Gas-producing Brain Abscess due to Peptostreptococcus

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Abstract

A case of anaerobic streptococcus brain abscess was reported in which the cerebral lesion appeared on CT as a ring-enhanced mass, and gas bubbles were seen following corticosteroid administration without antibiotics. Surgery revealed no encapsulation. Surgical drainage of the cavity and treatment with antibiotics and corticosteroid were ineffective. Excision of the abscess and treatment with chloramphenicol and glycerol were successful.

Key words: brain abscess, gas bubble, peptostreptococcus, corticosteroid, drainage, excision

Introduction

Computer tomographic (CT) differentiation between brain abscess and cystic glioma or metastatic tumor is sometimes difficult, although it is possible if a gas bubble is present in a mass lesion. We treated a patient with a brain abscess in which gas bubbles appeared following preoperative administration of corticosteroid without antibiotics. The brain abscess caused by gas-producing bacilli usually expand rapidly and invariably lead to death if not properly treated.

Anaerobic culture of the drained material in our case yielded peptostreptococcus micros, although it is usually difficult to isolate or identify anaerobic bacteria. Anaerobic bacteria are known to cause tetanus, gas gangrene, and foul-smelling infections. The recent awareness of the significant role of anaerobic bacteria in the brain has resulted in more frequent anaerobic cultures in neurosurgical patients.

Drainage of the abscesses and therapy with antibiotics and corticosteroids were not effective. Surgical excision and administration of antibiotics and glycerol were curative, with residual monoparesis of the right arm. We report our clinical experience with this gas-producing brain abscess because of its rarity, absence of capsule formation at the time of ring enhancement on CT, and questions about the role of steroid therapy.

Case Report

A 38-year-old man was admitted to the department of orthopedics of a local hospital because of weakness of the right leg for one week and one episode of hemoptysis. He was in a good general condition without headache or nausea. His temperature was 36.8°C. There was a monoparesis of the right leg. CT on December 2, 1981, showed a left frontoparietal mass with ring-shaped enhancement, suggesting brain abscess, cystic glioma or metastasis (Fig. 1). He was transferred to another hospital on the same day, following one right-sided convulsive seizure. The white blood cell count was 9,500/mm³ with 6% band forms, 70% N. seg., 4% Eos., 14% Lymph., and 6% Mono. Cerebrospinal fluid pressure was normal and the fluid contained 4 lymphocytes/mm³, glucose 64 mg/dl and protein 36 mg/dl. Various examinations failed to establish any primary infectious or metastatic source.

He complained of headache and weakness of the right hand after a few days. Following treatment with betamethasone, 8 mg/day for three days, but without antibiotics, neurological examination revealed a profound right hemiparesis, dysphasia and some confusion.

CT on December 9, 1981, showed marked edema surrounding a cystic lesion which contained gas bubbles; a ring-like configuration appeared after enhancement with contrast (Fig. 2). The mean absorption value of the gas bubble was $-367 \pm 135.5$ H.U. and that of
the ventricle was 21 ± 9.1 H.U. Brain abscess was therefore diagnosed, and emergency surgery was performed. A left parietal flap was turned down. The frontal and parietal lobes appeared to be increased in volume, edematous and soft. An abscess cavity was entered at a depth of 2 cm. It was filled with foul-smelling brown-yellow purulent material. The contents were aspirated, and the cavity was irrigated with saline containing ampicillin. There was no capsule. A decision was made not to excise, and a soft silicon tube was inserted for drainage.

Smears of the purulent material from the abscess showed Gram-positive cocci, and anaerobic culture grew peptostreptococcus micros. Postoperatively he received gentamycin 60 mg/day and betamethazone 12 mg/day for one week and ampicillin 12 g/day for three weeks until the time of the second operation. By one week, the levels of consciousness and speech were normal, but the right hemiparesis had not improved. After two weeks he started to complain of headache and speech difficulty. CT at that time revealed disappearance of the gas bubble and enlargement of the abscess (Fig. 4). He was operated on again on December 29, 1981. A large volume of yellowish odorless thin pus was aspirated from the cavity, and the abscess capsule was removed. Smears and cultures of the content were negative. Postoperatively, he received glycerol 400 ml/day for one week, chloramphenicol 4 g/day for one week and 1 g/day for 3 weeks, piperacillin 3 g/day for one month and then oral cefoperazone 2 g/day for one more month. He was able to walk within one month and discharged with monoparesis of the right arm. Three months after excision of the abscess, CT showed enlarged ventricles and a left frontoparietal low density area (Fig. 5).

Discussion

Gas-producing brain abscesses are rare except following war wounds or penetrating wounds of the head. Gas in the abscess cavity was reported in one of 300 brain abscesses1,2,18 and in one of 400 brain abscesses in children.91 Clostridium was the usual etiologic agent before the CT-era.27 Even after the introduction of CT, brain abscesses due to gas-producing organisms have been very rarely diagnosed, only once in recent neuroradiologic reports describing 128 cases of brain abscess.8,10,26 We rarely see gas bubbles in CT scans of brain abscesses, although they are described in a textbook on cranial CT.39

Anaerobic streptococci are currently referred to as peptostreptococci, which stain Gram-positive and occur in pairs and chains and do not require fermentable carbohydrate for growth. These bacteria are part of the indigenous microflora of the oral cavity, skin, gastrointestinal tract and genitourinary system and frequent causative agents in practically every type of human infection.3,20

Peptostreptococcus micros is a member of the genus peptostreptococcus which sometimes causes beta-hemolysis and may or may not produce gas. This peptostreptococcus acts in synergism with bacteroides or staphylococcus aureus to produce necrosis in infection.3,20

Recently, the organisms responsible for 347 brain abscesses were reported to be Gram-positive in 109, Gram-negative in 82, other in 10, multiple in 30, and negative in 116.41 None of the Gram-positive organisms in this series were anaerobic streptococci. However, of 100 patients with brain abscess or subdural empyema in van Alphen's series, eight had mixed cultures of anaerobic organisms,37 and non-hemolytic anaerobic streptococci were identified in four of 25 cases of cerebellar abscess.32

In 1963, Heineman and Braude14 reported anaerobic bacteria in 16 of 18 consecutive cases of brain abscess, and peptostreptococcus was present in 12 of them. More recently, Briody3 and Finegold11 stated that anaerobic bacteria are responsible for most brain abscesses. Many abscesses are due to mixed infections with both anaerobic and aerobic organisms,14,41 and this fact may be true in gas-producing brain abscesses.11

CT, particularly if used with contrast enhancement, is valuable in the investigation of patients with suspected intracranial abscess.33 It is generally considered that the appearance of ring-shaped contrast enhancement represents an encapsulated abscess,8,16,24,25,34 but this has been questioned. In experimental brain abscesses in dogs, Britt et al.4 showed that ring-enhancement in CT scans appeared in the histological stage of cerebritis without encapsulation, and they considered that this was due to changes in the blood-brain barrier (BBB) in the area of cerebritis. Absence of encapsulation at this stage was verified not only by us, but also by Whelan and Hilal.40 and Roeltgen et al.29

Corticosteroids are usually used to treat brain edema because of their antiinflammatory effect and their ability to protect the BBB. However, they also inhibit the capsule formation of brain abscesses.19,28 and their use is controversial. Some authors2,31,38 have reported that preoperative therapy with corticosteroids and antibiotics reduces inflammatory edema and improves the level of consciousness. They found an advantage in prolonging preoperative antibiotic therapy to form a capsule around the abscess and denied any focal spread.
Fig. 1 Preoperative enhanced CT scans on December 2, 1981, show a left frontoparietal cystic mass.

Fig. 2 Gas bubbles on enhanced CT scan on December 9, 1981, following corticosteroid treatment without antibiotics. A part of gas is outside of enhanced ring (arrow).

Fig. 3 Enhanced CT scans on December 11, 1981, show the shrunken abscess after surgical drainage of the cavity. Tip of a drainage tube and gas bubbles are seen.

Fig. 4 Despite of drainage and chemotherapy, the abscess expanded in 2 weeks on CT scans of December 28, 1981.

Fig. 5 Three months after excision of the abscess, enhanced CT scans on April 3, 1982, show enlarged ventricles and a left frontoparietal low density area.
of infection. Others\textsuperscript{1,3,15,25,30} insist that the protective effect of corticosteroids on the BBB inhibits the penetration of antibiotics into the brain abscess, so corticosteroids should not be used simultaneously with antibiotics unless extremely high doses of antibiotics are given.

In our case enlargement of the brain abscess and production of gas in the cavity occurred in one week, after administration of betamethasone for three days without antibiotics. Surgical drainage of the brain abscess followed by therapy with corticosteroids and antibiotics were not successful, while excision and therapy with glycerol and antibiotics led to a good result.

Isolation and identification of the causative microorganisms sometimes take weeks and antibiotic treatment is frequently inadequate or inappropriate.\textsuperscript{12) Before the antibiograms are obtained, we must select antibiotics which are of broad-spectrum and abscess-penetrating. Penicillin and chloramphenicol are recommended from this point of view,\textsuperscript{13,30} and also for their action against anaerobic bacteria.\textsuperscript{36) Despite recent reports of successful medical therapy\textsuperscript{13,30} of brain abscesses smaller than 3 cm in diameter, the fact that organisms were found in the pus despite therapeutically effective antibiotic levels and \textit{in vitro} evidence of sensitive organisms,\textsuperscript{13} suggests poor antibacterial activity of antibiotics within the abscess.\textsuperscript{40) Except in the early stage of parenchymal infection in which antibiotics are effective,\textsuperscript{31} surgical aspiration or excision is required. The results of surgical excision of brain abscesses in some centers have been better than those following aspiration and/or drainage.\textsuperscript{5,7,8,17,23} Recently, however, van Alphen and Dreissen,\textsuperscript{37) and Yang\textsuperscript{41) reported no significant differences in mortality among the various surgical techniques. Therefore, we consider that the most important factor influencing survival is relief of increased intracranial pressure by any form of surgery with the aid of CT.\textsuperscript{6,35}

\textbf{References}


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