

# Brain Abscess Diagnosed by Computerized Tomography

— Case Report —

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=國文抄錄=

## 電算化 腦斷層攝影術로 診斷된 腦膿瘍

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著者들은 19歲 男子 患者에서 發生한 腦膿瘍을 電算化 腦斷層攝影術로서 腦膿瘍의 位置와 被膜形成을 正確히 診斷함으로써 腦膿瘍을 容易하게 完全히 摘出하여 滿足할만한 結果를 얻었기에 報告하는 바이다.

**The authors describe a case of the brain abscess in the left temporal lobe which was accurately diagnosed by computerized tomography brain scan and complete surgical excision of abscess capsule was accomplished with great success.**

*Key Words · Brain abscess · Computerized tomography · Complete surgical excision · Abscess capsule.*

In 1926 Dandy<sup>4)</sup> proposed simple aspiration of the brain abscess via burr hole. Abscess excision first advocated by Clevis Vincent, et al., in the mid 1930's, has many advocates.<sup>3)11)</sup> But the operative treatment of the brain abscess remains a subject to debate. In recently repeated series, mortality from brain abscesses has been invariably high, ranging from 36% to 53% for all cases, and from 17

% to 40% after surgery, delayed detection and imprecise localization have in past been responsible for these disappointing results<sup>3)6)9)12)14)15)17)</sup>.

But the introduction of computerized tomography(CT) in surgical neurology has revolutionized the investigation of intracranial lesions<sup>1)7)14)17)19)21)</sup>. The CT presents the following informations; early and accurate iden-

tification of the capsule formation, accurate anatomical localization of a capsule, and identification of multiple loculi when present. These informations promote minimal surgical trauma by increasing the accuracy of the planned surgery<sup>7)14)17)21)</sup>.

Authors have presented a case of brain abscess, otogenic origin, in the left temporal lobe which was diagnosed accurately by carotid angiography and CT scan.

### Case Report

This 19-year-old man was admitted to this hospital on May 18, 1979 for evaluation and treatment of a possible brain abscess.

**History:** About 2 months before admission he was noted to have headache, stiff neck and low grade of fever. Lumbar puncture at that time showed clear cerebrospinal fluid (CSF) over a pressure of a 300mmH<sub>2</sub>O and he was treated as the impression of a meningitis at local clinic. About one month prior to admission headache was aggravated and occasional nausea and vomiting were noted, and 3 days before admission seizures occurred.

**Examination:** He was conscious and well oriented. The only positive findings was the early papilledema in the left optic fundi. Blood contents, electrolytes, urinalysis, and a chest radiograph were normal. On lumbar puncture the CSF examination revealed an opening pressure of 350 mmH<sub>2</sub>O. The total protein was 65mg/dl, the glucose 92mg/dl, and the cell counts 220/cu mm (70% lymphocytes), and microbiological study was reported to be negative. Simple skull films were normal except loss of air cells of left mastoid. Left common carotid angiography showed a 5-mm square shift of pericallosal artery to the right side. The middle cerebral artery was displaced upward and medial displacement of Syl-

vian point (Fig. 1). A CT brain scan showed a spherical mass with central lucency associated widespread cerebral edema within the left temporal lobe (Fig. 2).

**Operation:** A trephine opening was placed immediately over the center of the abscess under the general endotracheal anesthesia. After the dura was opened with a cruciate incision the contents of the abscess cavity was aspirated. It was purulent materials of about 30 cc in volume. The abscess cavity was irrigated with solution and then with solution of polyvinylpyrrolidone (Potadine), and 1 ml of lipiodol was injected. It was to allow to drain spontaneously. Simple skull x-rays were taken at intervals following the operation, and 7 days later the abscess wall was observed to be collapsed on plain skull films. On 8th day of the postoperation the abscess capsule was excised totally with enlargement of the trephine hole to about 4 cm in diameter.

**Postoperative course:** The patient was treated with penicillin and steroid, and did well. There was marked improvement of the headache, nausea and vomiting. He was discharged in relatively good condition.

**Pathologic findings:** The aspirated materials showed necrotic debris with multiple polymorphonuclear cells. Cultures did not grow. Gross examination of the excised abscess capsule showed a greyish-yellow, measuring 5.6×3×2.7 cm and cut surface showed a large cavity which was filled with 12 cubic cm liquid pus (Fig. 3). In microscopic findings multiple areas of old abscess were surrounded by fibrous capsule with acute and chronic inflammatory cells infiltration. There was also marked gliosis in the cortical tissue (Fig. 4).

## Discussion

Even since the turn of the century neurosurgeon have been trying to equal the results of Macewen in the treatment of brain abscesses<sup>3) 15)</sup>. In his series only one of 15 patients died. Despite great advances in diagnostic and neurosurgical techniques and a variety of antibiotics the mortality associated brain abscess remains distressingly high. The mortality from brain abscess reported in the literatures was generally 60% to 80% prior to antibiotics and 20% to 40% during antibiotic era<sup>3) 6) 9) 15)</sup>.

But the introduction of CT in surgical neurology has revolutionized the investigation of intracranial lesions. CT brain scanning facilitates both earlier detection and more accurate localization of abscess, and promotes minimal surgical trauma by increasing the accuracy of the planned surgery<sup>3) 9) 12) 14) 15) 17)</sup>.

Pyogenic abscess of the brain may arise as direct extensions of infections involving paranasal sinuses of the middle ear-mastoid complex, by hematogenous spread from sepsis elsewhere in the body, or following cerebral operations or compound depressed skull fractures. However, in approximately 20% of cases there is no evidence or history of prior infection. In the group cases in which the infection is blood borne from lesions elsewhere in the body, chronic infections have been especially common as primary sites of sepsis<sup>15) 23)</sup>.

Abscess that result from head injuries develop immediately beneath the site of injury and those secondary to sinusitis develop immediately beneath the site of injury and those secondary to sinusitis develop in direct continuity with infected sinusitis. Hence fro-

ntal abscess are often the result of frontal sinusitis. Abscesses secondary to infections in the middle ear-mastoid complex may be located either in temporal or the cerebellum and brain stem. Metastatic abscesses may develop anywhere in the intracranial compartment as metastatic tumors. The frontal and parietal lobes constitute the largest portion of cerebral mass which accounts for the high frequency of blood borne abscesses in these sites<sup>5) 18) 23)</sup>.

The most common organisms involved are staphylococcus aureus, anaerobic streptococci, coliform organisms, pneumococci, and dipht-heroids<sup>5) 12) 15) 18) 23)</sup>. The child with congenital cyanotic heart disease has the greatest risk of developing a brain abscess<sup>13) 16) 23)</sup>. Three factors contribute to the frequency with which the abscess is seen in this group; slowed circulation with a high hematocrit producing a sludging of the blood, a propensity for developing cerebral infarction secondary to emboli, and a right-to-left shunt with passage of venous blood into the systemic circulation without being filtered through the lungs. This combination of factors provides the necessary elements for the formation of a brain abscesses. The slowed circulation and the sludging of the blood causes stagnation first and then infarction, which in turn serves as a focus for the growth of circulating bacteria<sup>23)</sup>. In this group multiple abscesses are occasionally seen. Other authors have reported a 5% to 15% incidence of multiple brain abscesses<sup>3) 5) 23)</sup>. The overall incidence has in all probability decreased in the last three decades since antibiotic agents have been available for treatment of infectious disease<sup>23)</sup>.

It is important to realize that the most brain abscesses act as space-occupying lesions and that fever and signs of meningeal irritation may be absent. Unfortunately many brain

abscesses continue to remain undiagnosed until the patient becomes moribund or dies. An intracerebral abscess act as a rapidly expanding intracranial mass and compress midbrain and brain stem structures leading to coma and death, or it may rupture into ventricles or subarachnoid space, producing a fulminant overwhelming meningitis. When an brain abscess is suspected, therefore, close neurological observation is imperative while the patient is being-treated with antibiotics and undergoing diagnostic tests. Any deterioration in the level of consciousness or significant increase in neurological deficit demands immediate neurosurgical attention<sup>3) 12) 18) 23)</sup>.

Headache may be the only complaint in frontal abscesses, and objective findings may be absent until the abscess has become large enough to compress motor cortex and speech areas. Parietal abscesses may produce homonymous field defects in early stage of development. The clinical picture of purulent meningitis is characteristic and corresponds to a diffuse paralysis of the cortex of one cerebral hemisphere associated with a rise of intracranial pressure<sup>3) 12) 16)</sup>. There is little to add to this concise statement by Schiller<sup>22)</sup>, et al. Seizures are frequent (about 30%)<sup>12)</sup>. Cerebellar abscesses usually cause headache, ataxia, horizontal nystagmus, and increasing lethargy as CSF pathway are obstructed. Thus a careful history and neurologic examination are of most important factor in the prognosis; deep coma is always fatal if it develops in a few hours. Abscess may possibly be distinguished from other space-occupying intracerebral lesions if significance is attached to a history of recent infection and a high ESR is noted. If clear cut evidence of infection such as fever or elevation of peripheral blood WBC or polymorphonuclear reaction is required, the diagnosis will often be missed.

High incidence of spinal fluid sterility make lumbar puncture a poor diagnostic test for brain abscess. Approximately 64% of those tapped had increased opening pressure, 66% had elevated CSF protein, 20 to 30% had 0 to 10 WBC/cumm of CSF and 75% to 89% had normal CSF glucose<sup>3) 9) 15)</sup>.

About 15% to 28% of patients underwent lumbar puncture had subsequent neurological deterioration and many patients among them died secondary to the spinal tap<sup>3) 15)</sup>. Thus it is recommended that when a brain abscess is suspected, lumbar puncture should be withheld.

A review of the literature of the past few years show that the most useful diagnostic tests in brain abscesses have been angiography and ventriculography, and further angiography was regarded as the most useful test in the detection of subdural empyema<sup>3) 8) 10) 15) 23)</sup>.

In recently computed tomography, this rapid and safe method, permitting serial examinations, has proven to be a most accurate method of localizing inflammatory disease<sup>1) 7) 14) 17) 19) 21)</sup>. If contrast enhancement is additionally employed, the precise pattern and configuration of abscess formation is routinely demonstrated. It is important to recognize, however, that administration of steroids can markedly reduce the contrast enhancement of an abscess capsule. This is due to the stabilizing effect of steroid upon capillary endothelium, resulting in reduced extravascular diffusion of circulating contrast medium; it was also observed this effect in some cases of cerebral neoplasm<sup>16)</sup>. Plain CT scans revealed usually extensive areas of diminished absorption, with density measurements indicative of edema (associated with mass effect). With contrast medium injection, capsules well demonstrated; these were regular or irregular in both thickness and contour. A clinical and labora-

tory evidence of active infection is important in making the specific CT diagnosis of abscess.

A list of differential diagnostic considerations on gross CT findings, although not exhaustive, should include metastasis, glioblastoma, granuloma, infarction and changes from recent cerebral surgery.<sup>14)17)</sup> The presence of gas within the lesion is diagnostic of abscess in cases without recent surgery and without cranial trauma.

In program for diagnostic procedures the first to be obtained should be a high quality plain skull examination. Second, the CT scan is necessary. This study can be repeated as required to follow progress under conservative treatment, formation of a capsule from a stage of cerebritis, and postoperatively.<sup>17)</sup> Following this studies, lumbar puncture may be performed for confirmation of bacterial infection and for identification of specific organisms. If CT demonstrates that the mass effect is not marked, and that a herniation has not occurred, lumbar puncture may be performed with less hazard.

Electroencephalographic and radioisotope scan have little or no place if CT scans are immediately available and are technically satisfactory, angiography is generally less informative than CT scans. It, however, may reveal vascular abnormalities associated with accompanying meningitis and, only occasionally, capsular staining.

In 1926 Dandy<sup>4)</sup> proposed simple aspiration of the abscess via burr holes. Abscess excision was first advocated by Clovis Vincet, et al. Abscess drainage was associated with approximately the same mortality as excision (19% vs 22%)<sup>3)</sup>. Drainage has a lower postoperative long-term seizures incidence than excision despite the presence of retained abscess capsule. Retained capsule may present less of

an epileptogenic hazard than gliosis following the local trauma of excision<sup>3)</sup>. Excision of abscess was generally in better condition and less recurred than those having drainage. Still others begin with needle drainage of abscess and later perform a total resection of the abscess<sup>23)</sup>. Aspiration and drainage with instillation of thorostrast and appropriate antibiotics carried a mortality rate of less half that for excision, aspiration, or drainage without thorostrast. Also thorostrast was not associated with an increase in morbidity (postoperative seizures or severe neurological deficits), nor have we seen any long-term ill effects from thorostrast pyogram<sup>15)</sup>.

In this meantime, there appears to be no doubt that excision of cerebral abscess is now the preferred available treatment except for lesions involving vital areas where removal would result in a severe neurological deficits<sup>11)15)23)</sup>.

Removal of the brain abscess usually results in adequate internal decompression and prevents the postoperative complications of marked cerebral edema. In recent years intravenous hypertonic solutions (urea and mannitol) and glucocorticoid compounds have proved especially useful in dealing with cerebral edema. Following operation all patients should receive aggressive antibiotic therapy for three to four weeks.<sup>23)</sup>

The result of operative treatment of brain abscess depends upon the rapidity with which the diagnosis is made and operation is begun. There was a close correlation between the preoperative level of consciousness and the operative mortality rate<sup>3)15)23)</sup>.

## Summary

The case presented by authors was otogenic in origin and diagnosed accurately by the

computerized tomographic scan, and total excision of the abscess capsule was performed by two stage operation.

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□ Explanation of Figures □

**Fig. 1-a, b.** Left carotid anigogram A-P and lateral views; The ACA reveals square shift into the right side. The MCA is displaced upward and medially with stretching of opercular branches and the angiographic sylvian point is displaced upward and anteriorly.

**Fig. 2-a, b.** In preinfusion scans diffuse low density area is noted in the left temporal lobe with marked diminution of air cells in the left mastoid. A oval shaped double density is also noted in the low density area. The left lateral ventricle is collapsed. Compression deformity is also noted in the qudrigeminal cistern. After contrast infusion  $24.7 \times 32.7 \times 32.4$  mm sized oval ring enhancement is noted in the previously mentioned low density area.

**Fig. 3-a, b.** Gross examination of the excised abscess capsule showed a greyish-yellow, measuring  $5.6 \times 3 \times 2.7$ cm and cut surface showed a large cavity which was filled with 12 cubic cm liquid pus.

**Fig. 4.** In microscopic findings multiple areas of old abscess were by fibrous capsule with acute and chronic inflammatory cells infiltration. There was also marked gliosis in the cortical tissue.





□ 신 규만 의 논문 사진부도 ① □

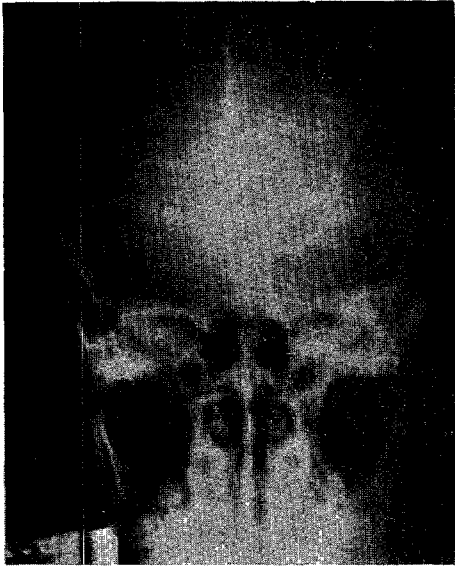


Fig. 1-a.



Fig. 1-b.

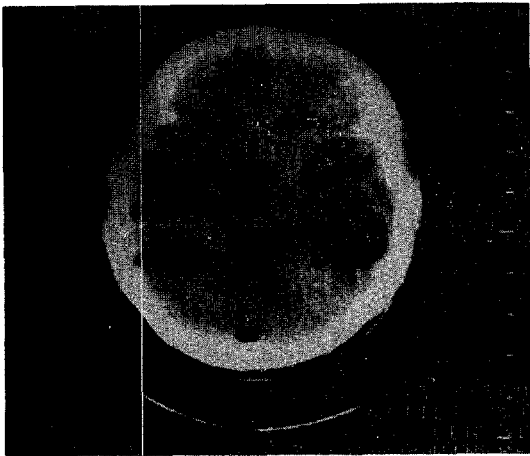


Fig. 2-a.

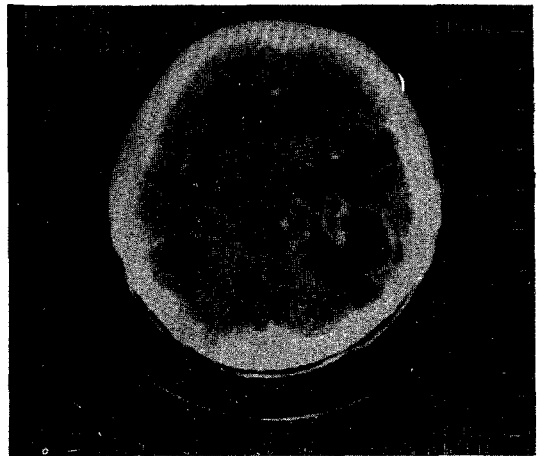


Fig. 2-b.

□ 신 규만 외 논문 사진부도 ② □



Fig. 3-a.



Fig. 3-b.

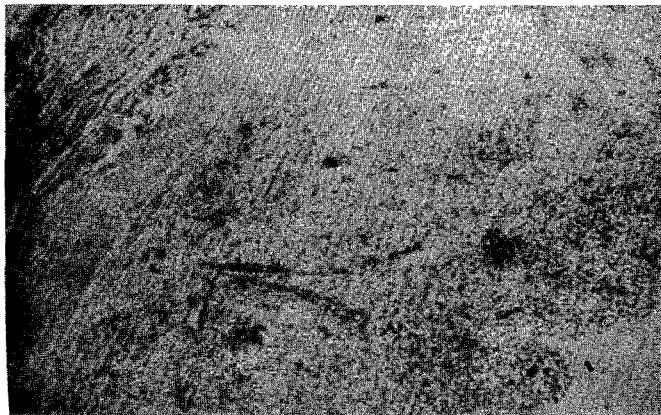


Fig. 4.