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Pneumosinus Dilatans and Arachnoid Cyst: A Unique Association

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Summary: The authors describe two patients in whom pneumosinus dilatans was associated with arachnoid cysts.

Index terms: Paranasal sinuses, abnormalities and anomalies; Arachnoid, cysts

Focal expansion of a paranasal sinus, "pneumosinus dilatans," is a relatively rare condition that can occur separately or in association with other conditions (meningioma, mucocele, fibrous dysplasia, acromegaly). We wish to report two cases uniquely linking pneumosinus dilatans and arachnoid cyst.

Case 1

A 35-year-old female nurse presented with an 8-month history of headaches often precipitated by valsalva type maneuvers. The patient occasionally experienced tingling in her face and left arm associated with several episodes of blurred vision. The neurologic exam was normal as was the electroencephalogram. Plain skull films showed asymmetric pneumatization of sphenoid sinus (Fig. 1A). Computed tomography (CT) scan in the axial plane showed a large extra-axial lesion of the left hemisphere (Fig. 1B) showing mass effect. Magnetic resonance (MR) imaging in the coronal imaging plane at T1-weighting (800/20/1) showed a large arachnoid cyst of the left anterior and middle cranial fossa and ballooning of the adjacent sphenoid sinus into the lesion (Fig. 1C). A far smaller arachnoid cyst of the right temporal lobe tip was also noted. An arachnoid cyst of the left hemisphere was confirmed surgically at the time of placement of cystoperitoneal shunt.

Case 2

A 37-year-old male firefighter was admitted for evaluation of an osteolytic lesion found on a routine dental x-ray series. CT scan including 3-mm coronal views of the sinuses showed a bone destructive soft tissue lesion of the left maxillary sinus floor (Fig. 2A). These same coronal images showed marked dilatation of the left side of sphenoid sinus and a low-density left middle cranial fossa lesion confirmed on axial CT slices (Fig. 2B). A left temporal craniotomy was first performed, confirming the presence of large arachnoid cyst. Communication between the subarachnoid space of the basal cisterns and the arachnoid cyst was surgically established. The patient later underwent radical left maxillectomy, where adenoid cystic carcinoma of the maxillary antrum was found.

Discussion

The term "pneumosinus dilatans" was first introduced (1918) by Benjamin (1) who used it to describe a rare condition characterized by expansion of a paranasal sinus that contains only air. Since that first report, many subsequent cases have appeared in the literature (2, 3).

The frontal sinus is most often affected, although occasional cases have been reported to involve the ethmoid and sphenoid sinuses as well (4, 5). Several hypotheses have been advanced to explain the cause of these lesions, including an aerobic infection, sequela of spontaneously emptied mucocele (6), intrasinusal hypertension, and a ball-valve air trapping mechanism.

While Lombardi et al (5) consider pneumosinus dilatans a separate entity, others feel it is reactive to a primary condition such as meningioma, mucocele, fibrous dysplasia, and acromegaly. In the past, there was confusion in the literature concerning the definition of an abnormally large sinus, with the terms pneumocele and pneumosinus dilatans used interchangeably. Som and Bergeron (7) define pneumocele separately, as the sinus walls show thinning, unlike pneumosinus dilatans where the walls are displaced but of normal thickness. We favor the term "pneumosinus dilatans" as being a descriptive term signifying a dilated sinus regardless of etiology (idi-

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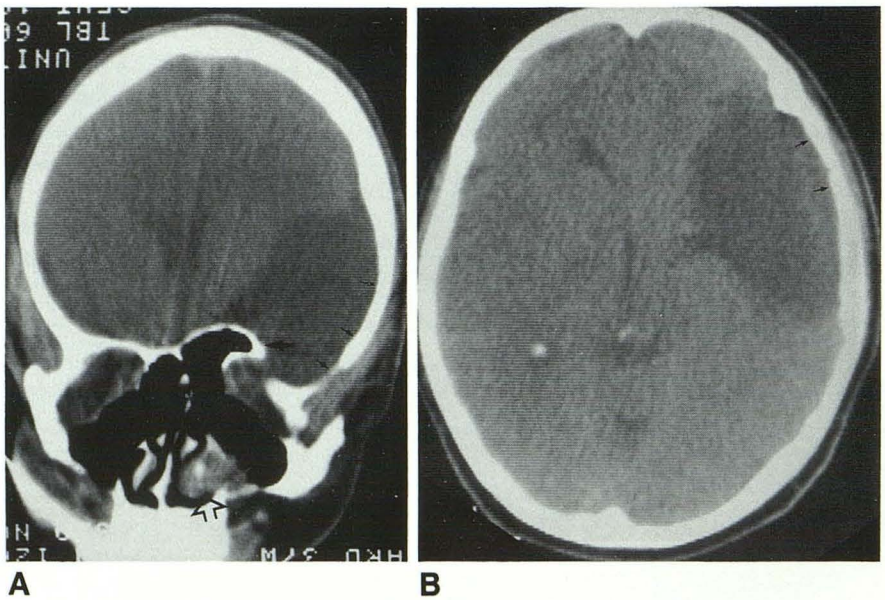
Fig. 1. *A–C*, Plain skull film (*A*) and coronal T1-weighted MR image (*C*) show "ballooning" of sphenoid sinus (*large arrow*). Large arachnoid cyst is seen on CT (*B*) and MR (*C*). Remodeling of the inner table of skull (*B* and *C*) is also seen (*small arrows*).

opathic, ball-valve, etc) and association (meningioma, arachnoid cyst, or no association).

The CT (8, 9) and MR appearances (10–12) of arachnoid cysts have been previously described. The CT criteria include fluid of cerebrospinal fluid (CSF) density, sharply defined margins, absence of calcification, and absence of contrast enhancement. Remodeling of adjacent bone as a manifestation of a slowly expanding process has been reported as an important sign in confirming the benign nature of arachnoid cysts (11).

Many theories as to the pathogenesis of arachnoid cysts have been advanced, with current theories including splitting or doubling of the arachnoid membrane (13) and variations in the condensation of the embryonic meninx primitiva and/or slight variation in CSF flow into the primitive pia-arachnoid during early embryogenesis (14). Robinson's (15) proposal that middle cranial fossa cysts were related to temporal lobe agenesis and that adjacent CSF spaces represented a passive collection has been refuted by many authors (16). While in our cases the expanded sinus seems to fill a void created by the arachnoid cyst, there is remodeling of the skull overlying the arachnoid cyst likely from the pressure of CSF pulsations.

Fig. 2. *A–B*, Coronal and axial CT scans show large left middle cranial fossa arachnoid cyst. Coronal CT slice (*A*) shows dilated left sphenoid sinus (*large arrow*) and left maxillary sinus carcinoma (*open arrow*). Note the remodeling of calvarium adjacent to the arachnoid cyst (*small arrows*, *A* and *B*).



This dichotomy of unilateral sinus enlargement in the face of an adjacent expanding cyst may indicate temporal differences in paranasal sinus development versus when the arachnoid cyst begins to expand. Similarities can be drawn between the homolateral sinus hypertrophy described by Dyke et al in their 1933 article on cerebral hemitrophy (17) and the sinus expansion seen in our two cases.

We favor the term "pneumosinus dilatans" as being descriptive and signifying a dilated sinus regardless of etiology and association. The incidental observation on plain film of asymmetric sinus dilatation may indicate an underlying arachnoid cyst and, therefore, CT or MR should be suggested. Pneumosinus dilatans, when seen with a CSF collection, would indicate its benign nature, confirming the diagnosis of associated arachnoid cyst.

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