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Analysis of computed tomography features of fungal sinusitis and their correlation with nasal endoscopy and histopathology findings

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Abstract

Objective: The purpose of this study was to analyze the computed tomography (CT) features of fungal sinusitis and to correlate them with nasal endoscopy and histopathological findings.

Materials and Methods: Our study included 16 patients of either sex and any age group who presented in the otorhinolaryngology clinic at our hospital and had evidence of definite sinonasal disease on clinical evaluation. Multidetector CT was carried out on Somatom definition AS + 128 slice CT Machine by Siemens Germany Ltd. Axial sections were performed with the plane of data acquisition parallel to the hard palate and slice thickness of 3 mm, reconstructions at 0.75 mm in coronal and sagittal planes. Scanning parameters included 190 mA S, 120 KV and tube rotation time of 0.5 s. Provisional CT diagnosis was made in all cases and correlated with nasal endoscopy and histopathological findings.

Results: Out of total 16 patients, 12 showed immunocompromised status and had infection with mucormycosis. Out of 12, 9 patients (75%) showed extension of disease beyond the sinonasal cavities and 4 (33.3%) showed evidence of bone destruction. All patients with candidiasis showed soft-tissue attenuation with hyperdense areas on CT scan. Nearly, 66.6% patients with aspergillosis showed soft-tissue attenuation with hyperdense areas and expansion of sinonasal cavities. Fifteen patients (93%) were proved to be of fungal sinusitis on histopathology. One patient of non-specific granulomatous infection showed bone destruction and mimicked fungal sinusitis on CT.

Conclusions: In the present study, fungal sinusitis could be correctly diagnosed on CT with high accuracy. Thus, understanding the different CT findings of fungal sinusitis allows the radiologist to play a crucial role in the diagnosis and prompt treatment.

Keywords: Allergic, fungal, invasive, sinusitis

Resume

Objectif: Le but de cette étude était d'analyser les caractéristiques de la tomodynamométrie (TDM) de sinusite fongique et de les corrélés avec l'endoscopie nasale et constatations histopathologiques.

Matériel et Méthodes: Notre étude a porté sur 16 patients du sexe soit et n'importe quel groupe d'âge qui ont présenté à la clinique d'oto-rhino-laryngologie à l'hôpital et présentaient des signes de maladie sinonasale précis sur l'évaluation clinique. Multidétecteur CT a été réalisée sur Somatomdefinition AS + 128 tranche CT Machine par Siemens Allemagne Ltd. Coupes axiales ont été réalisées avec le plan d'acquisition de données parallèle au Palais dur et tranche de 3 mm d'épaisseur, les reconstructions à 0,75 mm en coronal et plans sagittal. Paramètres de numérisation inclus 190 m, temps de rotation 120 KV et tube de 0,5 s. diagnostic de CT provisoire a été fait dans tous les cas et en corrélation avec l'endoscopie nasale et constatations histopathologiques.

Résultats: Sur total de 16 patients, 12 ont montré État immunodéprimé et eu infection avec mucormycose. Sur 12, 9 patients (75 %) ont montré l'extension de la maladie au-delà des cavités sinonasale et 4(33.3%) ont montré des

preuves de la destruction osseuse. Tous les patients atteints de candidose ne présentaient atténuation des tissus mous avec zones hyperdense CT scan. Presque, 66,6 % des patients présentant l'aspergillose a montré atténuation des tissus mous avec zones hyperdense et expansion des cavités des sinus. Quinze patients (93 %) ont été avérés de sinusite fongique sur l'histopathologie. Un patient d'infection granulomateuse non-spécifiques a montré la destruction osseuse et imité sinusite fongique sur CT.

Conclusions: Dans la présente étude, sinusite fongique pourrait être diagnostiquée correctement sur le CT avec une grande précision. Ainsi, comprendre les différents résultats de CT de la sinusite fongique permet le radiologue à jouer un rôle crucial dans le traitement de diagnostic et invite de.

Mots-clés: unllergic, champignon, une bactérie envahissante, sinusite

Introduction

Fungal sinusitis is an important clinical problem with diverse manifestations. It should be considered in all immunocompromised patients and in all patients with chronic sinusitis.^[1] The most recent and widely accepted classification of fungal sinusitis is broadly categorized as either invasive or non-invasive. Invasive fungal sinusitis is sub-divided into acute invasive fungal sinusitis, chronic invasive fungal sinusitis and chronic granulomatous invasive fungal sinusitis. Non-invasive fungal sinusitis is sub-divided into allergic fungal sinusitis and fungus ball.^[2] Its successful treatment requires a prompt diagnosis and frequently relies on radiologic imaging, specifically computed tomography (CT) imaging. In the present study, we have studied CT features of fungal sinusitis.

Purpose

The present study was undertaken to evaluate the CT features of fungal sinusitis, to classify them into invasive and non-invasive types and to further correlate CT findings with nasal endoscopy and histopathology diagnosis.

Materials and Methods

A prospective study of 16 cases of either sex and any age group who were presented in the otorhinolaryngology clinic, at our hospital and were found to have evidence of definite sinonasal disease on clinical evaluation was taken up.

All patients included in this study were assessed as follows.

Clinical details

- Detailed history regarding nasal obstruction, nasal discharge, epistaxis, sneezing and orbital symptoms was taken
- Relevant past and family history was taken
- Detailed findings of general and local examination including anterior and posterior rhinoscopy, oral and ophthalmoscopic examinations were recorded.

CT

Multidetector CT was carried out on Somatom definition AS+ 128 slice CT Machine by Siemens Germany Ltd. After obtaining the scout projection, the area of scanning was defined to include the region from the roof of frontal sinus until the hard plate.

Axial sections were performed with patient in the supine position and the plane of data acquisition parallel to the hard palate. The sections were taken with slice thickness of 3 mm and reconstructions were carried out at 0.75 mm in coronal and sagittal planes. Scanning parameters included 190 mA S, 120 KV and tube rotation time of 0.5 s. Extended cephalic/caudal sections were carried out in few cases to see the extension of the disease process.

Contrast enhanced CT was performed wherever indicated after giving a rapid bolus injection of 50 ml of non-ionic iodinated contrast material.

The images thus generated were reconstituted at appropriate window widths and window levels to depict the soft-tissue pathologies as well as bony abnormalities.

Provisional CT diagnosis was made in all cases based on CT pattern and pertinent clinical data.

Various CT patterns suggestive of fungal sinusitis were intrasinus high density nodular or linear interlacing areas, expansion of sinuses with thinning or erosion of bony walls, bone sclerosis or remodeling, extension of disease into adjacent soft-tissues, orbits or cranium. CT diagnosis was correlated with nasal endoscopic and histopathological diagnosis in all cases.

All patients underwent surgical debridement of sinuses and nasal cavities. Biopsies were taken for histopathology and restoration of drainage of sinuses was done.

Systemic antifungals were given to the patients depending upon the nature of fungus and extent of disease. Itraconazole and lipid based amphotericin

B was given to patients with aspergillosis and mucormycosis respectively for duration of 3-6 months. Most of patients with allergic fungal sinusitis responded well; however, patients with acute invasive fungal sinusitis having extrasinus extension and decreased neutrophil count showed poor response and eight patients died within 6 months.

Results

Sixteen patients with CT diagnosis of fungal sinusitis were included in our study [Table 1]. Out of these, 12 patients showed immunocompromised status in the form of diabetes mellitus acquired immune deficiency syndrome renal allograft recipient and acute/chronic myeloid leukemia and had an infection with mucormycosis.

All these patients presented within 2-3 weeks of onset of symptoms. Most common symptoms were due to orbital or intracranial extension of disease.

Out of 12, 9 patients (75%) showed extension of disease beyond the sinonasal cavities [Figures 1

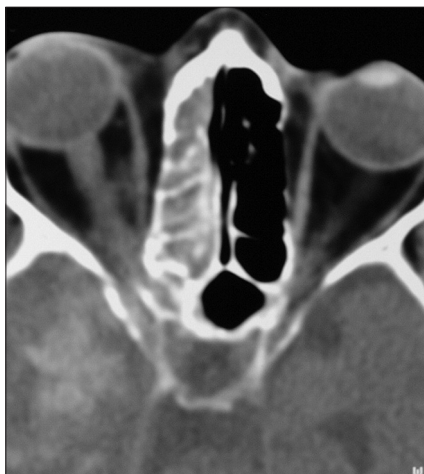


Figure 1: Mucormycosis-axial computed tomography: Section shows opacification of right ethmoid air cells with high attenuation areas. There is increased attenuation of right intraorbital fat with thickening of the optic nerve. Note an area of hemorrhage in right temporal lobe due to fungal cerebritis

and 2]. Four patients (33.3%) showed evidence of bone destruction and expansion of sinuses was not seen in any case. Out of these 12 cases, 9 patients showed unilateral pansinusitis and 3 patients had bilateral disease.

All patients with candidiasis showed soft-tissue attenuation with hyperdense areas on CT scan. Two out of three patients (66.6%) with aspergillosis also showed evidence of soft-tissue attenuation with hyperdense areas [Figure 3] and expansion of sinonasal cavities [Figure 4].

Patients with aspergillosis and sporothrix infection had symptoms since 6-12 months and had a history of allergy to dust and pollens with seasonal exacerbations. Two out of three patients of aspergillosis and patient with sporothrix infection had bilateral distribution of disease.

Out of 16 patients with CT diagnosis of fungal sinusitis, 13 patients had evidence of crustaceous and necrotic material (suggestive of fungal infection) on nasal endoscopy. One patient with sporothrix schenckii infection showed polypoidal masses with cheesy material on nasal endoscopy and was interpreted as inflammatory sinonasal polyposis on endoscopy. Two cases of aspergillosis were also



Figure 2: Mucormycosis-axial computed tomography: Section shows opacification of bilateral ethmoid air cells with breach in the right lamina papyracea and intraorbital extension

Table 1: CT features inpatients with fungal sinusitis

CT features	Mucormycosis (n=9)	Mucormycosis with candidiasis (n=3)	Aspergillosis (n=3)	Sporothrix schenckii (n=1)
Soft-tissue attenuation with hyperdense areas	2	3	2	1
Soft-tissueattenuation without hyperdense areas	7	Nil	1	Nil
Extension beyond sinonasal cavities	7	2	1	Nil
Bony destruction	4	Nil	1	Nil
Expansion ofsinonasal cavities	Nil	Nil	2	1

CT=Computed tomography

diagnosed as inflammatory polyposis on endoscopy as there was no evidence of mucosal invasion.

Out of 16 patients with CT diagnosis of fungal sinusitis, 15 patients (93%) were correctly diagnosed as proved on histopathology. One patient of non-specific granulomatous infection was wrongly interpreted as fungal sinusitis on CT scan because of the presence of erosion of the hard palate, which is common in acute invasive fungal sinusitis [Figure 5].

Discussion

Acute invasive fungal sinusitis is a rapidly progressing and most lethal form of fungal sinusitis, with a reported mortality of 50-80%.^[3]

Up to 80% of invasive fungal infections in this group are caused by fungi belonging to the order Zygomycetes, such as *Rhizopus*, *Rhizomucor*, *Absidia* and *Mucor* and infection by these organisms is sometimes termed zygomycosis.^[4]

The diagnosis of acute invasive fungal sinusitis is always a dilemma as the most common CT feature is non-specific mucosal hypertrophy and in some cases hyperdense attenuation is not seen, as in 75% cases in our study. However, the presence of immunocompromised status, bone erosion, extension beyond sinonasal cavities in conjunction with nasal endoscopy findings can clinch the diagnosis in all cases.

In chronic invasive fungal sinusitis, inhaled fungal organisms are deposited in the nasal passage and paranasal sinuses. Insidious progression occurs over several months to years, in which fungal organisms invade the mucosa, submucosa, blood vessels and bony walls of the paranasal sinuses. This results in significant morbidity and may even be fatal. Common organisms include *Mucor*, *Rhizopus*, *Aspergillus*, *Bipolaris* and *Candida*. On imaging in such cases, hyperdense attenuation with bony sclerosis and expansion is the most important clue to diagnosis as seen in our study.

In allergic fungal sinusitis, there is usually involvement of multiple sinuses if not pansinusitis and rhinitis. Disease tends to be bilateral and there is a frequent nasal component. The majority of the sinuses show near-complete opacification and are expanded. Non-contrast CT demonstrates hyperdense attenuation.^[5]

Fungus ball appears as a mass within the lumen of a paranasal sinus and is usually limited to one sinus. The maxillary sinus is the most commonly involved sinus. There is usually calcification in the fungal hyphae.^[6]

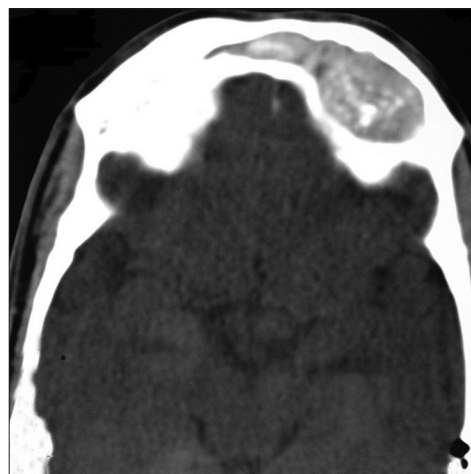


Figure 3: Aspergillosis: Axial computed tomography section shows soft-tissue attenuation mass with high attenuation areas in left frontal sinus with evidence of bony sclerosis



Figure 4: Aspergillosis: Coronal computed tomography demonstrates complete opacification and expansion of bilateral maxillary sinuses, nasal cavities and anterior ethmoid air cells with hyperdense attenuation



Figure 5: Non-specific chronic granulomatous lesion mimicking fungal sinusitis: Coronal computed tomography section shows diffuse mucosal hypertrophy in bilateral nasal cavities with destruction of the hard palate

Conclusions

In the present study, considering histopathological diagnosis as the gold standard, fungal sinusitis could be correctly diagnosed on CT with high accuracy as only 1 patient (out of 16) of non-specific granulomatous infection was wrongly interpreted as fungal sinusitis.

Understanding the different types of fungal sinusitis and knowing their particular radiologic features allows the radiologist to play a crucial role in alerting the clinician to use appropriate diagnostic techniques for confirmation. Prompt diagnosis and initiation of appropriate therapy are essential to avoid a protracted or fatal outcome. However, the sample data of the present study is limited, we need to study these CT features in a larger sample of patients and may be able to strongly emphasize the crucial role of CT scan in the diagnosis of fungal sinusitis in future.

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