Arachnoid Cysts of the Middle Cranial Fossa Complicated with Subdural and Intracystic Hematoma

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1. 4 cases were unilateral, and 3 cases were left, 1 case was right, and 2 cases were bilateral. All cases demonstrated high density cysts on CT scans. The cysts were located in the sylvian fissure and were surrounded by high density subdural hematomas. The cysts were not enhanced by intravenous contrast agents. The subdural hematomas were located in the posterior cranial fossa and were not enhanced by intravenous contrast agents.

2. In one case, the subdural hematoma was located in the posterior cranial fossa and was not enhanced by intravenous contrast agents. In another case, the subdural hematoma was located in the sylvian fissure and was not enhanced by intravenous contrast agents. In the third case, the subdural hematoma was located in the posterior cranial fossa and was not enhanced by intravenous contrast agents.

3. The subdural hematomas were located in the posterior cranial fossa and were not enhanced by intravenous contrast agents. The cysts were located in the sylvian fissure and were not enhanced by intravenous contrast agents.

4. In one case, the subdural hematoma was located in the posterior cranial fossa and was not enhanced by intravenous contrast agents. In another case, the subdural hematoma was located in the sylvian fissure and was not enhanced by intravenous contrast agents. In the third case, the subdural hematoma was located in the posterior cranial fossa and was not enhanced by intravenous contrast agents.

5. In one case, the subdural hematoma was located in the posterior cranial fossa and was not enhanced by intravenous contrast agents. In another case, the subdural hematoma was located in the sylvian fissure and was not enhanced by intravenous contrast agents. In the third case, the subdural hematoma was located in the posterior cranial fossa and was not enhanced by intravenous contrast agents.

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d) 4례 모두에서 주변부 부종과 심한 종괴현상이 관찰되었다.
e) sylvian fissure에 위치한 비교적 원형의 낭종내 혈종과, 인접하는 경막하혈종은 함께 응영(comma) 모양으로 관찰되었고(4례), 더 상부의 스캔상에서는 함께 파상으로 관찰되어(1례) 특이하였다.

결론적으로, CT상 중두개와 전저부에 위치하고 sylvian fissure를 따라 확장되는 비교적 동근 혈종이 광범위한 경막하 혈종과 같이 관찰될 경우, 이는 경막하 혈종과 낭종내 혈종을 동반한 지주막 낭종의 특징적인 소견으로 생각된다.

Index Words: Arachnoid, CT, Arachnoid cysts: Brain, hemorrhage

Introduction

Of all arachnoid cysts, arachnoid cysts of the middle fossa (ACMF) are the most frequently encountered. ACMF are of major neurosurgical interest due to their frequent association with subdural hematoma (SDH), an Unique combination that is rarely seen in arachnoid cysts of other regions. Difference in density on CT between ACMF and SDH usually delineates both entities. But in cases with accompany SDH (extracystic) and intracystic hematoma concomittently, diagnosis is sometimes difficult.

Five cases of ACMF with SDH including four cases of ACMF with intracystic hematoma and SDH are reported here with review of the literature.

Material and method

This report concerns five cases of ACMF complicated with SDH and intracystic hematoma which were operated in Capital Armed Forces General Hospital from March 1987 to October 1989 (Table 1).

All five were male soldiers in their early twenties.

All had signs of increased intracranial pressure. One of them had had episodes of seizure attacks for three years and the sign of sixth cranial nerve palsy.

Three of them had the history of trivial trauma one to two months before.

All patients took plain skull radiography and CT examination and were treated by SDH evacuation and membranectomy of arachnoid cyst. Specimens from arachnoid cyst wall were examined histologically.

They had had follow up CT examinations for about one to four months after operations.

Result

Four of five cases were involved unilaterally, three in left and one in right. In one case with bilateral ACMF, SDH and intracystic hematoma involved right side.

Plain skull radiographs of all five patients showed thinning and outward bulging of ipsilateral temporal bone, elevation of the sphenoidal ridge, and forward protrusion of the anterior wall of the middle fossa (Figs. 1a, 4a–b). Hypertrophy and pneumatization of the lesser wing of the sphenoid was also noted in three cases (Fig. 1a).

In one case with ACMF and SDH (case 1), CT showed the typical findings of ACMF, that is, homogeneous low density (CSF density) mass, no enhancement, sharp margination, expansion of the middle fossa and foreshortening of the temporal lobe, accompanied by
ipsilateral chronic SDH with the appearance of low density crescent (Fig. 1).

Remained four cases of ACMF accompanying SDH and intracystic hematoma showed no evidence of ACMF itself on CT, but an extensive, relatively round mass with slightly high density which was located in anterior aspect of middle fossa and extended up along the sylvian fissure (intracystic hematoma) (Figs. 2a–c, 3a–c, 5a–b). Enhancement of cystic wall was noted in two cases (Fig. 2b). In these four cases with intracystic hematoma, expansion of the middle fossa, thinning and bulging of squamous portion of temporal bone, anterior bowing of the greater wing of the sphenoid, and atrophic tip of temporal lobe were observed in addition to intracystic hematoma, suggesting the presence of ACMF antedating the hematoma (Figs. 2a, 2d, 3a–b, 5a). All four cases accompanied extensive SDH with slightly high density (Figs. 2b, 3b–c, 5b–c). In case 2 and 5, SDH and intracystic hematoma were not differentiated from each other on CT (Fig. 2a–b, 5b). Surrounding edema and severe mass effect were present in all four cases. In case 2, 3, and 5, and possibly in case 4, intracystic hematoma and neighboring SDH were together observed as the comma shape (Figs. 2a–b, 3b, 5b). And in case 3, superior extension of intracystic hematoma along sylvian fissure and SDH made a wavy appearance on the higher level scan (Fig. 3c).
Four patients underwent craniotomy. And evacuation of SDH, membranectomy of SDH, and partial resection of arachnoid cyst wall with removal of content of the cyst were done. In case 2, the possibility of the presence of ACMF was not appreciated preoperatively, and the first operation was done only to evacuate SDH by burr holes (Fig. 2d). In the second operation through craniotomy, cyst wall was partially resected. Hypoplastic left temporal lobe and communication between arachnoid cyst and SDH was observed during the operation. Other cases were diagnosed preoperatively as ACMF accompanying SDH. In case 4, a communication between the cyst and the subarachnoid space (sylvian cistern) was created in addition to the above operative procedures. Specimens from arachnoid cyst wall were confirmed histologically in all cases.

Postoperative follow-up CT scans were performed up to one to four months later (Figs. 2e–f) and they showed definite reduction in the size of ACMF, disappearance of SDH, and regression of mass effect in all cases except case 1, in which no change of ACMF nor of SDH was noted. It was thought that in case 1.
too small part of the cyst wall had been resected compared to other cases and it could be the cause of it. Further decrease of ACMF size was noted on second follow up CT scan in case 2 (Fig. 2f).

All patients had recovered without symptoms and signs of increased intracranial pressure. But in case 1 and 5, intermittent headache persisted.

**Discussion**

Arachnoid cysts occur in up to 0.4% of cases with intracranial tumors. And the region of the sylvian fissure is the most common location. Other common locations in-

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Fig. 2. Case 2. ACMF accompanying subdural and intracystic hematoma.

a. Precontrast CT scans. Subacute hematoma involves left temporal area. Note anterior bowing of the greater wing of the sphenoid.

b. Postcontrast CT scan shows membrane enhancement in the medial aspect of the extensive hematoma with severe mass effect. Note comma-shaped hematoma and surrounding edema.

c. Precontrast scan shows superior extension of intracystic hematoma.

d. After first operation, the hematoma was replaced with air after burr hole evacuation. Hypoplastic left temporal lobe with flattened anterior margin is well visualized.

e and f. 1 and 4 months after craniotomy, gradual decrease in the size of ACMF is observed on follow up CT.
clude cerebral convexity, posterior fossa, suprasellar region, and collicular plate\textsuperscript{5,15,19).

Since the original description of "serous cysts of the arachnoid" by Richard Bright in 1831\textsuperscript{5,14}, the pathogenesis and clinical significance of arachnoid cyst has been a matter of debate\textsuperscript{4~6,911,14,17}. There are three primary explanations for arachnoid cyst. Robinson maintained that they are subarachnoid in location, and regarded them as a true "external hydrocephalus" caused by a lag in development of the brain\textsuperscript{5}. Starkman made a systemic study of autopsied specimens and concluded that arachnoid cysts evolve from a developmental aberration characterized by splitting and duplication of the arachnoid

![Figure 3](image1.png)

**Fig. 3. Case 3. ACMF accompanying subdural and intracystic hematoma.**
a-c. Precontrast CT scans.
a. Expanded left middle fossa is occupied by intracystic hematoma.
b. Relatively round intracystic hematoma in sylvian fissure (arrows) and crescent SDH (open arrows, posterior) make the shape of comma. SDH is also observed in frontal area (open arrows, anterior).
c. Superior extension of intracystic hematoma (arrows) and SDH (open arrows) make a wavy or undulated appearance.

![Figure 4](image2.png)

**Fig. 4. Case 4. ACMF accompanying intracystic and subdural hematoma, right side.**
a and b. Skull AP and lateral view shows the findings of middle fossa expansion, thinning and bulging of right temporal squama, elevation and hypertrophy of the lesser wing of the sphenoid.
Fig. 5. Case 5. Bilateral ACMF with subdural and intracystic hematoma, right side. a and b. Precontrast a and b. Precontrast scans.
a. Expanded right middle fossa is occupied by slightly hyperdense intracystic hematoma. ACMF and hypoplastic temporal lobe with flattened anterior margin are shown in expanded left middle fossa.
b. Intracystic hematoma of anterior aspect of right middle fossa (arrows) and SDH (open arrows) make the shape of comma.
c. Postcontrast CT scan shows partial enhancement in the wall of SDH and severe mass effect.

membrane and that these cysts are truly intrarachnoid in location. The third theory is based on the heterotopic displacement of ependymal or choroidal elements into the subarachnoid space during embryogenesis.

The pathogenesis of enlargement of arachnoid cysts is uncertain. A few hypotheses have been put forward: secretion of fluid by the cyst wall, fluid filtration through the cyst wall due to an osmotic gradient, and trapping of fluid within the cyst by a ball-valve mechanism, presumably located at a small communication which exists between the cyst and the subarachnoid space. The first two explanations are clearly applicable in the case of noncommunicating cysts, whereas the third theory applies to the communicating cysts.

The marked predilection of ACMF for the male sex and the left hemisphere is seen in many series but difficult to explain. And ACMF is occasionally bilateral.

ACMF are often associated with agenesis of the temporal lobes. Seur et al suggested that the evidence of persistent temporal defect supports the hypothesis of temporal lobe agenesis being the primary event, the cyst being formed ex vacuo. But Galassi et al believed that the brain atrophy is not of a primary nature but is secondary to the presence of and the compression by the cyst. Patients with ACMF and temporal lobe agenesis are susceptible to trivial trauma. Though the exact reason for this is not clear, it may be due to the altered anatomy of the middle fossa.

Patients with ACMF usually become symptomatic for several causes (complications): there may be enlargement of the cyst or development of a hematoma either subdural (extracystic) or intracystic, each case producing increased intracranial pressure. And, following rupture of the outer membrane and escape of cystic fluid into the subdural space, subdural hygroma can also develop.

Presumably, unsupported blood vessels in the cyst capsule or the arachnoid can tear spon-
taneously or with varying degrees of head trauma, resulting in bleeding either into the subdural space or into the cyst itself\(^9,22\). Subsequently, membranes may form adjacent to, or within the cyst to envelop the hematoma. Especially in case of intracystic hematoma, the delicate relationship between hematoma and arachnoid membrane is likely to be obscured by this reparative process and be interpreted simply as chronic SDH\(^3,5\).

In cases with intracystic hematoma and SDH concomitantly, the presence of a ACMF antedating hematoma can be suggested by the characteristic hypoplastic temporal and occasionally frontal lobes on CT scan\(^3,5,10\). In addition to this finding, authors thought that we could make the suggestion of it by the findings of expanded middle fossa with skull changes, and a relatively round hematoma (intracystic hematoma) which is located in anterior aspect of middle fossa and extends up along the sylvian fissure. Authors also observed that intracystic hematoma in anterior aspect of middle fossa and neighboring SDH make together the shape of comma (Figs. 2a–b, 3b, 5b), and that superior extension of intracystic hematoma and SDH could make a wavy appearance on higher level CT scan (Fig. 3c). As these observations have not been mentioned in the literature hitherto and are thought to be specific, authors suggest these findings to be called as "comma sign" and "wave sign" of ACMF complicated with intracystic and SDH.

Surgical treatment of arachnoid cysts has been a very controversial issue. Some authors limit the indications for surgical treatment to complicated and symptomatic cases\(^4,7,21\). But many believe that all arachnoid cysts should receive surgical treatment because of their instability and potential danger to cause complications\(^6,9,10\). As for the types of operation, craniotomy with excision of the membranes and perforation into the basal cisterns\(^2,9,23\), and cystoatrial and cystoperitoneal shunts\(^1,7,10,16,21\) are the most commonly employed. The latter appears to have some limiting factors\(^1,10,13\): (1) persistence of arachnoidal membranes which may have secreting or filtering properties (2) limited operative inspection, especially of the bridging vessels through a burr hole or a small craniectomy (3) reexpansion of the brain, which may force the tip of the catheter into the cerebral parenchyma and cause its obstruction (4) shunts may be followed by recurrence in a fairly high number of patients. The former type of operation is generally accepted as an ideal treatment with low recurrence rate, especially in cases with associated SDH\(^2,9,21,23\) and in children\(^1\).

In the report of Galassi, steady reexpansion of the brain with possible obliteration of the cysts was observed on CT scans after craniotomy, especially in the cases with small communicating cysts. But in the cases with huge noncommunicating cysts, compressive and atrophic anatomic changes were not completely reversible\(^23\).

Authors have come to a conclusion that when we encounter a relatively round extracerebral hematoma, which is located in the anterobasal aspect of the middle fossa and extends superiorly along sylvian fissure, and large ipsilateral SDH on CT scans, we should consider the possibility of ACMF accompanying intracystic hematoma and SDH, and try to find the other radiological features which could suggest the presence of a ACMF antedating hematoma.

**REFERENCES**

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