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☐ Case Report ☐

Aspergillosis of the Paranasal Sinuses
— Diagnostic Significance of the Computed Tomography —

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Aspergillosis of the paranasal sinuses appears to be relatively rare in occurrence, but there is a growing incidence of it in accordance with the increasing use of antibiotics, steroid hormones, anticancer drugs, and radiation therapy. We have seen 15 cases of aspergillosis of the paranasal sinuses in which computed tomography (CT) was helpful for diagnosis. The characteristic feature of CT findings was the intermixture of high and low density areas in the affected paranasal sinuses, apparently caused by increased X-ray absorption due to calcification. These findings indicate that CT is useful in the preoperative diagnosis of aspergillosis of the paranasal sinuses.

Key Words: Aspergillosis, computed tomography of paranasal sinuses

Aspergillus is the most common fungal pathogen in sinus disease and is a spore-forming fungus commonly found in soil and decaying vegetable matter. The spores are ubiquitous, usually introduced by inhalation, and are frequent inhabitants of the human upper respiratory tract (Warder *et al.* 1975).

Today, the factors that predispose to fungal infections are apparently becoming more common. These factors include diabetes and diminished resistance to disease after tumor surgery, radiation therapy, cytostatic and immunosuppressive treatment, and long-term cortisone and antibiotic regimens (Zimmerman 1972).

A number of studies and our own experience, however, emphasize that aspergillosis of the paranasal sinuses often develops in people who are otherwise healthy (Stammberger *et al.* 1984). In addition to an absolute increase in the number of cases, diagnostic methods have significantly improved and become more subtle. The diagnosis of aspergillosis in the paranasal sinuses is difficult to make preoperatively in spite of the increasing number of reports showing its prevalence (Kumazawa *et al.* 1987). Earlier diagnosis with resultant earlier appropriate antifungal therapy may lead to greater therapeutic success than has been recognized to date (Aisner *et al.* 1977).

Therefore, we conducted a retrospective study to assess the diagnostic significance of aspergillosis in the paransal sinuses and to ascertain characteristic radiographic signs of the disease.

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MATERIALS AND METHODS

A retrospective study of 15 patients with proven aspergillosis of the paranasal sinuses was undertaken in the Department of Otorhinolaryngology, Wonju College of Medicine, Yonsei University, from 1985 to 1988. CT examination was undertaken using a Philips Tomoscan 350 in 11 of 15 patients with aspergillosis.

We studied historical work-ups, plain X-rays and CT scans of the paranasal sinuses, operative findings, and histopathological examinations with hematoxylin eosin, periodic acid schiff (PAS), or methenamine silver staining.

In 3 cases, strains were identified through direct smear and culture with Sabouraud's media.

RESULTS

Clinical presentations

There were 3 males and 12 females and patient ages ranged from 32 to 55 with a mean of 42.8 years. Disease occurred most often between the ages of 35 and 50: these patients accounted for 67% of the to-

Table 1. Analysis of aspergillosis of the paranasal sinuses

No	Age/Sex	Main symptom	Duration (year)	Involved sinus	CT findings
1.	39/F	Headache	5/12	Rt, E+M+B	+,#,*
2.	34/F	Toothache	5/12	Rt, M	+,#
3.	49/M	Purulent rhinorrhea	3	Rt, M	+,#,*
4.	55/F	Periorbital pain	2/12	Rt, E+M	+,#
5.	32/F	Toothache	1/12	Lt, M	+,#
6.	39/F	Headache	6/12	Lt, M	+,#,*
7.	43/F	Facial pain	1/12	Lt, M	+,#
8.	43/F	Nasal obstruction	4/12	Rt, M	not checked
9.	36/M	Nasal obstruction	3	Rt, M	+,#
10.	48/F	Epistaxis	10	Lt, M	+,#
11.	54/F	Nasal pain	1	Rt, M	+,#
12.	45/F	Nasal obstruction	1	Rt, M	+,#
13.	54/F	Headache	5/12	Rt, M	not checked
14.	36/F	Nasal pain	1/12	Lt. M	not checked
15.	35/F	Purulent rhinorrhea	3/12	Lt, M	not checked

Rt: Right, Lt: Left
E : Ethmoid sinus, M: maxillary sinus, B: Brain
+ : Calcification
* : Bony destruction of the sinus wall
# : Thickening of the sinus wall

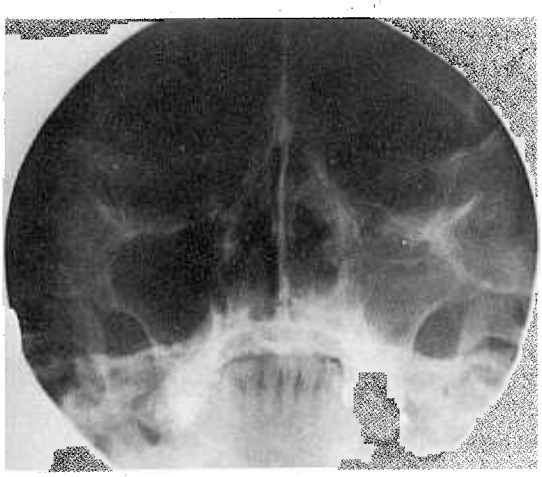

Fig. 1. *Water's view showing smooth homogeneous shadow in the left side of the maxillary antrum.*

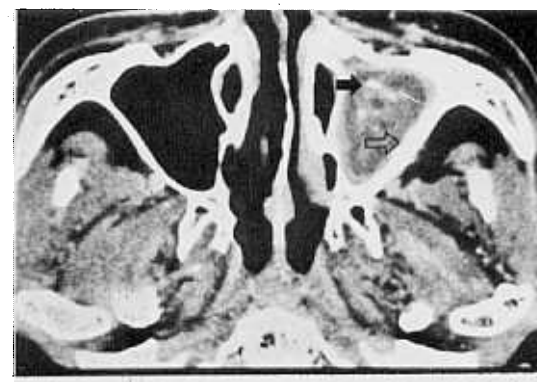

Fig. 2. *Axial CT scan showing calcification (→) and thickening of the sinus wall (⇨).*

tal. The period from the first onset of symptoms to a visit to our hospital was less than 6 months in 10 patients (66.7%). There was no evidence for history of a foreign body involving the affected paranasal sinus or serious dental problems. The most common symptoms were nasal obstruction, purulent rhinorrhea and headache. But relatively characteristic symptoms such as facial pain, periorbital pain, and toothache also occurred (Table 1).

Plain X-ray and CT findings

Plain X-ray of the paranasal sinuses showed unilateral opacification of the involved sinuses in all cases (Fig. 1). CT scan showed calcification and thickening of the sinus wall in all cases (Fig. 2) and destruction of the sinus wall in 3 cases (Fig. 3). The maxillary sinus alone was involved in 13 (86.6%) of

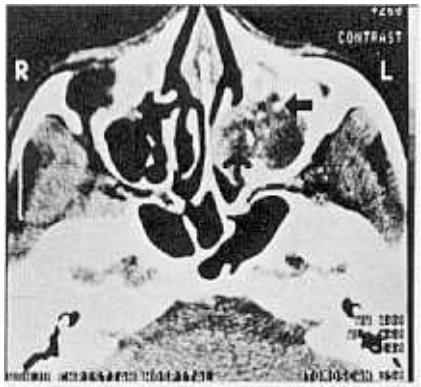

Fig. 3. Axial CT scan showing calcification (←), thickening of the sinus wall (⇐), and bony destruction (↑).

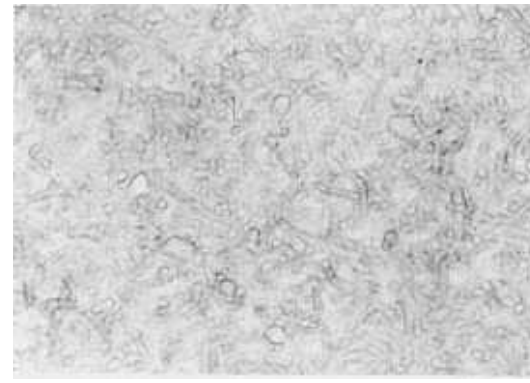

Fig. 4. Numerous branching septated hyphae (H&E, ×100)

15 patients.

Fungus culture and pathologic findings

Tangled masses of fungal hyphae were grossly dark brown and muddy. Sections of fungal masses showed a ball of branching septated hyphae in all cases (Fig. 4). Special stains such as PAS or methenamine silver were done and more clearly demonstrated the definite septae and dichotomous branching of hyphae at the acute angle. Especially among 3 cases of aspergillosis, 2 cases of A. fumigatus and 1 case of A. niger were identified after 3 consecutive cultures with Sabouraud's media.

DISCUSSION

Aspergillus is pathogenic in birds, animals and man. Eight of 350 species of aspergillus have been associated with human disease. The most common strains of the fungus that are responsible for paranasal sinus infection in man are A. fumigatus and A. flavus (Miglets *et al.* 1978).

Shubert (1885) first reported a case of A. fumigatus infection affecting a nasal cavity in a human female. Zarniko (1891), Mackenzie (1893), Harmer (1911), Tilley (1914), Skillern (1921), Mollari (1929), Adams (1933), and Kelly (1934) reported aspergillosis of the paranasal sinuses. In reviewing the literature, aspergillosis is most commonly found in females and there is no relationship between paranasal sinus infection and pulmonary aspergillosis (Miglets *et al.* 1978; Savetsky and Waltner 1961).

Two types of localized disease are described by Hora (1965). The noninvasive type resembles chronic or recurrent sinusitis. However, this is usually resistant to conservative therapy. At the present time, the mechanism concerning how the noninvasive type destroys and invades surrounding tissue is not known yet. The invasive type is more aggressive and it may extend to the orbit, cheek, adjacent sinuses or brain (Hora 1965; Mcquirt and Harrill 1979; Kumazawa *et al.* 1987). This study showed 14 cases of the noninvasive type. In case 1, bone destruction in the ethmoid sinus, orbital floor, and base of the skull and finally abscess formation in the temporal lobe were observed.

Veress *et al.* (1973) reported that two factors may also play an important role in paranasal sinus aspergillosis: 1) secretion of a toxic substance by fungi which penetrates into tissues under appropriate conditions and 2) induction of tissue necrosis due to an immune mechanism.

Although none of the patients presented here had any underlying systemic illness, it seems likely that local conditions in the maxillary sinus may predispose to fungal infection. Stevens (1981) has emphasized that functional obstruction of the sinus ostium may result in aspergillus infection and that the fungus favors hypoxic or anaerobic conditions. Aspergillosis developing in tissues of resistance or in an antrum such as the nasal sinuses will ideally be ball-shaped (fungus ball) (Stammberger *et al.* 1985) or necrotic material which is green-black in color and of a cheesy consistency (Meikle *et al.* 1985).

The most common manifestations are unilateral nasal obstruction and stuffiness. In particular, we could observe specific symptoms such as facial pain, periorbital pain, or toothache in cases of aspergillosis infection.

Stammberger *et al.* (1984) found that 27 of 59 patients had dense concretions of calcium phosphate

or calcium sulfate in the sinus fungal masses. The calcification that resembled metallic foreign bodies on X-ray was observed in 50% of their patients with aspergillosis (Kopp *et al.* 1985; Stammberger *et al.* 1984). The high density area of the CT finding in the paranasal sinuses appears to be caused by increased X-ray absorption due to the calcification (Nishikawa and Nishikawa 1987). Additionally, when the affected sinus is filled with pus, there is a corresponding low radiodensity seen on CT, precluding a clear definition of the fungal mass present. In our study, high radiodensity areas due to calcification were clearly demonstrated on CT, but were not seen on plain X-ray. Therefore, we believe that a CT examination is more sensitive in demonstrating such calcification.

However, aspergillosis must be confirmed by histopathological diagnosis for lesions of the tissues (Axelsson *et al.* 1978). There are several disease to be distinguished from sinus aspergillosis, such as bacterial sinusitis, malignant tumor, tuberculous sinusitis, ostemyelitis, Wegener's granulomatosis, and rhinosarcoma. Three of our cases of sinus aspergillosis were initially confused with neolpasm and required surgical removal of a specimen before a correct diagnosis of primary noninvasive aspergillosis could be made.

The aim of treatment should be the complete removal of the mycotic masses, elimination of predisposing factors, and protection from reinfecion (Stammberger 1985). As ventilation and drainage of the dependent larger sinuses are reestablished through their natural ostia, the mucosa of these sinuses usually heals without direct treatment. In this study, 14 of 15 cases were treated surgically and 8 were treated with a combination of oral administration and local irrigation of antifungal agents. Although no evidence of recurrence was seen in either group, it seems difficult to discuss the prognosis of the above two treatment groups because of the relatively short period of follow up. Therefore, reevaluation after further follow-up is needed.

CONCLUSION

Although preoperative diagnosis of aspergillosis of the paranasal sinuses is difficult, we observed calcification of the sinuses in all 11 cases of aspergillosis who underwent CT examination. Thus, we have concluded that CT is useful in the preoperative diagnosis of aspergillosis of the paranasal sinuses.

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