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CASE REPORT

Misery of neurosurgeon: Gauzoma causing foreign body granuloma-role of radiologist

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ABSTRACT

Materials used in neurosurgery to achieve hemostasis may be of resorbable or nonresorbable substance and may cause foreign body granuloma if left at the operative site. Foreign body granuloma depending on clinical history may be indistinguishable from an abscess, resolving infarction, and hematoma. Here we present two cases, who had decompressive craniectomy following road traffic accident. Follow-up computerized tomography (CT) scan revealed hyperdense lobulated lesion with peripheral rim enhancement. On magnetic resonance imaging (MRI), lesions were predominantly hypointense on T1-weighted images, and hyperintense on T2-weighted images and showed a lack of restricted diffusion. In view of recent craniectomy and imaging findings diagnosis of foreign body granuloma was made. Both patients underwent surgery, intraoperatively gauze pieces were retrieved from lesions which confirmed preoperative diagnosis. The combination of CT and MRI can diagnose foreign body granuloma, especially in trauma settings. Thus, we can help the surgeon by providing the probable diagnosis for proper management.

Key words: Decompressive craniectomy, foreign body granuloma, gauzoma, textilomas, Muslinomas

Introduction

Materials used in neurosurgery to achieve hemostasis may be of resorbable or nonresorbable substance. These substances may cause foreign body granuloma especially the nonabsorbable ones if left at the operative site.

Foreign body granuloma depending on clinical history may be indistinguishable from recurrent tumors, radiation necrosis, abscess, resolving infarction, hematoma, primary or metastatic neoplasm.[1] Hemostat associated with mass lesions have been variously referred to as textilomas, gossypibomas, gauzomas, or muslinomas.[1]

Computerized tomography (CT) and magnetic resonance imaging (MRI) can be used to recognise foreign body granuloma. Imaging appearance of retained foreign body material will depend on factors like time elapsed since surgery, the type of foreign-body reaction that occurs, and on the substance of the foreign material itself.[2] PubMed search revealed 14 case reports so far. Because of rarity, there is paucity of documented MRI findings.

Here, we present two cases of postoperative intracranial foreign body granuloma with special emphasis on MR imaging findings.

Case Reports

Case 1

A 29-year-old man was admitted to the Emergency Department following road traffic accident. He was conscious, but disoriented and vitals were stable. Non-contrast CT scan of head [Figure 1] revealed hemorrhagic contusion in right frontotemporoparietal lobe with transfalcine herniation with

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midline shift of 7 mm and a subdural hematoma in the right frontal region.

Emergency decompressive craniectomy with partial right frontal lobectomy was done.

On second postoperative day MRI [Figure 2] was done to look for residual hematoma and extent of parenchymal injuries.

MRI revealed an ill-defined oval mass around the right sylvian fissure abutting insular cortex. Mass was hypo to isointense on the T1-weighted image and heterogeneously hyperintense on T2-weighted images. Foci of hemorrhages were also noted within the mass surrounded by edema. Another rounded mass of similar signal characteristics was also noted in the right temporal lobe. In view of recent head trauma with intracranial bleed we gave the possibility of postoperative residual hematoma with surrounding inflammatory changes.

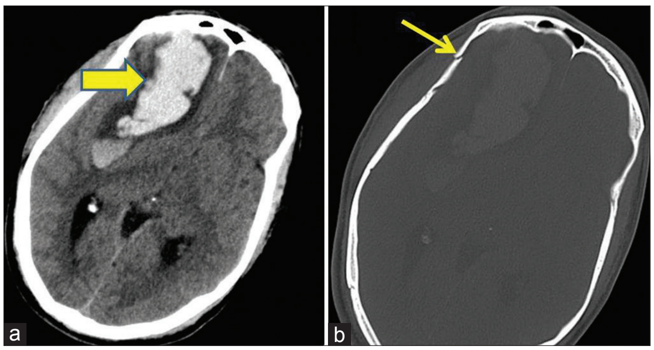

Figure 1: Case 1: (a) Noncontrast computerised tomography axial images of 29-year-old male following road traffic accident developed intraparenchymal contusion (broad arrow) showing hemorrhagic contusion in right frontotemporoparietal lobe causing transfalcine herniation with midline shift. SDH was seen in right frontal region. (b) Axial bone window sections showing fracture of right frontotemporoparietal bone (long arrow) with depressed fracture involving right orbital roof (not shown)

Two months later cranioplasty was planned so that implanted bone flap in the abdomen could be reimplanted to the skull. Prior to procedure, preoperative noncontrast computerised tomography (NCCT) followed by contrast-enhanced computerised tomography (CECT) scan of the head [Figure 3] was done which revealed a well-defined hyperdense lobulated mass of size approximately 2.2 cm × 1.5 cm in right insular cortex location. The mass showed intense peripheral rim enhancement. Another rounded mass of similar attenuation and enhancement was also noted in the right temporal lobe.

As the appearance of the lesion was more mass like, in view of clinical history, in order of probability foreign body granuloma, abscess and hematoma were kept as a differential diagnosis. So to further characterize contrast enhanced MRI was done [Figures 4 and 5].

MRI revealed two well-defined lobulated masses around the right sylvian fissure abutting insular cortex and another mass in the right temporal lobe. Both masses were predominantly hypointense on T1-weighted images, and hyperintense on T2-weighted image. There was thin uniform T1 iso- to hyper-intense, the T2 hypointense rim around both masses which showed intense enhancement with marked restricted diffusion. MR Spectroscopy showed noisy background and

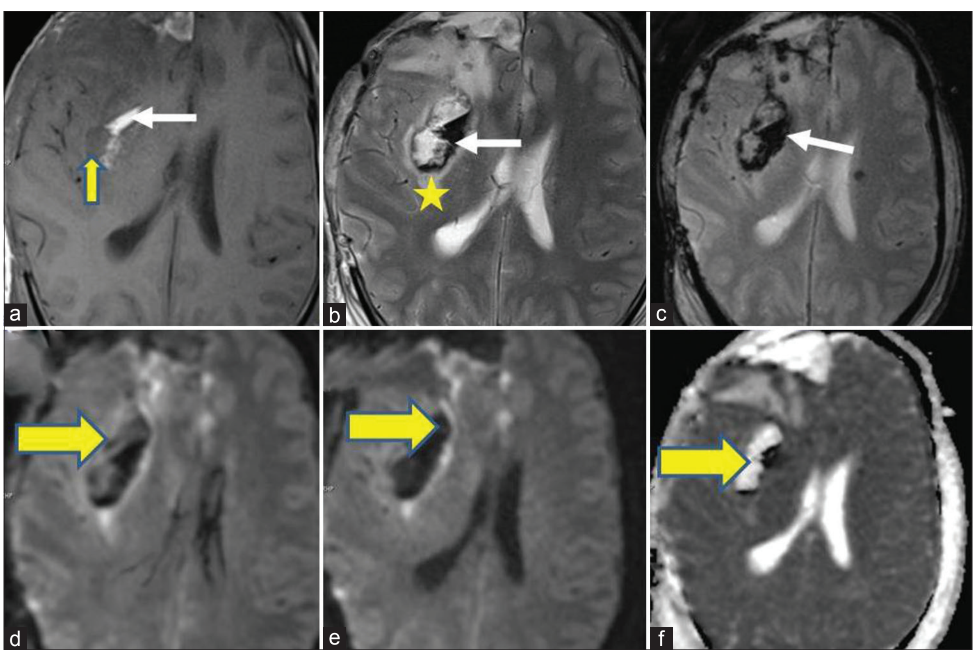

Figure 2: Case 1: Magnetic resonance imaging done on 2nd postoperative day showing lesion around (broad arrow) right sylvian fissure. (a) T1-weighted image showing isointense lesion abutting insular cortex (thin yellow arrow). (b) T1-weighted image showing hyperintense lesion with hypointense rim on lateral aspect. Surrounding hyperintense edema (star) was present. (c) Flash image showing blooming on medial aspect of the lesion (white arrow) representing bleed. (d-f) B500 and B1000 image showing no diffusion restriction (yellow arrow)

hence could not be interpretated. Perfusion study revealed both decrease relative cerebral blood volume (rCBV) and mean transit time as compared to normal brain parenchyma.

In view of clinical history and imaging appearance possibility of foreign body granuloma was made.

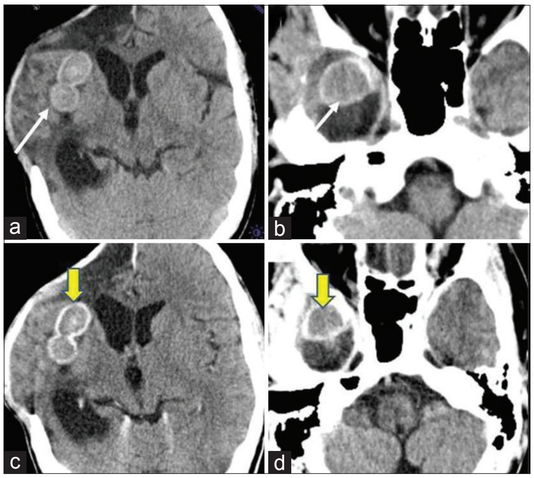

Figure 3: Case 1: Patient presented for cranioplasty after 2 months of operation. Noncontrast computerised tomography followed by contrast-enhanced computerised tomography was done. (a and b) Noncontrast computerised tomography showed two similar appearing well defined hyperdense lobulated mass. One measuring approximately 2.2 cm × 1.5 cm around right sylvian fissure is seen abutting insular cortex with surrounding gliotic changes and another rounded hyperdense mass noted in right temporal lobe (long arrow in a and b). (c and d) Axial postcontrast brain sections showing prominent peripheral enhancement of lesions in insular cortex and temporal lobe (broad yellow arrow in c and d)

Case 2

A 38-year-old man was admitted to the Emergency Department following road traffic accident. He was driving a bike and hit by four wheeler. On presentation, he was oriented but had a persistent headache, and history of unconsciousness and two episode of vomiting just after trauma. His vitals were stable.

NCCT head and spine were done which showed intracranial parenchymal hematoma. A decompressive craniotomy was done. Later the patient was discharged. After 2 years, the patient presented with a complaint of repeated headache. Clinical examination revealed no focal neurological deficit. NCCT followed by CECT of head [Figure 6a and b] was done initially which showed well defined rounded hyperdense lesion in left frontal lobe with peripheral enhancement possibility of foreign body granuloma, resolving hematoma, and abscess were kept as differential diagnosis following CT. To characterize the lesion further contrast enhanced MRI [Figure 6c-e] was done which showed the lesion to be iso- to hypo-intense on T1-weighted images, slightly hyperintense on T2-weighted/fluid-attenuated inversion-recovery image having hypointense rim, blooming on FLASH image. The lesion did not show any restriction of diffusion on diffusion-weighted images (DWI) but showed diffuse enhancement on postgadolinium images. A possibility of by combining MRI and CT findings a likely diagnosis of foreign body granuloma was made.

Discussion

The hemostatic agents used in the various neurosurgical procedure including decompressive craniectomy (as in the present

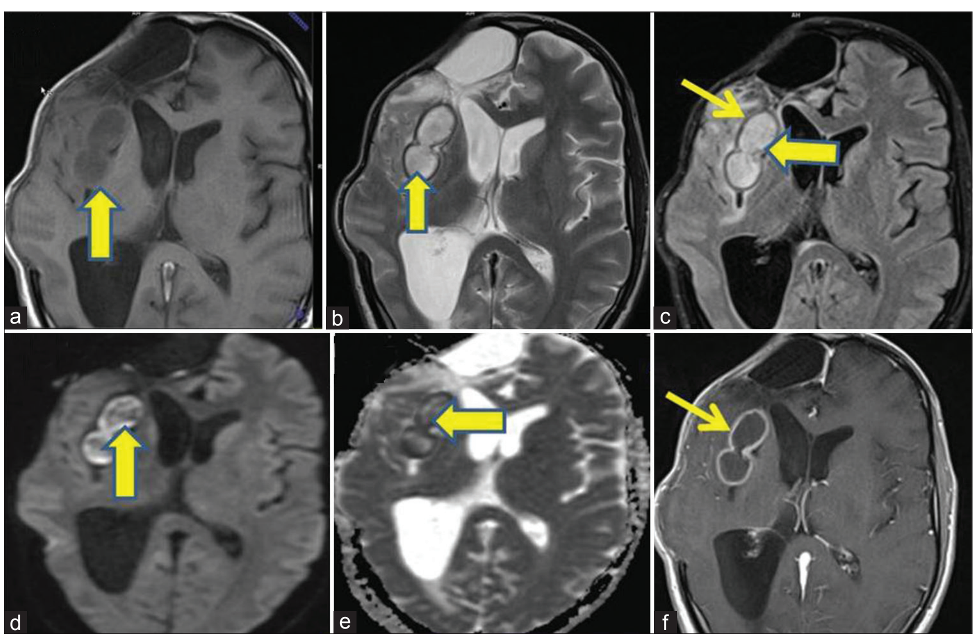

Figure 4: (a) Case 1: Axial T1-weighted image showing two well defined lobulated mass around right sylvian fissure abutting insular cortex (arrow) which is hypo to isointense. (b) T2-weighted axial image showing the hyperintense mass surrounded by hypointense rim. (c) Axial fluid-attenuated inversion-recoveryimage showing hyperintense mass with surrounding hypointense rim (thin arrow) (d and e) diffusion-weighted image at B1000 and ADC. Core of the lesion is not showing restriction of diffusion however surrounding rim shows restriction. (f) Postcontrast image showing peripheral enhancement (thin arrow). The core of lesion is not enhancing

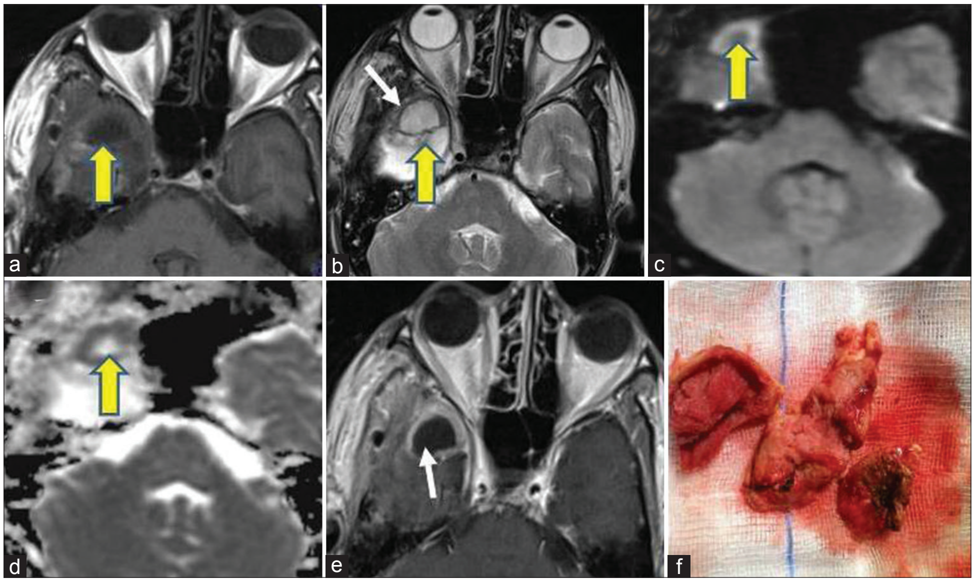

Figure 5: Case 1: (a) Axial T1-weighted image showing another rounded mass in right temporal lobe (yellow arrow) which is hypointense and surrounded by iso- to hyper-intense rim. (b) T2-weighted image shows hyperintense core surrounded by hypointense rim (thin white arrow). (c and d) On diffusion weighted image and corresponding ADC, the core of the lesions does not shows diffusion restriction. (e) Contrast was administered and it shows prominent peripheral enhancement in the lesions (thin arrow). (f) Peroperative image showing gauzoma

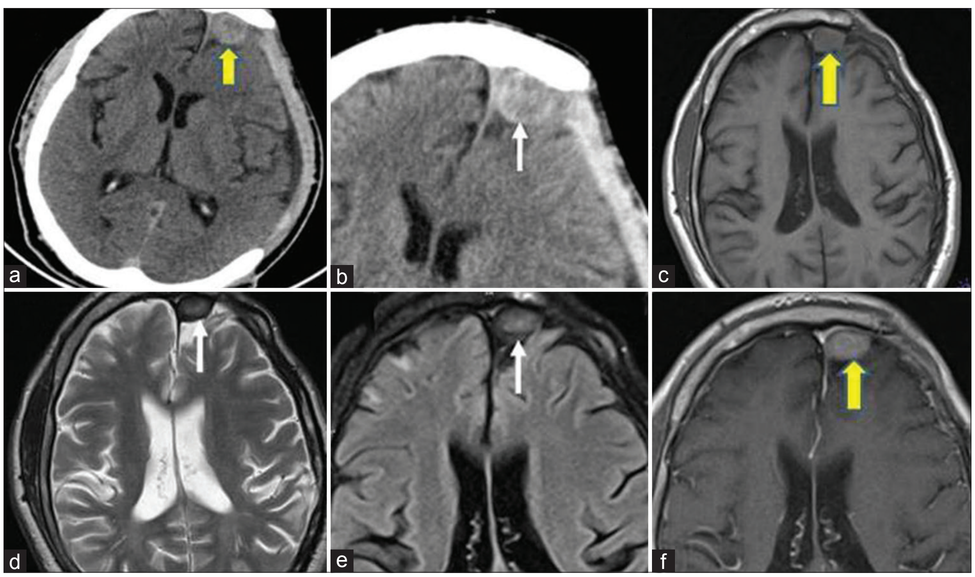

Figure 6: Case 2: Decompressive craniectomy was done for subdural hematoma involving left parietal lobe. Patient complain of memory loss for which computerized tomography followed by Magnetic resonance imaging was done. (a) Noncontrast computerised tomography show rounded hyperdense lesion (yellow arrow) in left frontal location. (b) contrast-enhanced computerised tomography shows prominent periphery enhancement. (c) Axial T1-weighted image of brain shows iso- to hypo-intense lesion in left frontal lobe (d and e) T2-weighted and fluid-attenuated inversion-recovery axial image showing hyper- to iso-intense lesion with surrounding hypointense rim (thin white arrow). (f) Postgadolinium image shows diffuse nodular enhancement (yellow arrow)

case) to achieve intraoperative hemostasis can cause foreign body reactions if left at the surgical site. Various terms have been described in the literature as gossypiboma, gauzoma, textiloma, and muslinoma reflecting the hemostatic materials used.[1]

Silk is used as approximation sutures, and its use has declined over several decades in favor of absorbable sutures.[3] However, in the neurosurgical field, silk is still used for providing temporary traction to control venous bleeding from the surrounding epidural space after opening the dura and it is known to cause serious foreign body reaction.[4] Gelatin sponges, oxidized cellulose, and microfibrillar collagen that induce hemostasis are the other resorbable hemostatic agents used in neurosurgical practice. The majority of reports about granulomas that look like a recurrent tumor or an abscess on.

MRI, is related to cotton and rayon as the source of these reactions[5] Mills and Lininger[6] reported a case of intracranial

Table 1: Imaging findings and differential diagnosis

Lesion	T1	T2	FLAIR	Peripheral enhancement post-GAD	Diffusion restriction	CT	T2 hypointense rim
Abscess	Hypointense	Hyperintense	Hypointense	Present	Present	Hypodense	Present
Resolving hematoma	Hyperintense	Hyperintense	Variable	Present	Can be present	Isodense	Present
Case 1 (gauzoma)	Hypo	Hyper	Hyper	Present	Not present	Hyperdense	Present
Case 2 (gauzoma)	Iso	Iso to hyper	Hyper	Present	Not present	Hyperdense	Present

CT – Computerized tomography; FLAIR – Fluid attenuation inversion recovery; GAD – Gadolinium

"myospherulosis" after instillation of antibiotic ointment into a posttraumatic brain abscess.

These agents left in the central nervous system after operation or other surgical procedure can induce an inflammatory reaction around the surgical site, which could be clinically symptomatic or asymptomatic (depending on material used and time since it was implanted).

Clinically, suture granulomas have been reported several months to 18 years after a variety of procedures.[7] Dzenitis *et al*. reported that foreign bodies may cause granulomas or brain abscesses as late as 31 years after their introduction.[8] Suture granuloma mimicking a recurrent lumber disc herniation was also reported by Ziyal *et al.*[6]

Previous reports of the CT and advanced MR imaging appearance of cotton granuloma are limited, and the MRI findings may include a rim-enhancing collection, which cannot be easily distinguished from an abscess resolving hematoma and other ring-enhancing lesions.[9] It has been suggested that relatively solid hypointensity on T2-weighted images may be helpful for distinguishing muslinomas from an abscess. However, the predominantly high signal on T2-weighted images were also been reported.[8,9]

In our case with the history of road traffic accident and presentation within months possibility of the tumor was ruled out. However, in those patients who underwent surgery for tumors, a differentiating recurrent tumor from foreign body granuloma can be difficult. Other possible differential diagnoses include abscess and resolving hematoma.

MRI findings of the foreign body granuloma are variable on the T1- and T2-weighted images depending on the nature of the hemostatic material used and pathology involved like chronic inflammation, granuloma formation, fibrosis or collagen deposition. However, these lesions invariably show nodular or ring enhancement.

The radiological differentiating features are given below in Table 1 and they are compared with features seen in our two cases.

In both of our cases gauzoma was found to be the foreign body responsible for granuloma formation. In the literature, various authors have found varying appearances of gauzoma as far as conventional MRI imaging is concerned. In our case, the mass showed predominantly hyperintensity on T2-weighted image and hypointensity on the T1-weighted image. The central portions showed few areas of low signal intensity on T2-weighted images that could represent degenerated foreign material and may be helpful in differentiating a gauzoma from a brain abscess.[1] Hypointense rim on T2-weighted images was seen in both the cases that could be due to surrounding fibrosis and chronic inflammation. The surrounding inflammation is also the reason for peripheral enhancement on post contrast image and diffusion restriction on DWI. In the setting of trauma with patient having history of craniectomy, the most important differential diagnosis was an abscess. An abscess could be ruled out as lesion did not show the restricted diffusion of its core that occurs invariably in abscess cavity. The hyperdensity on NCCT and the presence of mild edema were also against the diagnosis of abscess (prominent edema is seen surrounding the abscess).

In nontraumatic setting foreign body reaction may mimic brain tumors/cystic metastases on MRI. However, perfusion MRI as evaluated in one of our case (which showed decrease of relative cerebral blood flow and rCBV) can point towards foreign body granuloma.

The combination of CT and MRI including advanced MRI techniques can diagnose foreign body granuloma (exclude abscess/resolving hematoma/infarct) especially in trauma settings Thus, we can help the surgeon by providing the probable diagnosis so that they can plan preoperatively and manage subsequently thus decreasing the morbidity and mortality.

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Conflicts of interest

There are no conflicts of interest.

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