Intracranial epithelial cysts

Report of two cases

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The authors report two cases with large unilocular intracerebral epithelial cysts. Diagnosis was facilitated in both patients by computerized tomography (EMI scanner). The clinical and diagnostic aspects of previously reported cases are reviewed, and the etiology and pathogenesis of these cysts discussed.

Key Words • ependymal cysts • intracerebral epithelial cysts • neuroepithelial cysts • computerized tomography

Non-neoplastic cysts lined by cells which morphologically resemble epithelium occur in the central nervous system. The commonest example is the "colloid" or neuroepithelial cyst related to the ependymal lined cavities of the brain and spinal cord. Less often epithelial cysts are found intracerebrally, related to the intracranial subarachnoid spaces, or within the spinal canal.

We are reporting the findings in two patients with intracerebral epithelial cysts. The exact nature of these lesions has usually been unsuspected before surgical exploration or necropsy. We found computerized tomography with the EMI scanner of considerable diagnostic assistance in both our patients, as it was possible to identify the presence of a fluid-filled cyst prior to operation.

Case Reports

Case 1

This 38-year-old man was first admitted to the National Hospital in 1964 with a 6-month history of right-sided focal epilepsy; he had also noted weakness of the right arm and face prior to admission.

First Admission. The patient had a mild right hemiparesis. The sensory and visual systems were normal. There was no evidence of raised intracranial pressure. Skull films and an isotope brain scan were negative. A left carotid arteriogram showed a parietal mass lesion.

First Operation. When the dura was opened at craniotomy a thin-walled cyst containing slightly milky fluid ruptured. The cyst was lined by smooth cerebral tissue containing tortuous vessels. A firm postero-
inferior plaque was biopsied. It was found to be membranous and microscopically it consisted of congested glial tissue lined by pseudostratified columnar cells. The cells had ovoid nuclei containing finely granular chromatin and opaque homogenous cytoplasm. A continuous thin basement membrane lay between the lining cells and the glia. The cyst fluid contained 45 mg/ml of protein. Postoperatively the seizures were controlled by anticonvulsants and the hemiparesis improved.

Second Admission. He was readmitted to this hospital in 1974. For over 2 years the right focal seizures had increased in frequency and were occasionally accompanied by loss of consciousness. The right-sided weakness had recurred. On examination he had a dense right hemiparesis with sensory loss. Intracranial pressure was not raised clinically. Skull films showed the previous craniotomy but were otherwise normal. An isotope brain scan was negative. The EMI scan (Fig. 1) showed a well-defined, smoothly contoured cyst, 5.5 cm in diameter, in the left posterior frontal and parietal region. The x-ray absorption values of the lesion were only slightly greater than those of cerebrospinal fluid. The
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lateral ventricles and pineal body were displaced to the right, and the left ventricular trigone was depressed.

**Second Operation.** At re-exploration a cyst containing 70 ml of brown turbid fluid was found. Tissue lining the cyst was smooth and contained a calcified plaque. The wall was biopsied, and a communication between the cyst and the left lateral ventricle was fashioned. The two small cyst wall fragments obtained at biopsy microscopically resembled the first biopsy, though collagen now separated the basement membrane and the glia. There were a few lymphocytes surrounding vessels in the latter. Many of the epithelial lining cells contained yellow cytoplasmic granules with the staining properties of lipofuscin. A few cells showed apical cilia (Fig. 2). The cyst fluid had a protein content of 500 mg/100 ml. Postoperatively there was considerable resolution of the hemiparesis and anticonvulsant therapy controlled the seizures.

**Case 2**

This 22-year-old previously healthy man was admitted to the National Hospital in 1974, because of eight right-sided focal seizures over 36 hours, followed by right-sided weakness and some speech difficulty.

**Examination.** On examination 9 days later he still displayed a mild right hemiparesis. There was no sensory or visual system defect and no evidence of intracranial pressure. Skull films and an isotope brain scan were negative. A left carotid arteriogram demonstrated an avascular mass in the left frontal lobe. The EMI scan (Fig. 3) showed a spherical, low density lesion in the left frontal lobe; it had a smooth, clearly defined margin, and measured 6.0 cm in the anteroposterior plane and 4.0 cm transversely. The x-ray absorption values resembled those of cerebrospinal fluid. The anterior segments of both lateral ventricles were displaced to the right, and the left trigone was displaced posteriorly. These features indicated the presence of a fluid-filled cyst.

**Operation.** A left frontal craniotomy was performed. Frontal cerebral convolutions appeared widened and flattened, and a cyst was found posteromedially. The thin superficial cyst wall resembled arachnoid and was firmly attached to the underlying brain.

Smooth cerebral tissue lined the deeper part of the cyst. A communication was made into the left lateral ventricle. The slightly turbid fluid filling the cyst had a protein content of 11 mg/100 ml. Postoperatively the neurological abnormalities resolved. Two small specimens from the cyst wall microscopically showed dense collagen lined by cuboidal or low columnar cells. The cells had round nuclei containing finely granular chromatin and opaque eosinophilic cytoplasm. Most had apical cilia. In a few fields the cyst wall was folded, and a few short tubules lined by similar epithelial cells were seen in surrounding connective tissue (Fig. 4).

**Discussion**

Epithelial cysts related to the subarachnoid space have been reported in the parasagittal region, about the Sylvian fissure, and in the basal subarachnoid cisterns and posterior fossa. Intracerebral examples have been found chiefly in the cerebral hemispheres, although they have also been reported in the thalamus, quadrigeminal plate, and cerebellar vermis. Most intracerebral epithelial cysts presented in adult life and were unilocular,
FIG. 3. Case 2. A smoothly marginated, spherical low density mass is present in the left frontal lobe. A faint rim of slightly increased density can be seen on its medial aspect, and is probably due to compressed cerebral tissue. The left frontal horn is attenuated and the left trigone displaced posteriorly. Despite the size of the cyst, the degree of lateral ventricular displacement from the midline is slight.

though multiplicity was reported by Argyopoulos and Heppner,1 and by Rand, et al.,25 the latter in two infants. The predominant overall incidence was in females. Symptoms had usually been present for months, or even years. Presenting signs were variable, but usually led to the diagnosis of a space-occupying lesion. Some patients had evidence of raised intracranial pressure, and seizures and hemiparesis were common. Three cysts were not found until necropsy, two having been previously diagnosed as intracranial neoplasms, the third as due to cerebrovascular disease.3 Plain skull films and isotope brain scan were usually normal, whereas the EEG was often focally abnormal. Pneumoencephalography indicated a mass lesion in some cases, and in the children reported by Rand, et al.,25 the cysts were filled with air and so were more precisely outlined. Angiography indicated an avascular mass lesion in most cases. Computerized tomography, which has proved valuable in the diagnosis of intracranial tumors,7,13,28 generally allows the identification of fluid-containing cysts preoperatively. In both our cases this prediction was made and the possible benign nature of the lesion was indicated.
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The treatment of epithelial cysts has usually involved surgically creating an opening into the subarachnoid space or the ventricular system. Recurrence of the cyst has been reported when this method was used, often delayed for many years, as in our first case.

The origin of epithelial cysts related to the central nervous system is still debated. It is generally thought that they result from a developmental defect, the postulated primary event being the displacement of ependyma into the cerebral substance or the subarachnoid space. The ectopic cells would act as a nucleus for later cyst production. Various suggestions have been made about possible mechanisms whereby ependymal displacement is effected; these include an anomaly of mantle layer formation with displacement of ependyma into the subarachnoid space, pinching off of a ventricular diverticulum with isolation of an ependymal-lined pouch in the cerebral substance or differentiation of spongioblastic cells into ependyma about a primary encephaloclastic intracerebral defect occurring in early fetal life. Heterotopic glial nests, some containing ependymal lined canals, are reported in the subarachnoid space and bear some relationship to other developmental defects of the central nervous system. Islands of ependymal cells are also sometimes seen about the ventricular system, especially about the ventricular angles and the aqueduct. Such heterotopic cell nests may provide evidence that the postulated displacement may occur.

The epithelial lining cells of the intracerebral and extracerebral cysts have a varied morphology. They may be single or multilayered, cuboidal or columnar, and can contain cilia and cytoplasmic vacuoles. A subcellular basement membrane was seen in the case of Ghatak, et al., and in our second case. Because of their morphology the epithelial cells have often been thought to be ependymal in type, though uncommonly they show structure formation reminiscent of choroid plexus. Though cilia are found in the ventricular ependymal cell, they may also occur in the “Rathke’s cleft cyst” of the pituitary gland and in intracranial teratomatous cysts. Ciliated cells do not therefore prove that the cysts are of ependymal origin. Reporting on the electron microscopic characteristics of an intracerebral cyst, Ghatak, et al., concluded that the cells had morphological similarities with normal choroid plexus and ependyma, both derivatives of primitive neuroepithelial cells. Shuangshoti, et al., reviewed epithelial cysts and their relationship to ependyma and the choroid plexus. They suggest that all such cysts, whether related to or separate from the ventricles or the central canal of the spinal cord, are neuroepithelial in origin. They postulate that folding of the primitive neuroepithelium in the developing ventricles or central spinal canal leads to intraventricular or intramedullary projections. If the latter are pinched off an intramedullary cyst may develop, and the former may give rise to the more common, intraventricular, “colloid” or neuroepithelial cyst. They recognize that glial heterotopia may provide an additional origin for some cysts.

The cause of continued cyst expansion is unknown. Jakubiak, et al., postulated that a high protein content in the cyst fluid might attract further fluid from the surrounding tissues. The fluid protein content is very variable, as seen with the values of 45 and 500 mg/100 ml at the first and second operations.
in Case 1 of this report. In some cysts cell vacuoles have been seen, suggesting a secretory activity. The progressive symptoms and raised intracranial pressure in some patients is evidence of continued fluid accumulation. Ghatak, et al.,8 noted pino
cytotic vesicles in the epithelial cells, possible representatives of active cellular fluid transport. Further electron microscopic studies may throw light on the origin of these
cysts, and the fluid they contain.

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