 7]. On the 12th day after implantation of gelatin sponge, the inflammatory reaction is most remarkable, which is characterized by infiltration of lymphocytes and multinucleated giant cells. On the 30th day, the inflammation reaction mainly involves the dura mater adjacent to the implanted gelatin sponge. The complete absorption of gelatin sponge needs 20 to 45 days and eventually results in granuloma formation. The inflammatory reaction may last for over 45 days.

In the current case, the symptoms and neurological signs were similar to those in meningitis, and the evolution process of the disease was consistent with the course of inflammatory reaction to exogenous materials. Intraoperatively, we did not find gelatin sponge in the lesion, which may be due to the complete absorption of gelatin sponge. Definitive diagnosis is based on the characteristic histopathological findings.

The specific etiopathogenesis of foreign body granulomas is not well-elucidated. It is widely accepted that foreign body granulomas predominantly occur in patients with an allergic predisposition. Kothbauer *et al.* speculated that patients with primitive neuroectodermal tumor are more predisposed to form foreign body granuloma [3]. Recent studies have consistently showed that massive gelatin sponge may aggravate the giant cell reaction in the

brain tissue [3, 8]. Additionally, Sheno *et al.* also reported a patient who developed hearing loss after stapedectomy, which indicates toxicity of formaldehyde contained in the gelatin sponge [9]. The production process of gelatin sponge involves formaldehyde foaming, and thus we speculate that intracranial foreign body granulomas may also be associated with the irritant effect of formaldehyde on the brain tissue.

The diagnosis of intracranial foreign body granulomas is challenging, and brain MRI should be the first choice. The differential diagnosis includes intracranial recurrent tumors and brain abscess [2, 10-14]. Jang *et al.* proposed that magnetic resonance perfusion-weighted imaging (PWI) and magnetic resonance spectrum (MRS) can help identify intracranial foreign body granuloma; the relative cerebral blood flow in foreign body granulomas is usually not increased on PWI, and this entity often shows mild increased choline/creatine ratio on MRS [13]. Some studies suggested that the typical characteristics of foreign body granulomas is hyperintensity on both T2-weighted images and diffusion-weighted imaging (DWI), which may help differentiate a foreign body granuloma from a tumor or abscess [1, 3, 15]. This was applicable in the present case, too.

Mainstream treatment of intracranial foreign body granuloma includes conservative observation and surgical resection. For patients with mild symptoms, conservative approach can be adopted. Slater *et al.* reported two cases with intracranial foreign body granuloma, who recovered completely on conservative treatment [15]. For intracranial foreign body granulomas induced by gelatin sponge, we suggest surgical resection as the first choice of treatment, as this entity may be difficult to distinguish from recurrent malignant tumors. Moreover, the definitive diagnosis should be based on postoperative pathological examination [3]. In the literature, all reported cases were treated by surgery with satisfactory outcomes.

Conclusion

Foreign body granuloma caused by gelatin sponge is an extremely rare condition. Clinicians should be aware of this entity, as it is liable to be misdiagnosed as intracranial recurrent tumor or brain abscess. For symptomatic

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patients with a history of brain surgery, MRI is recommended. Surgical resection is the treatment of first-choice and is associated with a good prognosis.

Disclosure of conflict of interest

None.

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References

- [1] Feldman RP, Marcovici A, Suarez M and Goodrich JT. Foreign body granuloma mimicking intracranial meningioma: case report and review of the literature. *Neurosurgery* 1999; 44: 855-858.
- [2] Hasturk AE and Basmaci M. Foreign body granuloma mimicking recurrent intracranial tumor: a very rare clinical entity. *Acta Med Iran* 2013; 51: 816-818.
- [3] Kothbauer KF, Jallo GI, Siffert J, Jimenez E, Allen JC and Epstein FJ. Foreign body reaction to hemostatic materials mimicking recurrent brain tumor. Report of three cases. *J Neurosurg* 2001; 95: 503-506.
- [4] Knowlson GT. Gel-foam granuloma in the brain. *J Neurol Neurosurg Psychiatry* 1974; 37: 971-973.
- [5] Guerin C and Heffez DS. Inflammatory intracranial mass lesion: an unusual complication resulting from the use of Gelfoam. *Neurosurgery* 1990; 26: 856-859.
- [6] Rybock JD and Long DM. Use of microfibrillar collagen as a topical hemostatic agent in brain tissue. *J Neurosurg* 1977; 46: 501-505.
- [7] Tamargo RJ, Epstein JI, Reinhard CS, Chasin M and Brem H. Brain biocompatibility of a biodegradable, controlled-release polymer in rats. *J Biomed Mater Res* 1989; 23: 253-266.
- [8] Blaine G. Absorbable gelatin sponge in experimental surgery. *Lancet* 1951; 2: 427-429.
- [9] Shenoj PM. Ototoxicity of absorbable gelatin sponge. *Proc R Soc Med* 1973; 66: 193-196.
- [10] Akpınar A, Uçler N and Özdemir CO. Textiloma (gossypiboma) mimicking recurrent intracranial abscess. *BMC Res Notes* 2015; 8: 390.
- [11] Ribalta T, McCutcheon IE, Neto AG, Gupta D, Kumar AJ, Biddle DA, Langford LA, Bruner JM, Leeds NE and Fuller GN. Textiloma (gossypiboma) mimicking recurrent intracranial tumor. *Arch Pathol Lab Med* 2004; 128: 749-758.
- [12] Brochert A, Reynolds T and Baker R. MRI in a case of muslin-induced granuloma. *Neuroradiology* 2003; 45: 82-84.
- [13] Jang SW, Kim SJ, Kim SM, Lee JH, Choi CG, Lee DH, Kim EJ and Lee JK. MR spectroscopy and perfusion MR imaging findings of intracranial foreign body granuloma: a case report. *Korean J Radiol* 2010; 11: 359-363.
- [14] Vishteh AG, Apostolides PJ, Dean B and Spetzler RF. Magnetic resonance image of postcraniotomy retained cotton or rayon. Case illustration. *J Neurosurg* 1998; 88: 928.
- [15] Slater LA, Chandra RV, Holt M, Danks A and Chong W. Long-term MRI findings of muslin-induced foreign body granulomas after aneurysm wrapping. A report of two cases and literature review. *Interv Neuroradiol* 2014; 20: 67-73.