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Nasopharyngeal and Temporal Bone Blastomycosis: CT and MR Findings

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Blastomycosis is a fungal disease endemic to the Mississippi and Ohio River valleys and to the southeastern United States [1]. From the time blastomycosis was first isolated from the skin by Gilchrist in 1896 [2], numerous epidemiologic, laboratory, and clinical data have been collated in an attempt to fully define this disease process. There is wide variability in the clinical presentation, depending on the organ of involvement. Pulmonary, skin, and CNS involvement are well documented in the literature. However, a review of published reports revealed no previous cases of extensive nasopharyngeal and temporal bone involvement from disseminated disease. We present two case reports of patients with strikingly similar clinical and radiologic presentations.

Case Reports

Case 1

A. W. is a 43-year-old woman who initially presented with skin lesions in the right upper leg. She was treated with antibiotics and antifungal medications, and partial improvement was noted. Six months later, she was admitted with symptoms of recurrent neck pains and headaches with right ear pain and right facial weakness. Physical examination revealed bilateral otitis media, left worse than right, and right facial weakness. Multiple skin lesions were also seen. A chest radiograph showed a fine nodular pattern throughout both lungs. Initial head CT scan showed two ring-enhancing lesions in both cerebral hemispheres near the basal ganglia. Sections through the nasopharynx demonstrated an enhancing soft-tissue density in the right nasopharynx extending into the nasal cavity, right maxillary, and sphenoid sinuses (Fig. 1A). High-resolution temporal bone sections showed abnormal soft-tissue density filling the entire middle ear and mastoid air cells. There was destruction of the base of the skull and petrous temporal bone (Figs. 1B and 1C). Cultures of the middle ear fluid grew budding yeasts identified as *Blastomyces dermatitidis*. The patient was started on amphotericin B. A subsequent cranial MR study again showed the presence of a smaller nasopharyngeal mass. This extended into the adjacent maxillary sinus and pterygopalatine fossa. On the T2-weighted images, tissue with increased signal intensity filled the entire cavity of the right middle ear and mastoid antrum (Fig. 1D). A contrast-enhanced study showed two enhancing

masses in the left cerebellar peduncle and right thalamus (Fig. 1E). A follow-up head CT study after 1 month of treatment showed improvement in the size of the brain enhancing lesions.

Case 2

M. R. is a 12-year-old boy who was admitted on January 11, 1990, following a 6-month history of headaches, neck pains, right ear drainage, and intermittent fever. Physical examination showed bilateral purulent ear discharge with tenderness on the right side of the neck. No skin findings were noted. An initial chest radiograph showed an infiltrate in the left infrahilar region, and a chest CT scan confirmed the presence of a left lower lobe infiltrate and also showed hilar adenopathy. Sinus radiographs showed airway deformity in the right parapharyngeal area and soft tissue in the medial portion of the right maxillary sinus. A CT scan of the neck showed a 3-cm nasopharyngeal mass on the right extending into the parapharyngeal space (Fig. 2A). On bone windows, destruction of the skull base was noted (Fig. 2B). Fluid in the right middle ear was also seen. MR images of the head and neck revealed a large exophytic nasopharyngeal mass extending into the parapharyngeal space. This mass extended into the right posterior nasal cavity, base of the skull, middle cranial fossa, and right external auditory canal (Figs. 2C–2F). High signal on T2-weighted images was also seen in the middle ear and right mastoid air cells. Owing to the aggressive nature of the mass, it was initially believed to represent a rhabdomyosarcoma. The patient underwent an intraoperative biopsy, which revealed thick-walled budding yeast identified as *Blastomyces dermatitidis*. The patient was started on amphotericin B and a repeat MR scan 17 days later demonstrated marked improvement in the size of the nasopharyngeal mass.

Discussion

Blastomycosis is a granulomatous fungal infection caused by a dimorphic fungus, *Blastomyces dermatitidis*. Except for occasional reports of laboratory inoculation, the fungus is primarily acquired by inhalation of spores from the environment. From the lungs, the disease disseminates via hematogenous and lymphatic routes to involve other organ systems [4]. The clinical presentation can be classified as acute, chronic, or disseminated. Laskey and Sarosi [5] reported

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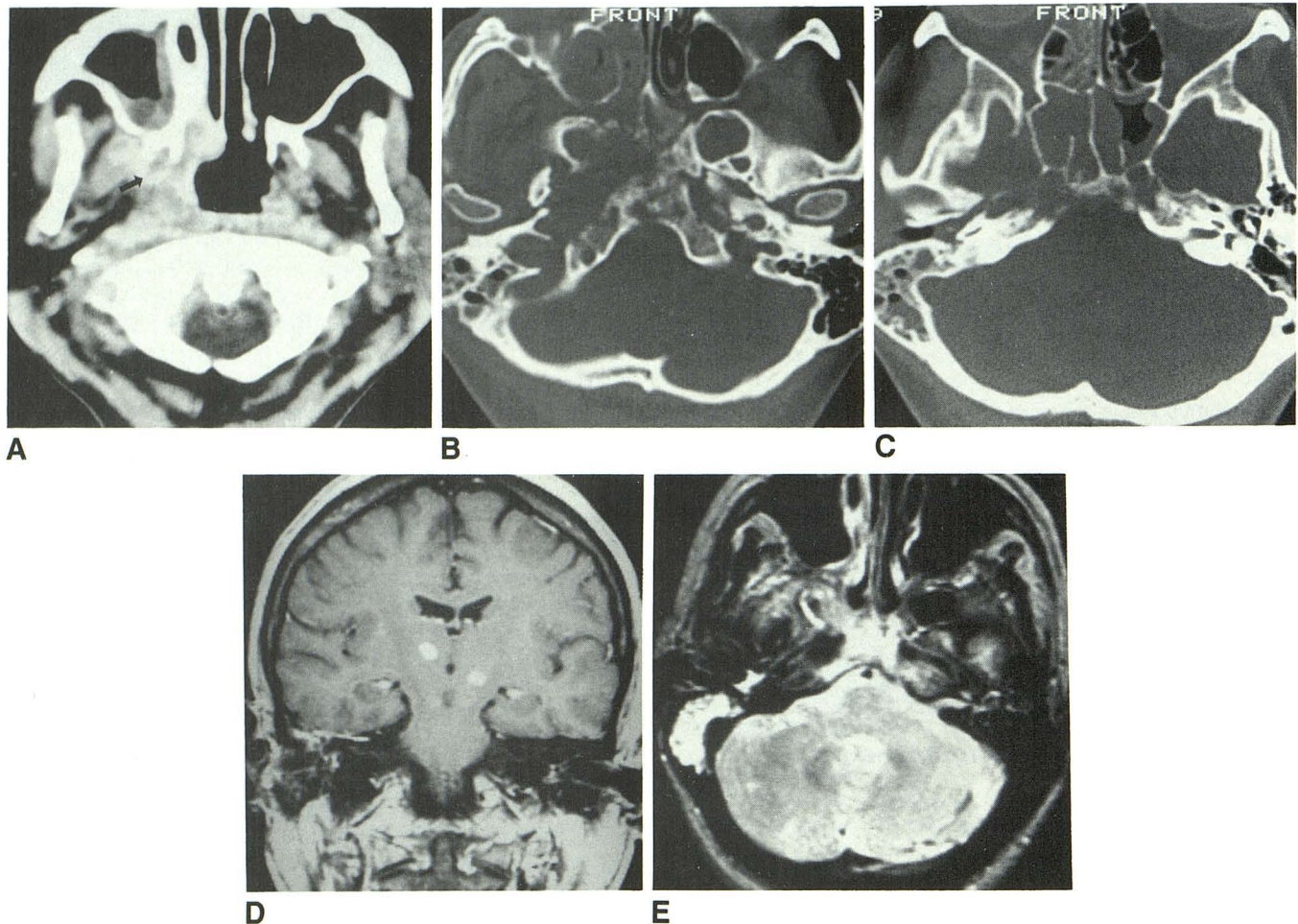


Fig. 1.—Case 1: 43-year-old woman.

A, Contrast-enhanced CT scan shows thickened right nasopharyngeal wall (arrow) with soft-tissue mass in posterior nasal cavity. A soft-tissue mass is also noted in right maxillary sinus.

B, High-resolution temporal bone CT scan shows lytic destruction of clivus, right pterygoid plates, and body of sphenoid. There are soft-tissue masses in nasal cavity, maxillary sinus, and pterygopalatine fossa.

C, Higher CT section shows soft-tissue densities in middle ear and mastoid air cells on the right. Involvement of both sphenoidal sinuses is also noted.

D, T2-weighted MR image (2700/80) shows high signal intensity in right middle ear and mastoid air cells, as well as a mass with intermediate signal intensity in right naso- and parapharyngeal regions.

E, Postcontrast T1-weighted MR image (500/20) shows two enhancing areas in right thalamus and left midbrain.

endogenous reinfection in three patients who presented initially with primary lung involvement.

Skin lesions are classically painless, nodular or papular initially, but may later enlarge to form large abscesses if left untreated [6]. Deeper lesions are also associated with the cutaneous manifestations. Owing to the similarity of the blastomycosis lesions with other fungal and bacterial skin lesions, definite identification of the organism by means of a variety of available laboratory techniques [7] is essential before treatment is instituted.

The chest radiograph findings of blastomycosis are well described. Halvorsen et al. [4] classified the pulmonary findings into air-space disease, nodular masses, interstitial disease, and cavitory lesions. Stelling et al. [8] described a miliary pattern of lung involvement by blastomycosis. However, the clinical predictive value of the various patterns of lung involvement remains a source of controversy.

CNS involvement by blastomycosis was estimated by Parker et al. [9] to constitute 2.5% of all cerebral mycosis. Intracerebral involvement results from either hematogenous spread in disseminated disease or from contiguous spread from the sinuses or, as in our cases, from a primary focus in the nasopharynx. Initially, it was thought that parenchymal involvement with blastomycosis originated from a diffuse leptomeningitis [9]. However, purely parenchymal involvement and purely leptomeningitic lesions have been described [10]. The predominant CNS infecting form is the yeast form, which generally produces noncaseating granulomas and appears as nodular enhancing lesions on brain CT scans [11]. Major differential diagnoses for primary leptomeningitic involvement include tuberculosis, cryptococcosis, metastatic cancers, various vasculitides, and sarcoidosis [12]. A single parenchymal abscess may be confused with tumor on imaging studies. CSF cultures or smears, biopsy specimens, and

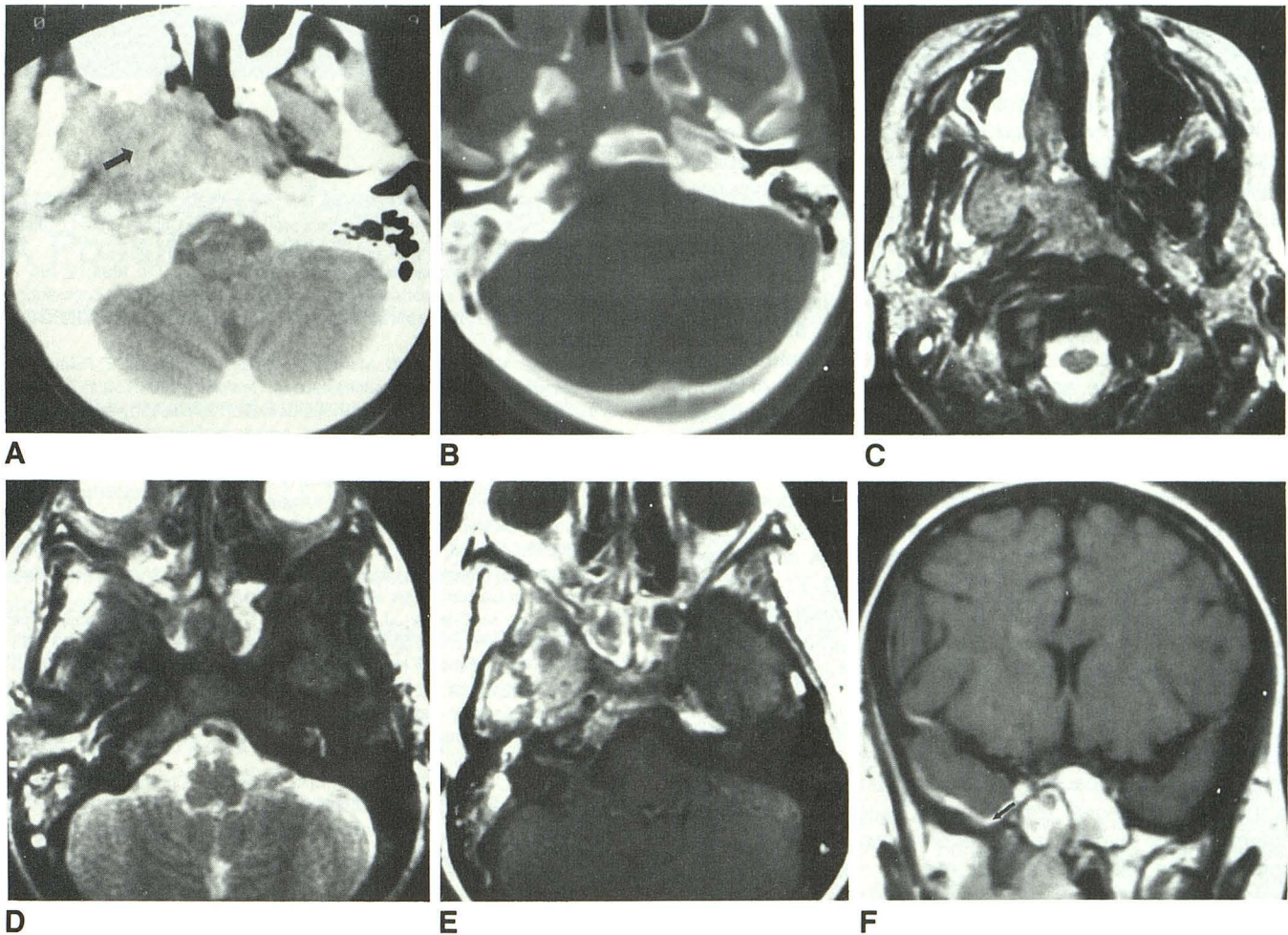


Fig. 2.—Case 2: 12-year-old boy.

A, Contrast-enhanced CT scan shows large right nasopharyngeal soft-tissue mass (*arrow*) obliterating parapharyngeal space and extending into pharyngeal airway.

B, CT scan with bone windows of higher region shows destruction of right petrous apex. Note soft-tissue mass in right middle ear and mastoid air cells.

C, T2-weighted MR image (2000/100) shows nasopharyngeal mass with intermediate signal intensity extending into nasal cavity and pterygoid region. Hyperintense signal is seen in right maxillary sinus.

D, Higher-section T2-weighted MR image (2000/100) shows extension into sphenoidal sinus with intermediate signal intensity medially and higher signal intensity laterally. Also note high signal intensity in right middle ear, external ear, and mastoid air cells.

E, Postcontrast axial T1-weighted MR image (800/20) shows enhancement of soft-tissue mass in right middle ear and mastoid air cells. Enhancement in both sphenoidal sinuses and right posterior ethmoid is also noted.

F, Postcontrast coronal T1-weighted MR image (900/20) reveals enhancement of floor of right middle cranial fossa extending into cavernous sinus (*arrow*). Also note mass in sphenoidal sinus with discontinuity of the floor of the body of the sphenoid.

correlative clinical data will aid in the accurate diagnosis of blastomycosis.

Blastomycosis, being a systemic illness, has also been reported to involve other sites. There are isolated reports of blastomycosis affecting bone, liver, heart, adrenal glands, genitourinary tract, and several sites in the extracranial head and neck region [13–15]. These rare sites of involvement are of special interest because of the increased likelihood of delayed diagnosis and treatment. The predominance of other diseases as well as the atypical presentation of blastomycosis in those sites hinders correct early diagnosis with resultant severe sequelae.

Our two cases highlight the complementary role of CT and MR in diagnosing lesions involving the base of the skull. CT,

aside from its detection of soft-tissue masses, clearly showed the bony destruction of the skull base. On the other hand, MR imaging provided better characterization of the mass, primarily because of the absence of bone artifact. The contrast-enhanced MR studies revealed the intracranial dissemination of blastomycosis (intracranial abscesses and contiguous epidural spread). Likewise, spread of the infection into the pterygopalatine fossa was clearly shown in both cases. In case 2, on the axial T2-weighted images, there was a soft-tissue mass adjacent to the area of bone destruction above the floor of the sphenoid sinus. This mass had intermediate signal intensity on T2-weighted images and most likely represented the mycetoma. Zinreich et al. [16] reported a characteristic hypointense signal in the sinuses on T2-weighted

sequences in cases of fungal sinusitis. This finding was attributed to increased concentration of iron and manganese in these infections. The bright signal in the adjacent middle ear and mastoids may represent retained secretions associated with the obstruction caused by the nasopharyngeal mass. The MR signal characteristics of inflammation are typically similar to that of water, although variation from this has been reported and extensively studied [17, 18].

The role of gadopentetate dimeglumine in extracranial head and neck imaging is still under investigation. The preliminary reports have been mixed and the indications are still in question. Contrast medium has been reported to be of use in detecting small nasal and paranasal tumors, perineural infiltration at the skull base, and leptomeningeal extension of lesions [19]. Recently, Vogl et al. [20] noted that contrast enhancement of inflammatory tissues exceeds that of tumor and that, potentially, this can be used as a differentiating point. In our cases, contrast-enhanced images were useful primarily to demonstrate leptomeningeal and brain parenchymal involvement. The abnormal areas in the nasopharynx and sinuses were well shown on the routine spin-echo T1- and T2-weighted images. However, with future availability of fat-suppressed T1-weighted sequences, contrast-enhanced images may better characterize the spread of infection in the skull base.

These two cases are of interest because of the unique nature and similarity of their radiologic presentation. In both cases, the primary focus of hematogenous dissemination was in the nasopharyngeal soft tissues. Owing to the infiltrative nature of this mycotic inflammatory process, the infection spread to the base of the skull and the epidural space, the temporal bone, pterygopalatine fossa, and paranasal sinuses. In the first case, there was hematogenous spread into the brain parenchyma. This pattern of infiltration of the nasopharyngeal space is indistinguishable from the aggressive appearance of other fungal diseases [21], which closely mimics the spread of malignant nasopharyngeal tumors. Mancuso and Hanafee [22] described and classified lesions of the nasopharynx on the basis of their imaging characteristics. These cases would be categorized as deep infiltrating lesions, and the major diagnostic consideration would be malignant neoplasms, primarily squamous cell carcinomas of either the lymphoepitheliomatous or transitional cell type. Other malignant tumors in this region include rhabdomyosarcoma, adenocarcinoma, adenoid cystic carcinoma, lymphoma, sarcoma, and metastatic disease. Bohman et al. [23] cited benign causes of such infiltrative spread and included mucormycosis [21], postoperative edema, and postbiopsy hemorrhage. Extension from a malignant otitis media can also present in a similar fashion. To this list of benign infiltrative nasopharyngeal

lesions, we submit disseminated blastomycosis as another consideration.

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