Case Report

A Large Endodermal Cyst with Xanthogranuloma at the Frontal Skull Base, Slowly Recurring with Hemorrhage

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A 45-year-old man with a past history of the removal of a degenerated hematoma two times presented with general convulsion. Computed tomography (CT) showed a high-density lobular mass growing from the right frontal skull base and occupying the right frontal lobe. Magnetic resonance imaging (MRI) demonstrated a homogeneously hyperintense mass on T_1-weighted imaging and a homogeneously hypointense mass on T_2- and T_2*-weighted imaging. We removed the lesion, which intraoperatively showed a blackish-brown and jellylike mass with machine oil-like fluid. There was a thin and elastic membrane at the boundary between the mass and degenerated brain tissue, and we removed as much of the membrane as possible. On light microscopy, most parts of the mass consisted of a degenerated hematoma with xanthogranuloma, while the thin and elastic membrane revealed one or two layers of non-ciliated columnar epithelial cells based on thin fibrous tissues with microvessels. Immunohistochemical staining showed that these epithelial cells contained periodic acid-Schiff (PAS)-positive granules, and were positive for cytokeratin (CAM5.2), carcinoembryonic antigen (CEA), and epithelial membrane antigen (EMA). Ultrastructural examination showed numerous microvilli at the surface of non-ciliated cells, and an interdigitation-like, dense adhesion structure. On the basis of pathological findings, the patient was considered to have a large endodermal cyst (EC) at the frontal skull base, probably derived from Seessel's pouch. We speculate that EC developed inflammatory changes with xanthogranuloma, which caused further damage to the blood vessels and continuous hemorrhage.

Keywords: endodermal cyst, hemorrhage, Seessel's pouch, xanthogranuloma

Introduction

Endodermal cyst (EC) is a rare congenital cyst made up of epithelium, consisting of mucin-secreting columnar cells with underlying connective tissue. It is usually located ventral to the cervical and thoracic spine.[1–3] Intracranial ECs at the midline of the posterior fossa and anterior brainstem are rare,[1,2) and, moreover, supratentorial EC is particularly uncommon; however, some cases have been reported.[4–16) Fluid in the cysts usually contains various levels of proteins; therefore, T_1-weighted images on magnetic resonance imaging (MRI) show various intensities.[17–20) Partial resection of the cyst wall occasionally induces cyst recurrence.[1,2,12) Here, we describe the first reported case of a large EC with xanthogranuloma at the frontal skull base, which slowly recurred with continuous bleeding. We also discuss the origin of EC and cause of hematoma, showing informative atypical neuroradiological images as well as interesting intraoperative and histopathological findings.

Case Presentation

I. History

A 45-year-old man presented with general convulsion. On arrival at our hospital, his consciousness was clear and neurological examinations demonstrated only right anosmia. When he was 26 years and 29 years old, he had undergone surgery in our hospital to remove a right frontal lobular mass which showed a high density on computed tomography (CT) (Fig. 1a). The previous lesions were believed to have been totally removed; however, lobular cavities still remained (Fig. 1b). The high density mass slowly regrew.

II. Radiological findings

CT on admission showed a bright, high-density lobular mass growing from the right frontal skull base and occupying the frontal lobe (Fig. 1c). MRI demonstrated a homogeneously hyperintense mass on T_1-weighted images (Fig. 1d) and a homogeneously hypointense mass on T_2-weighted images (Fig. 1e). T_1-weighted coronal imaging after the injection of gadolinium contrast medium showed a mass located on the crista galli and cribriform plate without contrast enhancement (Fig. 1f). Cerebral angiography showed neither tumor stains nor abnormal vessels.

III. Operation

We performed a third surgery with bifrontal craniotomy. After opening the dura mater at the surface of the frontal lobe, we found a blackish-brown and jellylike mass with machine oil-like fluid (Fig. 2a, arrow), which was too viscous to remove by suction. Some parts of the mass were like hard stone (Fig. 2b, c; arrow). Because we strongly suspected that the mass was associated with an EC, we removed not only the hard, jellylike mass but also the thin, elastic membrane (Fig. 2a, b; arrowheads) around the mass as much as possible.

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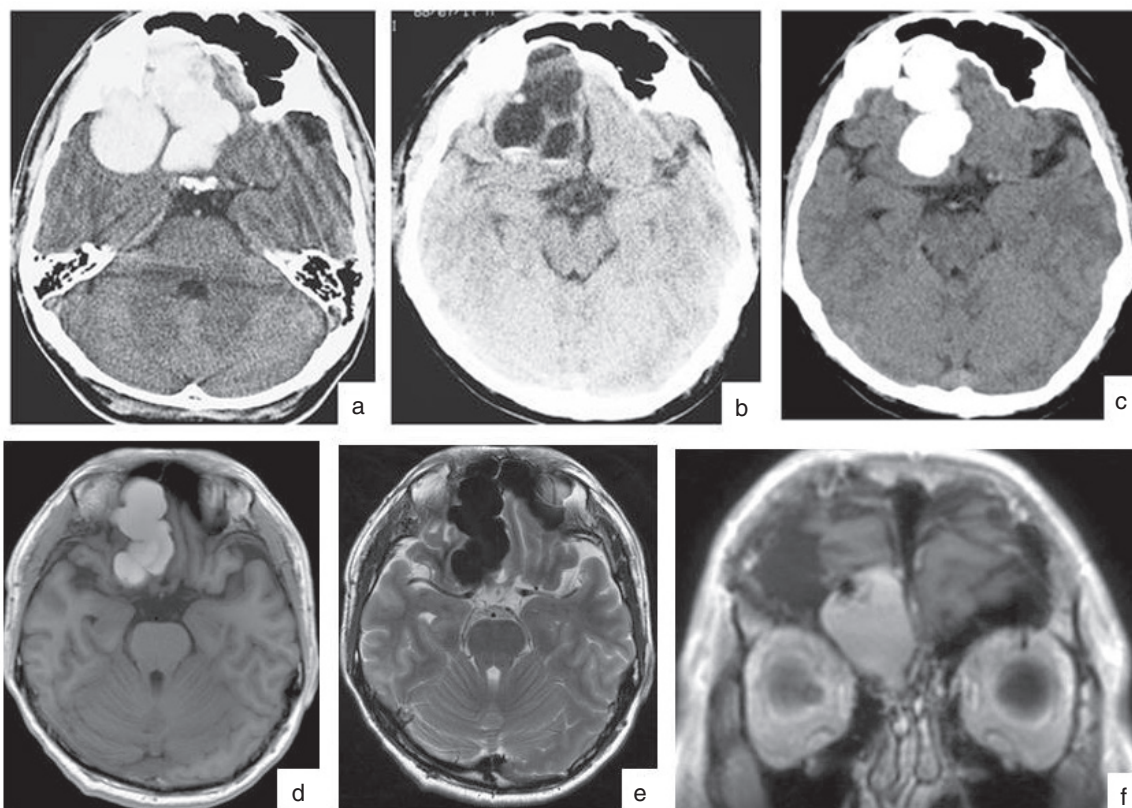
Fig. 1 a: Computed tomography (CT) before the first operation showing a bright, high-density lobular mass growing from the right frontal skull base and occupying the frontal lobe. The right frontal sinus was smaller than that on the left. b: CT after the first operation showing that the high-density mass had almost been removed; however, lobular cavities remained. c: CT before the third surgery, showing recurrence of the high-density lobular mass, which was similar to the mass of the first operation. d: Axial T_1-weighted magnetic resonance image (MRI) demonstrating a hyperintense lobular mass growing from the right frontal skull base and occupying the frontal lobe. e: The lobular masses showed hypointensity on T_2-weighted MRI. f: Coronal T_1-weighted MRI with gadolinium, demonstrating that the mass adhered with crista galli and the cribriform plate of the right frontal skull base and grew upward. No enhanced lesion was visualized.
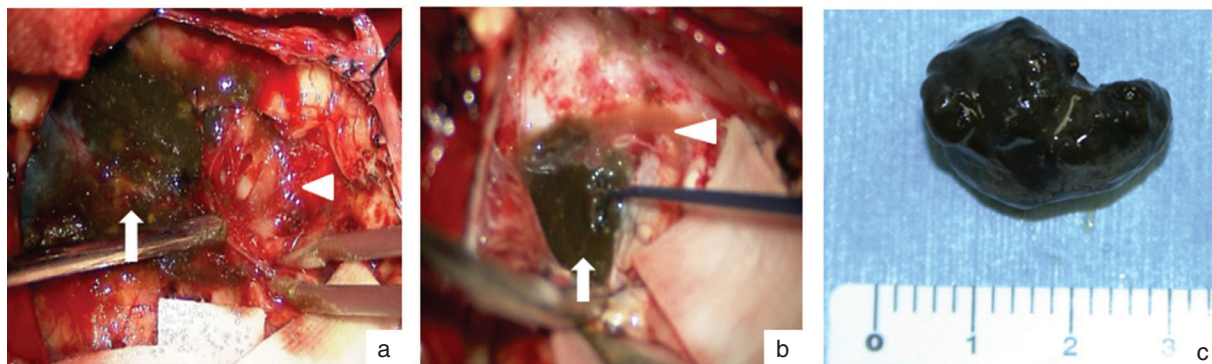

Fig. 2 a: Intraoperative photograph after opening the dura mater showing a blackish-brown and jellylike mass with machine oil-like fluid at the surface of the right frontal lobe (arrow). There was a thin, elastic wall at the boundary between the mass and degenerated brain tissue (arrowhead). b: Intraoperative photograph showing a hard, blackish-brown mass (arrow) at the right frontal skull base covered with a thin, elastic membrane (arrowhead). c: Intraoperative photograph showing one of the pieces of the hard, blackish-brown mass partially removed.

IV. Pathological findings

Histopathological examination of the hard, blackish-brown mass showed that most parts of the mass were a degenerated hematoma with cholesterol clefts (Fig. 3a); however, some parts were xanthogranuloma which consisted of numerous cholesterol clefts surrounded by fibrous tissue, inflammatory cells, and macrophages with hemosiderin (Fig. 3b). Histopathological examination of the thin, elastic membrane revealed that one or two layers of epithelial cells were based on thin fibrous tissues with microvessels (Fig. 3c). With a
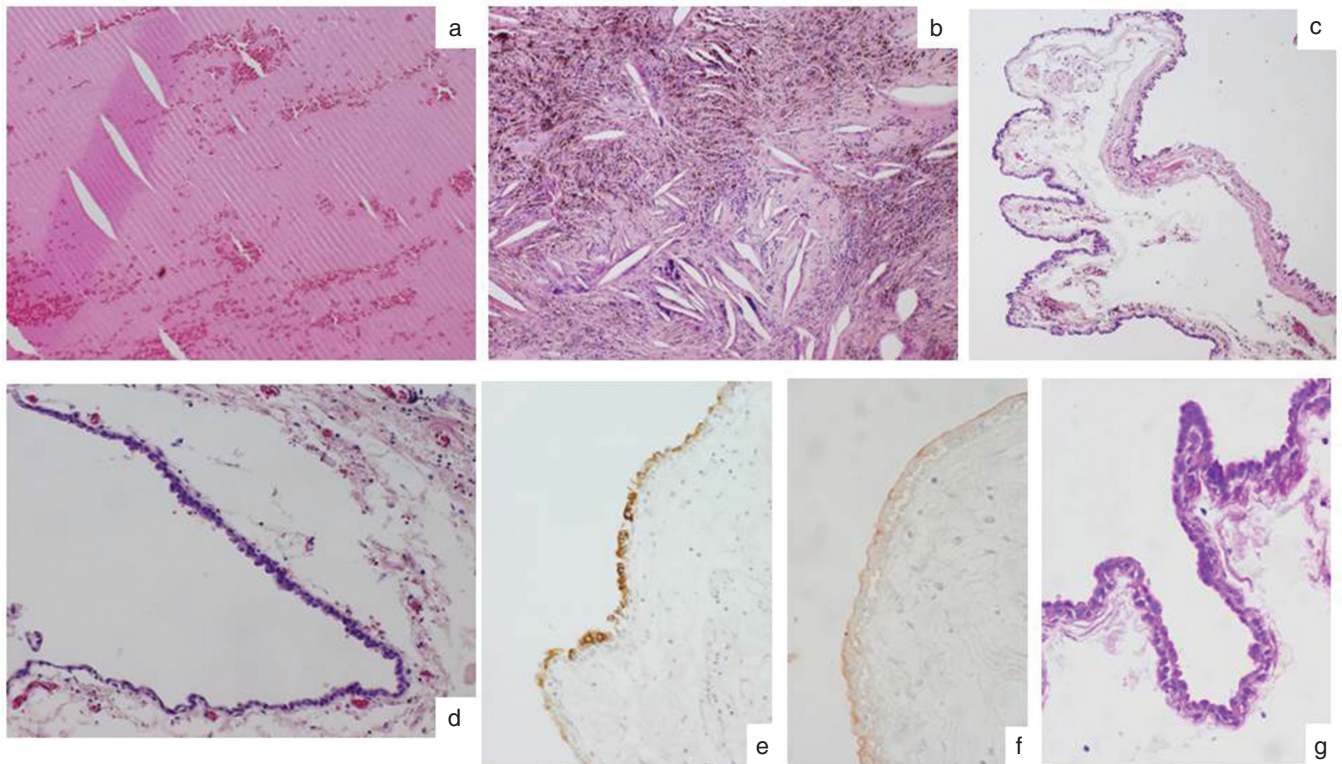
Fig. 3 Histological examination of the hard mass (a and b), and thin, elastic wall (c–g). a, b: Hematoxylin and eosin (HE) stain (original magnification ×100). Photomicrographs of the hard mass showing that most parts were a degenerated hematoma with cholesterol clefts (a); however, some parts were xanthogranuloma which consisted of numerous cholesterol clefts surrounded by fibrous tissue, inflammatory cells, and macrophages with hemosiderin (b). c: HE stain (original magnification ×100). Photomicrograph of the thin, elastic wall showing one layer of epithelial cells based on thin fibrous tissues with microbleeds. d: HE stain (original magnification ×200). Single layer based on the thin fibro-connective tissue which consisted of non-ciliated columnar epithelial cells. e: Non-ciliated columnar epithelial cells were positive for cytokeratin (CAM5.2) (original magnification ×200). f: Non-ciliated columnar epithelial cells were also positive for carcinoembryonic antigen, especially at the surface of epithelial cells (original magnification ×200). g: Photomicrograph of periodic acid-Schiff (PAS) staining showing that most of columnar epithelial cells contained PAS-positive granules (original magnification ×200).

high magnification, one or two layers consisted of non-ciliated columnar epithelial cells (Fig. 3d). Immunohistochemical staining showed that the non-ciliated columnar epithelial cells were positive for cytokeratin (CAM5.2) (Fig. 3e). Carcinoembryonic antigen (CEA; Fig. 3f) and epithelial membrane antigen (EMA) were also positive, especially at the surface of epithelial cells; however, they were negative for glial fibrillary acidic protein (GFAP) and S-100 protein. On periodic acid-Schiff (PAS) staining, most columnar epithelial cells contained PAS-positive granules (Fig. 3g), which showed that these cells produced mucin. No clear goblet cells were found. Ultrastructual examination of this membrane showed numerous microvilli at the surface of non-ciliated cells, and the dense interdigitation-like adhesion structure was well-developed (Fig. 4). Based on these findings, the pathological diagnosis of the cyst wall was EC with xanthogranuloma.

V. Postoperative course

Postoperative CT showed the total removal of the mass and disappearance of lobular cavities. His postoperative
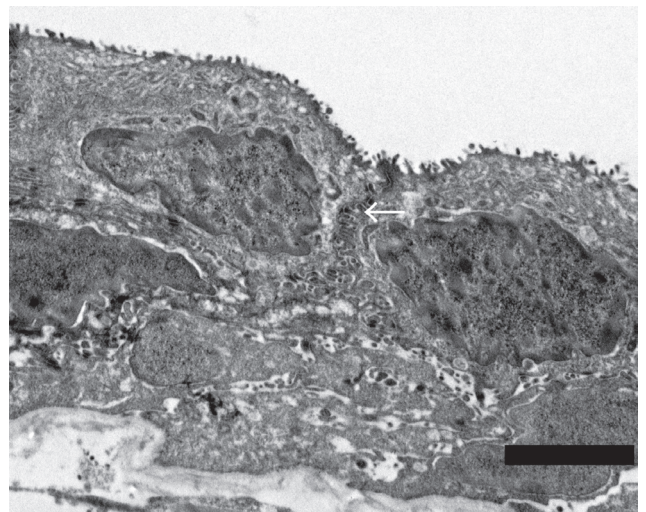

Fig. 4 Electron micrograph showing a dense, well-developed interdigitation-like adhesion structure (arrow) and numerous microvilli. Bar indicates 2 μm.

course was uneventful, and he was discharged without any new neurological deficit. CT and MRI showed no evidence of recurrence of intracranial bleeding at 18 months after the third surgery.

Discussion

Although intracranial ECs are markedly less frequent than those of the spinal canal, the major location of intracranial lesions is the posterior fossa,[1,2] while some supratentorial cases have been reported, such as involving the convexity,[5,7,8,12,15] septum pellucidum,[11,14] third ventricle,[6,16] superior orbital fissure,[10] along the optic nerve,[13] and the suprasellar area.[4,9] ECs are considered to originate from the persistence of endodermal remnants of the notochord during closure of the neurenteric canal in the third week of embryogenesis.[1–3] The rostral part of the notochord is near the mesenchyma forming the clivus. That is why ECs are mainly located in the spinal canal, and sometimes in the posterior fossa, and they are also called neurenteric cysts (NCs);[2,3,5,9,12,13,15,18–20] however, this explanation does not apply to supratentorial lesions like in this case. Graziani et al. reported that supratentorial ECs may arise from a remnant of Seessel's pouch, which is an endodermal diverticulum. It transiently appears as an outpouching of the embryonic pharynx rostral to the pharyngeal membrane and caudal to Rathke's pouch.[9] They suggested that remnants of Seessel's pouch may develop in various locations. For example, a cyst in the sella is called Rathke's cleft cyst (RCC), a cyst in the suprasellar area is called ectopic RCC, and a cyst in the third ventricle is called a colloid cyst (CC). There seems to be no immunohistopathological criteria to distinguish among RCC, CC, NC, and EC. These cysts are considered to show common characteristics with an endodermal origin.[7,9,16] Although supratentorial ECs may arise from ectopic endodermal remnants, their precise origin remains unknown.

Neuroradiological imaging shows variable signal characteristics in ECs. On CT, cysts usually appear as low- to isodense, but are sometimes high-density lesions.[17,20] On MRI, cysts are usually iso- to hypointense on T_1-weighted images, iso- to hyperintense on T_2-weighted images, and show no restriction of water diffusion on diffusion weighted imaging (DWI) without contrast enhancement.[17–20] Usually, the bright signal intensity on T_1-weighted images depends on the high-level contents of mucous in cysts, which differs from the intensity of an arachnoid cyst.[17] In our case, atypical findings of CT and MRI were considered to be due to the concentration of a degenerated hematoma with mucous contents. From the pathological findings, we speculate as follows: minor bleeding from fibro-connective tissue underlying epithelial cells or the disintegration of mucinous fluid produced by epithelial cells may cause chronic inflammation and hemorrhage, and, consequently, xanthogranuloma might occur. A cholesterol granuloma may result in the further damage of blood vessels and continuous hemorrhage in the cyst, leading to a large, growing hematoma.[21] Similar radiological and pathological findings have been reported as xanthogranuloma in the sellar region,[22–25]

which is usually smaller than in this case. Amano et al. reported a correlation between xanthogranuloma and RCC based on pathological examination, and speculated that RCC becomes inflamed, then bleeds, and subsequently degenerates, which induces xanthogranuloma.[22]

Although ECs are congenital anomalies of a benign nature, cysts are known to recur from the residual cyst wall if they are removed partially or only the aspiration of fluid in the cyst is conducted.[1,2,12] Therefore, a complete cure is important to remove as much of the cyst wall as possible.[1,2,12] In this case, two incomplete removals of the cyst wall led a gradual recurrence of the cyst with hematoma. Inexperienced surgeons might not be aware of the origin of hematomas or the accurate pathological diagnosis of this lesion, because this EC showed atypical neuroradiological features with continuous bleeding. We were aware of the possibility of this lesion being an EC before the third surgery. Although we removed as much of the cyst wall attached to the degenerated brain tissue as possible, we remain doubtful of the complete removal of the large cyst wall at the third surgery. We suggest that this patient should be followed-up periodically. We recommend that surgeons become aware of this rare type of EC with hematoma.

Conflicts of Interest Disclosure

None of the authors have any conflict of interest in this article. All authors who are members of The Japan Neurosurgical Society (JNS) have registered an online Self-reported COI Disclosure Statement Form through the website for JNS members.

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