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CASE-BASED UPDATE

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Epidermoid cyst of the brain stem symptomatic in childhood

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Abstract *Background:* Epidermoid cysts may remain asymptomatic for a long period of time due to their slowly growing pattern corresponding with the normal human skin turnover time and due to soft and light cyst content. They do not cause compression of neural and vascular structures initially that is why almost all of the cases in the literature are diagnosed during adulthood. *Methods:* We report here an epidermoid cyst in childhood, which was located in the medulla oblongata, unusually and atypically with liquefied cyst content. The liquefaction may occur due to an intrauterine or early childhood infection. The reported case also suffered previously a severe respiratory infection. Although the cyst is located in and around a highly eloquent neural area, plasticity of the brain stem prevented neurological deterioration due to this very slow growing extraaxial mass lesion. The ordinary cyst content found in the center of the cyst cavity during the operation suggested that the same ordinary material, which was previously at the periphery, ran to get liquefied in time. *Conclusion:* We suggest that the symptoms of this present case appeared very early due to liquefaction of the cyst content with compression and displacement of the brain stem caudally. The recent infection process may predispose the pathological condition.

Keywords Brain stem · Bulbus · Childhood · Epidermoid · Epidermoid cyst · Liquefied · Medulla · Medulla oblongata

Background

Introduction

Years ago, epidermoid tumors were first called due to their "mother of pearl appearance" as the "tumeur perlee" by French pathologist Cruveilhier and were defined as the "most beautiful of all tumors" [9]. The incidence of these tumors is between 1 and 2% of all intracranial mass lesions [6, 7, 19, 22, 31, 39]. Most of the cases are symptomatic during adulthood, and the age of presentation usually is in the fourth decade of life [39]. Some of the cases had been asymptomatic and diagnosed incidentally [13, 19]. There are very few cases diagnosed during childhood [4, 6, 24, 25, 40].

The usual location is parasellar region and pontocerebellar angle [1, 3, 27, 39, 41]. Other common locations are sylvian fissure, suprasellar region, cerebral [18, 29, 43] and cerebellar hemispheres [18, 32, 43], and lateral and fourth ventricles [12, 14, 18, 32, 39, 42, 43]. Posterior fossa epidermoid cysts usually arise in the lateral subarachnoid cisterns [3, 28, 43], and those located in the brain stem are rare [6, 15, 22, 25, 28, 40]. Tumors located in the medulla are even more rare [15, 28, 29, 36, 37, 40, 44]. As far as we know, there are only 17 cases of epidermoid tumors reported in the literature [4, 15, 20–22, 24–29, 35, 37, 40, 44] (Table 1).

These maldevelopmental lesions contain classically waxy and pearly white material composed of desquamated keratin, cholesterol crystals, and cellular debris. The

Table 1 Relevant literature review of brain stem epidermoid tumors

No.	Authors	Year/reference no	Age/sex	Location	Cyst content	Surgical resection	Recurrence
1	Bhatia et al.	1978 [4]	3.5/M	Pontomedullary	Nm	Subtotal	Died
2	Leal and Miles	1978 [25]	3.5/F	Medullary	Nm	Subtotal	Died
3	Schwartz and Balentine	1978 [35]	14/F	Pons	Nm	Subtotal	Died
4	Weaver and Coulonn	1979 [40]	1/M	Pons	Nm	Subtotal	Nm
5	Ogawa et al.	1985 [29]	38/F	Pontomedullary	Nm	Subtotal	Died
6	Guy et al.	1989 [20]	25/F	Pons	Nm	Subtotal	Nm (2 years)
7	Iihara et al.	1989 [21]	32/M	Pons	Yellowish flaky	Subtotal	Nm
8	Obana and Wilson	1991 [28]	27/M	Pons	Nm	Subtotal	Nm (1 year)
9	Obana and Wilson	1991 [28]	27/F	Pontomedullary	Putty-like	Total	Nm (3 years)
10	Obana and Wilson	1991 [28]	37/M	Pontomedullary	Flaky-like	Subtotal	Nm (8 years)
11	Fournier et al.	1992 [15]	14/M	Pontomedullary	Nm	Subtotal	Died
12	Radhakrishnan et al.	1992 [30]	13/F	Pontomedullary	Nm	Post-mortem diagnosis	Nm
13	Yoshizato et al.	1996 [44]	69/F	Pons	Pearl-like flaky	Subtotal	Nm (2 years)
14	Kuzeyli et al.	1996 [24]	2/M	Pons	Nm	Subtotal	Nm
15	Malcolm et al.	1996 [26]	25/M	Pontomedullary	Creamy fluid	Total	Nm (1 years)
16	Sinha	1999 [37]	37/F	Pons		Subtotal	Nm
17	Kachhara et al.	2000 [22]	55/M	Medulla	Pearly white	Total	Nm (9 months)
18	Caldarelli et al.	2001 [6]	1.5/F	Pontomedullary	Whitish	Gross total	(+) (18 months)
19	Present case	2004	5/F	Medulla	White-milky fluid	Gross total	In follow up

Nm Not mentioned

typical cyst content is cheesy and flaky white and soft and putty-like. As to our knowledge, there is no reported case of an epidermoid tumor with liquefied cyst content.

Pathogenesis

Epidermoid cysts are slow growing tumors and develop from inclusion of epidermal elements during closure of the neural groove between the third and fifth weeks of embryonic life. There is a lateral preference due to proliferation of multipotential embryonic or transplanted epithelial cell remnants moved with migration of otic vesicles or developing neurovasculature [12, 43]. Median location of the epidermoid tumors which is usually typical for dermoid tumors occurs with separation of neuroectoderm from the cutaneous counterpart. Iatrogenical occurrence following serial subdural taps was also reported [16]. Multiplicity is very rare [29].

Epidermoid tumor fills the subarachnoid space before displacing the neural and vascular structures. Enlargement of the tumor is due to accumulation of breakdown products of desquamated epithelial cells. Keratin and cholesterol accumulate in the subarachnoid space and give the milky-white or pearly appearance. Caldarelli et al. [6, 7] reported that the cyst content may appear as a milky fluid at the surgery, although no one in their reported cases showed this pattern.

The tumor extends from the cisternal space into the brain stem and is usually demonstrated as an exophytic lesion in the pons and medulla. The brain stem parenchyma may cover the cyst content in time and may give the appearance that the lesion is endophytic. Additionally, the intraaxial location of epidermoid cysts was denied by some authors. It was stated that the endophytic location should be attributed to the progressive invasion and splitting of the brain stem brought about by the growth of ectodermal remnants primarily developing around the basilar artery [6, 28].

Clinical presentation

These very slowly growing congenital lesions tend to be symptomatic in adulthood. They may be associated with cutaneous lesions such as dermal sinus [39]. The neurological symptoms depend on the location of the epidermoid tumor. Recurrent episodes of aseptic meningitis after spontaneous rupture or leakage of cyst content may be another type of clinical presentation [20, 25, 26, 35]. On the other hand, due to the plasticity of the neural architecture, these slowly growing lesions may stay silent or present with minor symptoms, although there may be severe radiological compression of important neural structures.

Evaluation and management

Magnetic resonance imaging (MRI) scan is the best modality for the diagnosis of epidermoid cysts. On T1-weight-

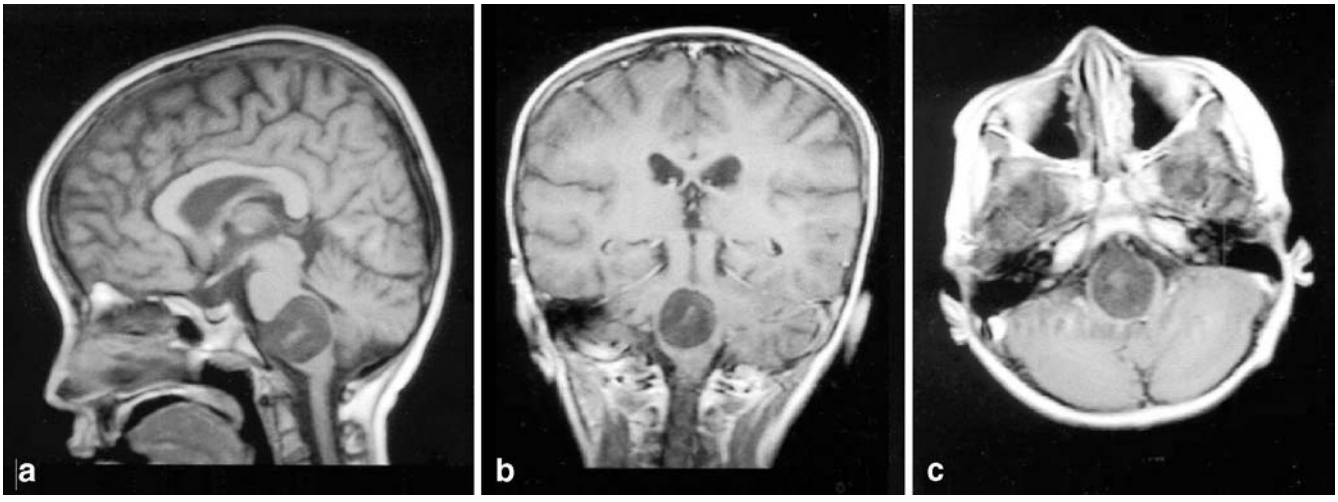

Fig. 1 Preoperative sagittal (**a**), coronal (**b**) and axial (**c**) MRI scans of a 5-year-old female demonstrated a round mass lesion in medulla oblongata. Perioperatively, shortly after midline medullotomy, a white-milky fluid drained from the lesion cavity. There was also some ordinary epidermoid cyst content in the center of the lesion cavity which can also be recognized on the preoperative MRI scans

ed scans, the tumor usually is hypointense, an intensity that is intermediate between the brain and the cerebrospinal fluid (CSF), with no contrast enhancement [10, 22, 23, 38]. If contrast enhancement occurs, it is usually at the margins of the tumor [43]. On T2-weighted images, they are usually hyperintense without having peritumoral edema. If the MRI scan reveals CSF-like signal of the cyst, diffusion-weighted imaging studies will differentiate the epidermoid cyst with restricted diffusion from an arachnoid cyst [6]. On computed tomography (CT) scan, the tumor appears hypodense or isodense or sometimes spontaneous hyperdense due to protein, lipid, calcium, and hemosiderin content [5]. On operated patients, cholesterin crystals are clues of capsule remnant. Calcification may be present; however, it is more prevalant in dermoid tumors. Sometimes, the neuroradiological findings may be atypical and misleading [6]. The differential diagnosis should be performed with arachnoid cysts, dermoid tumors, lipomas, and cholesterol granulomas [10, 23, 39, 43]. Although teratomas are neoplastic lesions, they may also include epidermoid component, and both lesions may appear simultaneously in the same patient [39, 42]. There are cases in the literature where the diagnosis could be performed only after autopsy.

Some cases of epidermoid cyst may undergo spontaneous remission with two different mechanisms. The first one is tumor decompression due to the leakage of the cyst content into the subarachnoid space or CSF pathway. In time, occurrence of local arachnoiditis may prevent this drainage, and the neurological symptoms may reappear [39, 41]. The second mechanism is the spread of the cyst content to subarachnoid spaces with slow growth, which does not cause any significant compression of the neurovascular structures. On such cases, the CSF flows through perivascular interstices [14, 39].

These tumors should be removed as radical as possible without risking the patient's neurological status. Although

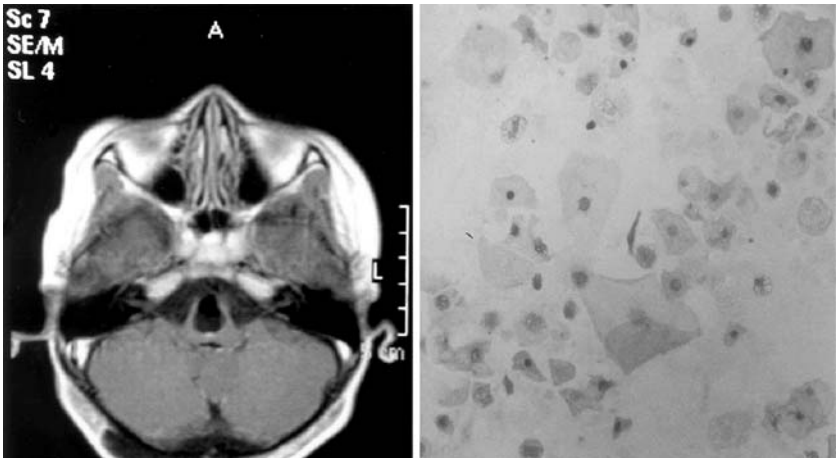

Fig. 2 **a** Postoperative axial MRI scan of the patient demonstrated gross total removal of the mass lesion. **b** Histopathological examination of the material revealed the epidermoid cyst, including desquamated uniform superficial and intermediate squamous cells with abundant cytoplasm, demonstrating varying degrees of keratinization (May-Grunwald Giemsa, ×400)

the cyst content can be removed easily [28], radical removal with the germinative layer is not always possible because it is usually adherent to important neural and vascular structures. Especially, for brain stem epidermoid cysts, simple aspiration or subtotal excision of the tumor may be performed. Of all reported 18 cases of brain stem epidermoid cysts in the literature, six patients died due to the postoperative progressive deterioration [4, 15, 25, 29, 30, 35].

It was reported that neither type of excision nor preoperative tumor size has significant incidence on prognosis [39]. Postoperative aseptic meningitis occurs due to incomplete excision of the cyst capsule and spillage of the cyst content to the subarachnoid space during the operation. The incidence of this complication in different series changes between 2 and 50% [14, 19, 33, 39, 41, 45]. Irrigation with hydrocortizon solution perioperatively and administration of dexametasone postoperatively may avoid occurrence of an aseptic meningitis [3, 31, 33, 39, 41, 43].

The recurrence rate is between 1 and 54% and may be avoided to devitalize the remnant of capsule fragments during the operation [3, 31, 33, 34, 41, 43]. The growth rate of an epidermoid tumor is one generation per month, which corresponds with the turnover time of normal human skin. For a single cell remnant, the time of recurrence is equal to the patient's age at that time of the resection plus 9 months [2, 43]. Reoperation should be performed when the patient becomes symptomatic again, because no dissection plan between the capsule and the arachnoid may be present during the second operation. The reoperation is usually performed for decompression. Malignant degeneration for recurrent epidermoid tumors is also reported [8, 11, 17, 27, 33].

Illustrative case

A 5-year-old female with progressive dysphagia, diminished gag reflex, and hoarseness was admitted. Three months ago, she suffered a severe respiratory system infection and sinusitis, and at that time, she was hospitalized for a month. Neurological examination revealed moderate IX, X, XI, and XII nerve palsies, and MRI scan demonstrated a round mass lesion in the medulla oblongata (Fig. 1). Actually, the tumor was insinuating itself from the premedullary cistern into the medulla. The patient was operated with a suboccipital craniotomy. Shortly following midline medullotomy, a white-milky fluid drained from the lesion cavity. There was also some ordinary epidermoid cyst content in the center of the lesion cavity. This material was also removed. Postoperative MRI scan demonstrated gross total removal of the mass lesion (Fig. 2a). Histopathological examination of the ordinary material removed from the center of the lesion revealed an epidermoid cyst (Fig. 2b). Several days after the operation, the patient's lower cranial nerve palsies gradually improved.

Conclusion

Speculations may be obtained about the liquefaction mechanism of epidermoid cyst content. It might depend on severe infection process, which occured shortly before the clinical presentation. The absence of drainage in this liquefied cyst content may cause symptoms. The disturbance on the vascular supply of the cyst due to any reason may be another mechanism.

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