DIAGNOSTIC ACCURACY OF MRI IN DETECTION OF INVASIVE FUNGAL SINUSITIS TAKING HISTOPATHOLOGY AS A GOLD STANDARD

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ABSTRACT

OBJECTIVE: To determine the diagnostic accuracy of MRI in detection of invasive fungal sinusitis taking histopathology as gold standard. **METHODS:** Cross sectional study conducted in department of radiology of a tertiary care hospital in Karachi in 6 months period from 27-04-2018 to 26-10-2018.The data was collected by evaluating digital records of patients collected over specified period of time. **RESULTS:** A complete analysis of cross sectional examination of 282 patients were carried out for evaluation of invasive fungal sinusitis. The study include 149 male and 133 females with a median age of 39.6 years. Among the study population invasive fungal sinusitis confirmed with histopathology seen in 46 patients. **CONCLUSION:** The present study indicates that MRI should be used as a screening modality for invasive fungal sinusitis.
Key Words: Fungal Sinusitis; MRI, histoathology

Introduction

Fungal sinusitis is an important clinical problem with diverse manifestations. It should be considered in all immune compromised 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 (IFS) is sub divided into acute invasive fungal sinusitis, chronic invasive fungal sinusitis and chronic granulomatous invasive fungal sinusitis.[2]

The most common predisposing factor for IFS is neutropenia, commonly associated with clinical conditions or treatments such as leukemia, bone marrow transplant, chronic immunosuppressive therapy, and aids. Functional neutropenia, such as that encountered in poorly controlled diabetes mellitus and diabetic ketoacidosis, is another well-known risk factor.[3,4]

Historically, the mortality of IFS has been cited as 50% to 80%.[5] Recent series have reported a decreased mortality from 7% to 18%. This disease is largely attributed to earlier detection and intervention.[6]

Accurate early diagnosis of IFS is difficult because the presenting symptoms of IFS are similar to routine viral or bacterial rhinosinusitis. symptoms with indolent rhinosinusitis, as well as the spectrum of physical findings, a diagnosis of IFS hinges on histopathologic evidence of fungi invading nasal tissue (hyphal forms invading sinus mucosa, submucosa, blood vessel, or bone).[7,8]

Identifying invasive techniques to accurately evaluate high-risk patients displaying symptoms compatible with IFS is of most importance, both for early detection and to avoid unnecessary surgery in comorbid patients. The clinical signs and symptoms of invasive fungal disease are nonspecific, and fungal culture

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results are often negative or significantly delayed. Histopathology with the demonstration of invasive fungal elements in tissue remains the diagnostic gold standard for IFS, but invasive sampling is often not possible in critically ill or coagulopathic patients. Therefore, radiologic imaging plays an essential role in the timely diagnosis and management of suspected IFS.[9] The current imaging modalities advocated for IFS are computed tomography (CT) and magnetic resonance imaging (MRI). Described signs of IFS on MRI include obliteration or infiltration of periantral fat, inflammatory changes in the orbital fat and extraocular muscles, and leptomeningeal enhancement.[1]

One of recent study reported sensitivity and specificity for MRI 85 % and 75% while another study shows 17.39% prevalence of invasive fungal sinusitis respectively.[4,10]

Contrast MRI has high yield in detection of complicated invasive fungal sinusitis such as meningitis, cerebral abscess, cranial nerve palsy. It help in assessing the severity of disease on comparison of CT scan, MRI with contrast is more superior in detection of intra cranial and intra orbital soft tissue extension. To our knowledge there are currently no studies reporting sensitivity and specificity data for diagnostic accuracy of MRI scan in evaluation of invasive fungal sinusitis in Pakistan. The purpose of this study is to find the accuracy of MRI in detection of invasive fungal sinusitis taking histopathological findings as gold standard.

Material and Methods

This was a single centre study, cross sectional study conducted at the department of radiology of a tertiary care centre, intended to evaluate the diagnostic accuracy of MRI in detection of invasive fungal sinusitis taking histopathology as a gold standard in 6 months period from 27-04-2018 to 26-10-2018.The data was collected by evaluating digital records of patients collected over the specified time. Study was duly approved by hospital's ethical review committee.

The patients who was reported to the department of radiology for MRI and fulfilled the inclusion criteria was included in the study. Patient demographics and clinical history was taken by the principal investigator. Laboratory investigations were done by consultant pathologist of experience more than 5 years. Radiological investigations was done by consultant radiologist of experience more than 5 years. After receiving laboratory and radiological results diagnosis for invasive fungal sinusitis was made. Inclusion criteria includes either gender, Age 25-60 years, fever, diabetic, nasal blockage. Patients with HIV infection and who are not giving consent are in exclusion criteria. Stratification analysis with respect to age groups, gender, diabetic mellitus, fever and nasal blockage symptoms as presented in table 1 to 2 and observed that accuracy of MRI in detection of invasive fungal sinusitis was more than 80%.

Material and Methods

A total number of 282 participants were listed in the study scanned in a period of 6 months. The average age of the patients was 39.67 ± 12.18 year. There were 149 (52.84 %) male and 133 (47.16%)were females. Out of 282 patients,192 (68.09%) were diabetic, fever was observed in 114 (40.43%)patients and nasal bloackage was found in 222 (78.72%) cases. Rate of invasive fungal sinusitis was 16.3%

	Frequency (%)
Mean age in years	39.67±12.8
Age groups	
≤30 years	82(29.0)
31-40 years	72(25.5)
41-50 years	60(21.2)
51-60 years	68(24.1)
Gender	
Male	149(52.8)
Female	133(47.1)
Diabetes Mellitus	
Yes	192(68.0)
No	90(31.9)
Fever	
Yes	114(40.4)
No	168(59.5)
Nasal Blockage	
Yes	222(78.7)
No	60(21.2)

Table 1: Descriptive statistics of all the patients under study

(46/282) confirmed with histopathology. Out of 46 patients 29 (63%) shows meningeal enhanacement, 17 (37%) develop cerebral abcesss, 4 (8.7%) develop cavernous sinus thrombosis, cranial nerve palsy found in 6 (13%) and 15 (32.6%) have intraoribital extension. Sensitivity, specificity, PPV NPV and accuracy of MRI in detection of invasive fungal sinusitis was 82.6%, 89.4%, 60.3%, 96.3% and 88.3% as computed and presented. Stratification analysis with respect to age groups, gender, diabetic mellitus, fever, nasal blockage and MRI features as presented in (Tab.1 to 3) and observed that accuracy of MRI in detection of invasive fungal sinusitis was more than 80%.

MRI	Histopathology		Total
	Positive	Negative	
Positive	38	25	63 (22.3)
Negative	8	211	219 (77.7)
Total	46 (16.3)	236 (83.7)	282

Sensitivity	38/46	82.60%
Specificity	211/236	89.40%
PPV	38/63	60.30%
NPV	211/219	96.30%
Accuracy	(38+211)/282	88.30%

Table 2: Diagnostic accuracy of MRI in detection of invasive fungal sinusitis taking histopathology as a gold standard

	Frequency (%)
MeningealEnhancement	
Yes	29 (63)
No	17 (37)
Cerebral Abcess	
Yes	17 (37)
No	29 (63)
Cavernous Sinus Thrombosis	
Yes	4 (8.7)
No	42 (91.3)
Cranial Nerve Palsy	
Yes	6 (13)
No	40 (87)
Intraorbital Extension	
Yes	15 (32.6)
No	31 (67.4)

Table 3: MRI feature of invasive fungal sinusitis

Discussion

The radiologic characteristics of invasive fungal sinusitis have been described in both the radiology and otolaryngology literature. Early reports focused on bony destruction, best evaluated with CT.[33-34] Bone destruction, however, occurs relatively late in the disease process, and late diagnosis may partially explain the historically high mortality of 50% to 80%. More recent reports have focused on more subtle earlier manifestations of the infiltrative nature of this fulminant infection and specifically the development of soft-tissue abnormalities outside the confines of the sinuses. This is most notably found anterior or posterior to the maxillary sinus walls.[36-37] These findings likely occur earlier in the natural history of the disease process, and the detection of extra sinus involvement may be contributing to earlier diagnosis and improved survival.[38] Some authors have argued for early MRI scanning in patients with suspected AFIFS based on the possibility of underestimation of disease with CT.[39] Indeed, one of the inherent advantages of MRI over CT is that it has better soft-tissue contrast resolution, which is the ability to detect subtle differences in tissues of similar appearance. However, the best imaging modality for detecting AFIFS in immune compromised patients has yet to be established.[37-38-39]

In this study the average age of the patients was 39.67 ± 12.18 years. There were 149 (52.84%) male and 133 (47.16%) were female. In Groppo et al study[4] the median age was 46 years. In this study male was 61% and female was 39%.

MRI scans have earlier been assessed as a screening tool in IFS, and studies have found variable sensitivity of 64%-87%.[4,39] In present study rate of invasive fungal sinusitis was 16.3% confirmed with histopathology. Sensitivity, specificity, accuracy of MRI in detection of invasive fungal sinusitis was 82.6%, 89.4%, and 88.3% as computed. Similar result was also reported in one of Recent study reported sensitivity and specificity for MRI 85 % and 75% while another study shows 17.39% prevalence of invasive fungal sinusitis respectively.[4,10]

However, as MRI was done for specific indications, it is likely that this is a sub-group with more advanced and aggressive disease. Other studies have looked

at early routine MRI as a diagnostic tool in Invasive fungal sinusitis and have reported better sensitivity.[4] MRI appears to be better than CT at screening for AFIFS. Magnetic resonance imaging has the added benefit of conferring no ionizing radiation exposure, which is important for all patients who might be undergoing many studies over their lifetime given the multiple comorbidities and particularly important for pediatric patients. Computed tomography is often useful for operative planning and intraoperativeimage-guided navigation, especially in extended endoscopic surgery of the paranasal sinuses and anterior skull base in both adults and children.[40] Reserving CT for treatment planning purposes in patients identified as having AFIFS by screening MRI would serve to limit both cost and radiation exposure. Furthermore, MRI alone can also be used for intraoperative image guidance, allowing radiation to be altogether avoided.

Conclusion

The present study indicates that MRI should be used as a screening modality for invasive fungal sinusitis because of its higher sensitivity and zero radiation exposure. Computed tomography should be considered as a second-line tool, reserved for surgical planning and intraoperative image guidance.
Radiographic imaging has particular utility in certain clinical situations, such as those in which the clinical signs and symptoms are more suggestive of uncomplicated bacterial or viral rhinosinusitis. In these scenarios, imaging may reveal early signs of AFIFS with subtle infiltration of the facial fat anterior or posterior to the maxillary sinus walls.

Conflict of Interest: Declared none

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