ORIGINAL ARTICLE

Diagnostic Accuracy of C.T Scan in Fungal Sinusitis, Diagnosis and Extent

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[1]*Conception, Synthesis and Planning of the research*
[2]*Review the Study*
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ABSTRACT

Objective: To assess the diagnostic accuracy of computed tomography in evaluation of diagnosis and intra cranial / intra orbital extent of fungal sinusitis, histopathology kept as reference value.

Study Design: Descriptive, cross - sectional study

Place and Duration: This study was carried out at Radiology and Otorhinolaryngology department of Civil Hospital and Dow Medical College Karachi, from January 2015 to December 2015.

Materials and Methods: Out of 427 patients of nasal obstruction only 98 cases were included, whose diagnosis of nasal polyposis was confirmed on clinical examination. All these patients referred from ENT Ward to the Radiology Department at Civil Hospital Karachi for C.T scan to know the extent of the lesion. Patients between 20 - 65 years of either gender, clinically diagnosed cases of sinonasalpolyposis and recurrent / chronic rhinosinusitis were included in the study. Exclusion criteria were cases of acute rhino sinusitis and postsurgical cases. All CTs were reported the expert and proficient radiologist of the department having more than 05 years of experience CT reporting. CT results assess for the presence of high density areas in the plain study, of the sinusthinning /expansion and bone erosion noted and extent of the disease noted that is the presence or absence of intracranial and intra orbital.

Results: Among all 98 numbers of patients in this study rate of complications are highest at the age group of 20-30 years i.e. 28.6%. No significant gender preponderance was noted statistically. 41 (41.8 %) of the patients had intra cranial extension, 47 (47.9%) had intra orbital extension and 59 (60.2%) had bony erosions The sensitivity of CT scan by taking histopathology findings as gold standard was 89.3% and specificity 86.9%. The positive predictive value of CT scan was 95.7% and negative predictive value was 71.4% and Diagnostic Accuracy was 88.7%

Conclusion: There is considerably high sensitivity rate and reasonable specificity of CT imaging in the diagnosis of fungal sinusitis and detection of bone erosions, intracranial / intra orbital extension of the disease which is confirmed by histopathology results.

Keywords: Diagnostic accuracy, histopathology, fungal sinusitis, intra cranial, intra orbital, sinonasal polyposis.

Introduction

Allergens are normally present in the atmosphere and its presence is the commonest cause of sinonasal disease and rhinosinusitis.[1] Rhinosinusitis is a common disease approximately 20% of people suffers from it sometimes in their lives. [2] Amongst patients who underwent surgery for chronic sinonasal disease, approximately 6% to 9% are found to have allergic fungal sinusitis.[3] The association of fungi has been suggested for many years as a cause of chronic sinonasal disease that ends up in sinonasal polyposis and nasal blockage. The cause is still not clear but a recent Egypt study reported that 92 % cases of nasal polyposis are associated with fungal infection.[4]

There are two forms of fungal sinusitis, invasive and non-invasive. Invasive form is divided on the basis of severity and duration into acute fulminant fungal sinusitis and granulomatous and chronic invasive mycosis. Non-invasive forms are allergic and fungal ball (myecetoma). The causative organism of invasive variety is mucormycosis while both patterns of disease found in aspergillus.[5, 6] On imaging Invasive infections present as soft tissue opacification of sinuses with destruction of sinus walls with or without intracranial or intraorbital extensions while Non-invasive infection results showed opacification and expansion of sinus without bony destruction.[6]

In Current studies have shown a worldwide increase in incidence of reported cases of skull base erosion in fungal rhinosinusitis. A local study showed intraorbital extension in 29.78% of cases and skull base erosion in 19.14% of cases.[7] Clinical presentation varies from inflammatory changes to exophthalmos, decreased / loss of ocular movement and loss of vision.[8] There is diversity of intracranial complications, varies from meningitis, brain abscess to space occupying lesion.[8]

Fungus sinusitis has specific density that clearly visualized on imaging. Usually initial recommendation for sinus problems are plain radiography that is waters view for PN Sinuses. For lack of clear visualization of all ethamoidal sinuses, osteomeatal complex and extent of the disease, cross sectional imaging required that is C.T and MRI. For the purpose of bone evaluation MRI has limited role and in those conditions in which MRI is contraindicated therefore the only remaining imaging modality of choice is CT scanning. The diagnostic criteria for fungal sinusitis include homogeneous / heterogeneous opacification, air fluid levels+/-, mucosal thickening, polyps formation, osseous erosion / destruction, calcification, retroantral, intraorbital, intracranial, and overlying superficial soft tissue extension.[9]

It has been observed that the sensitivity and specificity of CT scan for evaluation of fungal sinusitis was 95% and 92.5% respectively with positive predictive value 96.2% and negative predictive value 90.27. However, the sensitivity, specificity, positive and negative predictive values of preoperative CT imaging of fungal ball was 83%, 94%, 56% and 98% respectively.[9]

Main objective of this study was to assess the diagnostic accuracy of C.T scan in diagnosis and extent of fungal sinusitis. International data is available on this topic that had reported high sensitivity and specificity of CT in the detection of fungal sinonasal disease. The rationale of this study is to evaluate the data in our local setup as no such published data are available in our population.

Materials and Methods

This cross sectional descriptive study was conducted in the Department of Radiology and Otorhinolaryngology from January 2015 to December 2015 of Civil Hospital Karachi (CHK). Out of 427 Patients of nasal obstruction only 98 cases were referred to Radiology Department of Civil Hospital Karachi for CT scanning whose diagnosis of sinonasal polyp was confirmed by the clinical examination. All observations were properly monitored and followed by histopathology. Biopsy of every patient was conducted by expert pathologist. Data was entered and results analyzed using SPSS version 17 software. The study results were evaluated in terms of diagnosis and the extent of fungal sinusitis keeping postoperative findings along with histopathology results as gold standard / reference value.

Other inclusion criteria were patients of chronic or recurrent rhinosinusitis of either gender between 20 – 65 years of ages. Questionnaire was designed and filled by investigators after validation and reliability assessment. Cases of acute rhinosiusitis, other causes of nasal obstruction like DNS and postoperative cases excluded from the study. Bias and cofounders were controlled by excluding cases of acute rhino sinusitis by thoroughly reviewing patient history. Patients were well informed about the procedure and written consent was taken prior to the procedure.

The standard protocol for paranasal sinuses was followed. The procedure were performed by using Toshiba

Activation 16 slice multi detector CT scanner with imaging protocol of axial and coronal studies with 3-5mm contiguous sections at Civil Hospital Karachi. In all patients (98 in numbers) CT scans of the PNS were carried out. Images were obtained with soft tissue window setting before and after administration of contrast ultravist with dose of 50 ml 2.5 flow rate (1mg/kg). Radiologist of more than 05 years post fellowship experience, examined the CT scans to evaluate fungal sinusitis on computed tomography. CT criteria for the presence or absence of fungal sinusitis / fungus ball (according to operational definition) was followed and findings were confirmed with histopathological results from relevant Otorhinologist (ENT Specialist).

Operational Definition:

Findings of Fungal Sinusitis on CT scan.

The majority of sinuses show near complete opacification on unenhanced CT scan, the sinuses are typically opacified by centrally (often serpiginous) hyperdense material with a peripheral rim of hypodense mucosa. It is also called double density sign (DDS).

Other findings include .Homogenous or / heterogeneous opacification of sinus, high density areas, mucosal thickening, polyps formation, osseous erosion / destruction, calcification, retroantral, intraorbital, intracranial, and overlying superficial soft tissue extension.

The data was entered and statistical analysis were carried out by using SPSS 17. Mean and standard deviation was calculated for age. Frequencies and percentages were computed for gender, presence of fungus ball and biopsies results. The diagnostic accuracy of computed tomography in fungal sinusitis was assessed in relations of sensitivity, specificity, positive predictive value and negative predictive value by keeping histopathology as gold standard / reference value.

Results

Out of 98 patients there were 50 (51.1%) male and 48(48.9%) female patients. The youngest patient included in the study was 20 years old male and oldest patient was a 65 years old lady with mean of 34.6122±10.94year. The common sinus involved maxillary sinus, ethamoid sinus and combination of both sinuses were 60%. Following were the results of C.T findings. There were 90 (91.8%) patients had fungal ball / dense areas in the sinuses and 08(8.1%) patients had no fungal balls, 59 (60.2%) had bony erosions and 39(39.73%) patients had no bony erosions, 41(41.8%) patients had intracranial extension and 57(58.1%) patients had no intracranial extension and 47(47.9%) patients had intra orbital invasion and 51(52.0%) patients had no intra orbital invasion Table I.

Table 1: C.T Findings of fungal Sinusitis in the study (n=98)

Findings	No. Of patients	%age
High density areaswith a peripheral rim of hypodense mucosa.(DDS)	90	91.8%
Expansion of the sinus	79	80.6%
Bone erosion and thinning	59	60.2%
Intracranial	41	41.8%
Intra orbital	51	52.0%

Figure. 1 Histopathology / microscopic slide in fungal sinusitis Figure.2

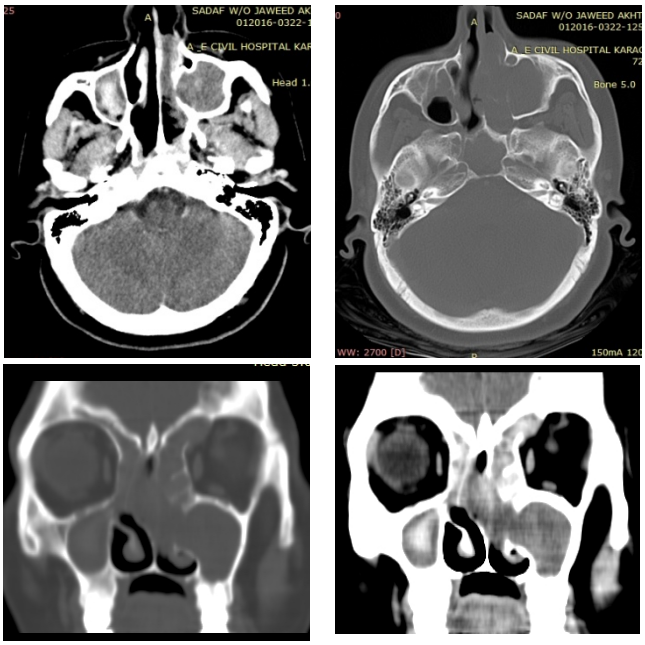

Figure 1. Fungal Sinusutis with Double Density Sign, intra orbital extension and bone erosion

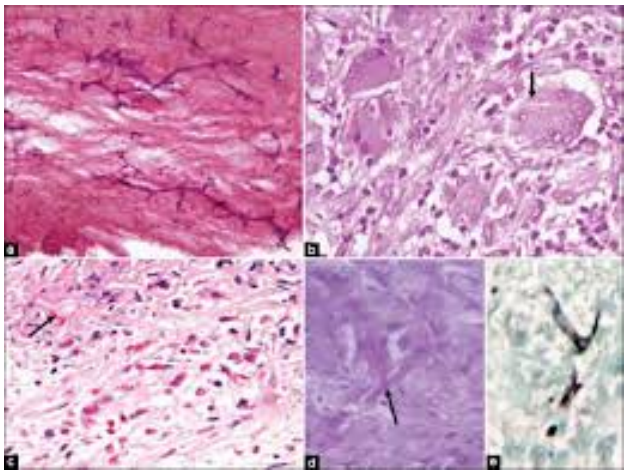

Figure 2: Sections show (a) Aspergillus in necrotic background (H and E), (b) fungal hyphae in giant cell (H and E), (c) many eosinophils and hyphae (H and E), special

stains highlighting the fungal morphology (d; PAS) and (e; silver methanamine)

There were 67(68.3%) patients true positive, 03(3.0%) patients false positive, 08(8.1%) patient false negative and 20(20.4%) patients true negative. The sensitivity of CT scan by taking histopathology findings as gold standard was 89.3% and specificity 86.9%. The positive predictive value of CT scan was 95.7% and negative predictive value was 71.4% and Diagnostic Accuracy is 88.7%. (Table II and III).

Table II: Diagnostic Accuracy Of C.T In Fungal Sinusitis Keeping Histopathology As Gold Standard(N=98)

Sensitivity	89.3%
Specificity	86.9%
Positive PV	95.7%
Negative PV	71.4%
Diagnostic Accuracy	88.7%

Table III: Distribution of true positive, false positive, false negative and true negative cases in the C.T study (n=98)

Results of CT	Histopathology Results		Total
C.T Positive	True positive 67	False positive 3	70
C.T Negative	False negative 8	True negative 20	28
Total	75	23	98

Discussion

Fungal sinusitis had serious complications and may extend to orbit and show intracranial extensions if not diagnosed and timely treated. [10] Plain radiographs such as waters or Caldwell view is the initial investigation, but diagnostic accuracy is very low for extension of the disease and detailed evaluation needs cross sectional imaging.[11] Therefore, currently CT scan of paranasal sinuses is the imaging of choice for sinusitis.[12] Multiple slice of 3mm thickness through ostiomeatal complex can be taken.[13] Because of these multiple slices, patient has a high x-ray absorption dose in paranasal sinuses spiral CT.[15]

In our study sensitivity and specificity of CT scan was 89.3% and 86.9% respectively for detection of fungal sinusitis. The sensitivity is in the range of 84% to 97% in detection of sinusitis in various sinuses with the highest sensitivity for ethmoidal sinusitis and lowest sensitivity for frontal sinusitis. Specificity of limited CT scan varies between 94% and 100%.[7] For instance Goodman et al used screening coronal CT scan method and he found the sensitivity 93% and specificity 89%.[14] In another study with the 4-slice technique, sensitivity were 81%, specificity 89%, NPV and PPV 74% and 92% respectively[15] however, due to the 16 slice in our proposed CT scan method, these variable in our study were 89.3%, 86.9%, 95.7% and 71.4%. In this study there were 51% male and 49% female patients and this is As compared with the study of Tezer et al[15] there were 58% male and 42% female patients, which is comparable with our study. In present study sensitivity and specificity of CT scan was found 89.30% and 86.9% respectively. As compared with the study of Sharifian et al[16] the sensitivity and specificity of CT scan was found 95% and 92.5% respectively, which is comparable with our study. In the current study positive predictive value and negative predictive value of CT scan was found 86% and 70% respectively. As compared with the study of Sharifian et al[16] the positive predictive value and negative predictive value of CT scan was found 96.2% and 90.2% respectively, which is also comparable with our study.

Fungus may be characterized by its radiological features and histopathological findings. Plain radiography and CT scan are two frequently used imaging modalities. Plain radiography fails to image individual ethmoid air cells, ostiomeatal complex or exact extent of mucosal disease. Magnetic resonance imaging is indicated and helpful when there is suspicious of intracranial extension but it provides limited evaluation of osseous destructions. Therefore, CT scan of the sinuses remains the imaging modality of choice The C.T diagnostic criteria for allergic fungal sinusitis include mucosal thickening, polyps formation, homogeneous opacification, osseous erosion, air fluid levels, intraorbital, intracranial, retroantral and overlying facial superficial soft tissue extension polyp.[9] CT scan has lesser cost and accurate diagnosis in comparison with per operative and histopathological finding.

Conclusion

On the basis of the statistical analysis and results of this study it is determined that CT imaging has significantly high sensitivity and a reasonable specificity in the diagnosis, detection of bone erosions, intracranial and intra orbital extension of the disease. it reflects the fact that, this so called innocent disease can leads to serious morbidity and even mortality, which is confirmed by histopathology findings.

RECOMMENDATIONS: It is suggested that early CT scanning is mandatory for the diagnosis of the disease and for the exact extent of the disease as to avoid dangerous outcomes of a trivial disease.

References

1. Chaudhry AN, Ahmad MW. Para nasal sinuses mucosal thickening: comparison between conventional radiography and computed tomography. PMJHS 2009 :128-130.http://pjmhsonline.com/paranasal_sinuses_mucosal_thicke.htm
2. Chatterjee SS, Chakrabarti A. Epidemiology and medical mycology of fungal rhinosinusitis: otorhinolaryngology clinics. An Ant J 2009; 1: 1-13.
3. Schubert MS. Allergic fungal sinusitis: pathophysiology, diagnosis and management. Medical Mycology. 2009 ;47(sup1):S324-30.
4. Bassiouny A, Ragab A, Attia AF, Atef A, Hafez N, Ayad E, et al. Prevalence ofextramucosal fungal elements in sinonasal polyposis: a mycological and pathologicstudy in an Egyptian population. American Journal Otolaryngology. 2011;32(4):308-
5. Pagella F, Matti E, Bernardi DF. Paranasal sinus fungus ball: diagnosis and management. Mycoses 2007; 50(6):445-51.
6. Reddy CE, Gupta AK, Singh P, Mann SB. Imaging of granulomatous and chronic invasive fungal sinusitis: Comparison with allergic fungal sinusitis. Otolaryngol Head Neck Surg 2010; 143(2):294-300.
7. Marfani M, Jawaid M, Shaikh S, Thaheem K. Allergic fungal rhinosinusitis with skullbase and orbital erosion. The Journal of Laryngology & Otology. 2010;124(02):161-5
8. Gupta A, Bansal S, Gupta A, Mathur N. Visual loss in the setting of allergic fungalsinusitis: pathophysiology and outcome. The Journal of Laryngology & Otology.2007;121(11):1055-9.
9. Broglie MA, Tiguely M, Holzmann D. How to diagnose sinus fungus balls in the paranasal sinus? Rhiniology 2009; 47: 37-9.
10. Som PM, Lidov MW. Paranasal sinuses In: Taveras J. Radiology: Diagnosis Imaging Intervention. Baltimore: Williams and Wilkins; 1998: 2-6.
11. McAlister WH, Lusk R, Muntz HR. Comparison of plain radiographs and coronal CT scans in infants and children with recurrent sinusitis. Am J Radiol 1989; 153(6): 1259-64.
12. Lloyd G. The sinuses In: Sutton D. Textbook of Radiology and Imaging, 6th ed. New York; Churchill Llivingstone; 2002: 1297-1300.
13. Goodman GM, Martin DS, Klein J, Awwad E, Druce HM, Sharafuddin M. Comparison of a screening coronal CT versus a contiguous coronal CT for the evaluation of patients with presumptive sinusitis. Annals of allergy, asthma & immunology: official publication of the American College of Allergy, Asthma, & Immunology. 1995;74(2):178-82.
14. Awaida JP, Woods SE, Doerzbacher M, Gonzales Y, Miller TJ. Four cut sinus computed tomographic scanning in screening for sinus disease. South Med J 2004; 97(1): 18-20.
15. Tezer MS, Tahamiler R, Çanakçioglu S. Computed tomography findings in chronic rhinosinusitis patients with and without allergy. Asian Pacific Journal of Allergy and Immunology. 2006 ;24(2-3):123.
16. Sharifian H, Kashani SS, Mazaher H, Abhari M. Assessment of the accuracy of paranasal sinuses limited CT scans in the diagnosis of sinusitis. Iran J Radiol 2006; 3(4): 225-8. http://www.sid.ir/en/VEWSSID/J_pdf/98020060404.pdf