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Diffuse Pneumocephalus from *Clostridium perfringens* Meningitis: CT Findings

Pneumocephalus is defined as "the presence of air or gas within the cranial cavity" [1], but no distinction is made between localized and diffuse gas collections. We report a case of diffuse pneumocephalus caused by the gas-forming organism *Clostridium perfringens*. To the best of our knowledge, this is the first demonstration of diffuse pneumocephalus associated with *Clostridium* meningitis and the first publication of the CT findings.

Case Report

A 1-month-old boy was brought to the emergency room by his mother because of increasingly irregular respirations. On physical examination, the baby was hypotensive and his fontanelle was full. A Gram stain of the CSF showed Gram-positive rods. Diffuse pneumocephalus and generalized edema were identified on a nonenhanced head CT scan (Fig. 1). The patient died 6 hr after admission. At autopsy, a thick exudate was found on the brain surface. No abscess was seen on the gross specimen. Histologic examination revealed meningitis, and one section showed encephalitis. Brain culture grew *Clostridium perfringens*.

Discussion

Gas-forming organisms produce pneumocephalus through brain abscesses and meningitis. Excluding cases with a superimposed condition, like surgery or trauma, that can produce diffuse pneumocephalus, abscesses have been reported to produce only a localized pneumocephalus. Similarly, meningitis with a gas-forming organism has been reported to produce a localized pneumocephalus.

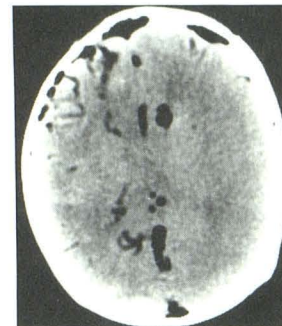
Despite the common occurrence of severe penetrating and non-penetrating head trauma, *Clostridium* meningitis without an associated brain abscess is extremely rare [2-4]. A search of the English literature yielded only 23 documented cases. *Clostridium* meningitis was associated with head trauma in 10 cases [2, 5-10], surgical intervention in five [11-15], gastrointestinal disease in four [3, 16, 17], and genitourinary surgery in one [4]. No focus was mentioned in one case [18], and no septic focus was found in two [19, 20]. One of the two cases with no focus of seeding yielded no organism in the CSF on either Gram stain or culture although the patient had signs and symptoms of meningitis and *Clostridium* bacteremia [20]. No focus of meningeal seeding could be found in our patient either clinically or pathologically.

Only one description of the CT findings of *Clostridium* meningitis has been published [19]. Unfortunately, no CT scans were included in the report, and the only description provided was that no abscess, subdural effusion, or enlarged ventricles were found. A CT scan of a patient with *Clostridium* in the CNS was found [21], but it showed a *Clostridium* abscess. Consequently, the only CT findings to date of *Clostridium* meningitis are the ones in this report: diffuse cerebral edema and diffuse pneumocephalus.

The two patients who had uncomplicated *Clostridium* meningitis with pneumocephalus had multiple gas-containing cysts at autopsy [16]. Neither had a diffuse pneumocephalus similar to that in our patient, although no radiologic studies were performed in either patient. Alternatively, our patient did not show gas-containing cysts either on CT or on pathologic examination.

In conclusion, we add *Clostridium perfringens* meningitis to the differential diagnosis of diffuse pneumocephalus found on a CT scan.

Fig. 1.—Nonenhanced axial CT scan shows diffuse pneumocephalus with gas in subarachnoid space, parenchyma, and ventricles. Indistinctness of gray matter–white matter interface is consistent with generalized edema.



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