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Prevalence of Ethmoid Sinus Abnormalities on Brain CT of Asymptomatic Adults

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To evaluate the prevalence of ethmoid sinus abnormalities in adults without clinical history of sinusitis or allergic rhinitis, the brain CT scans of 156 patients were analyzed prospectively. In 17 cases (10.9%) the ethmoid labyrinth showed abnormalities. In most of these cases (88%) the ethmoid disease was localized to four or fewer cells. Men were more often affected than women (ratio, 2.5:1), and the prevalence of abnormalities was fairly similar across age groups.

Isolated ethmoid sinus infections usually go unrecognized if uncomplicated, and the diagnosis is made retrospectively [1]. However, most bacterial infections of the paranasal sinuses begin with ethmoiditis [1, 2]. During recent years the crucial role of ethmoid sinus disease in the genesis of recurrent frontal and maxillary sinusitis has been emphasized [3, 4]. Standard sinus radiographs incompletely delineate ethmoiditis because of the superimposition of various ethmoid cells, whatever the radiographic position [5, 6]. Axial CT sections allow excellent analysis of the ethmoid labyrinth [7, 8]. The aim of this prospective study was to determine the prevalence of ethmoid sinus abnormalities on brain CT scans of adults whose clinical history was free of symptoms of sinusitis or allergic rhinitis.

Subjects and Methods

During a 10-week period from May to July 1988, 729 consecutive brain CT scans were obtained for indications other than CT evaluation of paranasal sinus abnormalities. The CT scans were evaluated prospectively for ethmoid sinus alterations and correlated with clinical history. Patients were excluded from the study population for any of the following reasons: under 18 years old, unconscious or confused, antecedents of surgery or radiation therapy involving the facial region, clinical history of sinusitis, or allergic rhinitis (the study was conducted between spring and summer).

One hundred fifty-six patients with no clinical indication of sinus disease (so-called asymptomatic patients) were included in the study. The population consisted of 80 men and 76 women, 18 to 89 years old (mean age, 55.7 years).

The scans were obtained with a Tomoscan 310 or a Tomoscan 60 TX.* Axial contiguous 9-mm-thick slices were obtained with the former unit and 10-mm-thick sections with the latter. In some cases additional 3-mm-thick slices were acquired for study of the posterior fossa. The study focused on ethmoid abnormalities, so only the sections depicting the ethmoid labyrinth were reviewed. Owing to the relatively small extent of the ethmoid in the craniocaudal axis and to the thickness of the slices, only three to five sections were displayed. For this reason the frontal, maxillary, and sphenoid sinuses were partially or totally unseen on the sections, and thus abnormalities of these cavities were not considered in the present study.

All images were photographed at a wide window width (1600 HU), centered to -120 HU to favor the demonstration of soft tissue. The sections were not reviewed at narrow window settings despite the usefulness of such windows to differentiate between trapped secretions and active subclinical infection, this last condition showing frequently with contrast enhancement. Actually, it was considered that such a differentiation was not mandatory in the present

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study, whose prime purpose was to determine the prevalence of ethmoid sinus abnormalities on brain CT scans in asymptomatic adults and not to make a definite diagnosis. Furthermore, owing to the small size of the ethmoid cells, the thickness of the CT sections (9–10 mm) was not convenient for a detailed analysis of the type of ethmoid abnormality.

Results

Each ethmoid cell was classified as either normal (clear with thin wall) or abnormal. Two different abnormalities were considered: (1) a thickened wall with hypertrophic mucosa and (2) a totally opacified cell (by fluid or hypertrophic mucosa). If two or more cells were affected by the process, the abnormalities could be detected either singly or in combination. According to the number of abnormal ethmoid cells, the extent of the process was graded as I, one cell; II, two to four cells; or III, five cells or more. Uni- or bilaterality of the process was noted.

Of the 156 asymptomatic patients, 139 (89.1%) had a normal CT appearance of the ethmoid labyrinth. Seventeen (10.9%) of the patients had some type of ethmoid cell abnormality. The age and gender distribution of the patients with normal and abnormal CT scans is given in Table 1. Men were more often affected by asymptomatic ethmoid cell abnormalities than women, except in the 18–40-year-old group.

In each age group the prevalence of asymptomatic ethmoid abnormality was fairly similar (18–40 years = 11.4%, 41–60 years = 15%, >60 years = 10.9%).

The extent and type of ethmoid abnormality are given in Table 2. Unilaterality of the lesion was characteristic in grade I, but in grade II most of the lesions (80%) were bilateral. There was a relatively equivalent distribution of the type of ethmoid cell abnormality among all groups. In no case did we note bone erosion or an expansile lesion (mucocoele).

Discussion

Isolated ethmoid sinus infections usually go unrecognized, but they are frequently the nidus of bacterial infections of the paranasal sinuses [1, 2]. In recent years the important role of the ethmoid sinus disease in the genesis of recurrent frontal or maxillary sinusitis has been emphasized [3, 4]. For this reason there is a need for a systematic radiologic evaluation of the ethmoid sinus in cases of recurrent sinusitis. The standard views allow good demonstration of the frontal, maxillary, and sphenoid sinuses, but they are insufficient to ap-

TABLE 2: Extent and Type of Ethmoid Abnormalities Diagnosed on Brain CT Scans in 17 Asymptomatic Patients

	Unilateral	Bilateral	Type		
			HM	TO	MT
Grade I	5	—	2	3	—
Grade II	2	8	3	2	5
Grade III	1	1	1	—	1
Total	8	9	6	5	6

Note.—HM = hypertrophic mucosa, TO = total opacification, MT = mixed type.

preciate the ethmoid labyrinth. Actually, in all projections there is superimposition of some ethmoid cells, because of the complexity of the ethmoid labyrinth; furthermore, a group of opacified cells can be masked by the low air density in adjacent normal cells [5]. Conversely, axial CT sections offer good demonstration of the ethmoid labyrinth [6]. However, recent studies have shown that the coronal plane is the closest to the view of the endoscopist and the best plane in which to display the anatomy of the osteomeatal unit [3, 4]. Furthermore, thin sections are mandatory for the precise assessment of ethmoid abnormalities [6].

Soft-tissue disease is often found within the paranasal sinuses on CT, and it is not rare that the patient is asymptomatic [5]. In the ethmoid labyrinth such asymptomatic abnormalities can represent either scarring or a chronic inflammatory process. Sometimes it can be difficult to diagnose an active process. In an excellent paper, Som et al. [5] described the principles of a correct CT evaluation of the nature of ethmoid sinus abnormalities. Because of a recent resurgence of interest among otolaryngologists in a selective and conservative surgical treatment of ethmoid abnormalities, we decided to determine prospectively the frequency of such lesions in asymptomatic patients. During the period of study we performed 156 brain CT scans in adults free of symptoms of present or past sinusitis or allergic rhinitis. In 139 cases (89.1%) the ethmoid labyrinth showed no abnormality. In 17 cases (10.9%) some type of ethmoid disease was noted.

This occurrence is lower than the rate (35%) of abnormal ethmoid sinuses detected on cranial CT scans of pediatric patients [9]. However, the high percentage of incidental ethmoid sinus abnormalities reported in that study decreased significantly among children who were older than 12. Probably young children have more frequent sinus infections without clinical evidence of sinusitis, a hypothesis that can be explained in the context of frequent upper respiratory tract infections in children. In young children, other causes of ethmoid sinus clouding include tears and redundant mucosa.

Another paper [10] reports a very low occurrence (1%) of ethmoid sinus abnormalities in an asymptomatic pediatric population. It is difficult to comment on this low rate of ethmoid sinus disease; perhaps some technical pitfalls can explain this observation (for example, partial volume effects on small ethmoid labyrinths in children).

To our knowledge there is no report of incidental ethmoid sinus abnormalities in asymptomatic adults diagnosed on

TABLE 1: Ethmoid Sinus Appearance by Age and Gender in 156 Asymptomatic Patients

Age (years)	Normal		Abnormal	
	Male	Female	Male	Female
18–40	21	14	1	3
41–60	21	19	6	—
>60	26	38	5	2
Total	68	71	12	5

brain CT scans. Recently, in a retrospective evaluation of incidental paranasal sinus disease on MR imaging of the brain, one investigator reported a rate of 6.2% of ethmoid sinus disease (Moser FG, personal communication). This report was made with analysis of 263 consecutive T2-weighted MR examinations of the head (excluding indications associated with possible sinus disease) without correlation with clinical history. The rate of ethmoid sinus abnormalities is lower than in our series, a difference that is probably due to the fact that, despite a better sensitivity of MR for detecting active mucosal disease, fibrosis can be difficult to diagnose on MR because of the low signal intensities on T1- and T2-weighted images. Thus, these cases with fibrosis can be missed on MR but seen on CT.

In summary, our study suggests the following conclusions: (1) incidental ethmoid sinus abnormalities are not infrequently discovered (10.9%) on brain CT scans of adults without clinical history of sinusitis or allergic rhinitis; (2) processes localized to four or fewer cells are far more frequent than more extensive lesions; (3) men seem more affected than women; and (4) whatever the age group, the prevalence of ethmoid sinus disease is fairly similar in adults.

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