DIAGNOSTIC ACCURACY OF MAGNETIC RESONANCE IMAGING FOR DIAGNOSIS OF ACUTE INVASIVE FUNGAL SINUSITIS TAKING HISTOPATHOLOGY AS A GOLD STANDARD

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ABSTRACT

Objective: To find the diagnostic accuracy of magnetic resonance imaging in diagnosing the Acute Invasive Fungal Sinusitis taking histopathology as a gold standard.

Study Design: Retrospective study.

Place and Duration of Study: Radiology Department of Doctor's Trust Teaching Hospital, Sargodha, from Mar 2019 to Aug 2019.

Methodology: The study was conducted in the Radiology Department of Doctor's Trust Teaching Hospital affiliated with Rai Medical College, Sargodha from the period of March 2019 to August 2019. The size of the sample was 17 patients who were immune compromised and was diagnosed for acute fungal sinusitis. The magnetic resonance imaging scans were reviewed by the senior radiologist and histopathology reports and survival data was also recorded for the patients.

Results: The diagnostic results of magnetic resonance imaging were sensitive and accurate in predicting the acute invasive fungal sinusitis in patients. The sensitivity of the results was 85% and the specificity of the results was 96%. The positive predictive value for magnetic resonance imaging was 94% and the negative predictive value for magnetic resonance imaging was also 96%.

Conclusion: It was concluded from the study that magnetic resonance imaging is a sensitive diagnostic tool for predicting the acute invasive fungal sinusitis.

Keywords: Fungal sinusitis, Immune compromised, Magnetic resonance imaging, Sinusitis.

INTRODUCTION

Fungal infections are commonly observed in population of Pakistan. Fungal infections occur when the immunity of body is low. Fungi is present in air, water and in soil. There are four major sub groups of microbiology and fungal infections belong to one of them. There are many forms and shapes of fungi from unicellular, moulds and having filamentous branches. Fungi identification is easy. Types of fungi are wide spread and it has thousands of types. The common types of fungi which are encountered in medical practices are Aspergillus species and Candida species[1]. The Zygomycota order is considered the rare form of infection and is considered invasive in nature.

It affects sinusitis. Fungal spores are widely present in the external environment. If the environment of the fungal growth is suitable it develops pathological potential. The fungal spores which are inhaled by normal healthy persons are destroyed by the operation of immune system of body.

Acute invasive fungal sinusitis is not a common disease. It is very rare. It usually affects the patients who have low immunity[1,2]. Antibiotics prolonged usage, mosit and dark environment , poor ventilation and low immunity disturb the pathways of sinus to fight against fingi. The predisposing common factors for acute invasive fungal sinusitis is neutropenia which is associa-

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ted with the treatment of bone marrow transplant, the immune suppressive therapies, leukemia and AIDS[3,4]. Functional neutropenia is also another risk factor which is observed in poorly managed diabetes and in diabetic ketoacidosis. The patients having neutropenia have haemotological malignanacy. Species found in these patients belongs to Aspergillus. The patients who have renal failure and over loaded iron and are using deferoxamine also have chances to develop acute invasive fungal sinusitis. Fungi growth is fast insufficient iron supplies. Evidence from the literature illustrated that the diabetic patients have more chances of survival from acute invasive fungal sinusitis as compared to the patients who are immune compromised. Prognosis is not linked with the isolated strain usually. The poor prognosis of acute invasive fungal sinusitis was found in the patients of neutopenia, aplastic anemia, old age, hepatorenal failure, intracranial complications and late diagnosis[5].

Invasive fungal sinusitis can further be divided as. Chronic Granulomatous invasive fungal rhinosinusitis. Chronic IFR (Invasive fungal sinutis). Acute invasive Fungal rhinosinusitis. Acute invasive fungal rhino sinusitis (AIFR), cases had observed high morbidity and mortality. From last two decade the situation of the disease has not changed. From the name of disease it is clear that the fungi invade the vascular and neural structure when the inhaling of fungal spores occur which disturb the immunity of the body. Neurovascular system is disrupted through the growth of fungi in mucosal lining (2) which leads to thrombosis and develops necrosis. Proposed definition of acute invasive fungal sinusitis is considered as the presence of fungal hyphae within the sinonasal mucosa, submucosa, vasculature or bone, in the setting of one month or less of sinusitis symptoms[4].

Acute invasive fungal sinusitis progression is at fast rate and its infection is difficult to treat which affect the head and neck region therefore the morbidity and mortality is high. Treatment options for AIFS are anti fungal therapy, surgical debridement and the compromised immunity

enhancement[5,6]. Mortality rate of AIFS is from 70 to 85% which was found in studies[4]. With the advancement in medical technology the mortality rate has reduced from 10 to 20% due to the timely diagnosis of AIFS and its intervention plan. It is difficult to diagnose clinically the AIFS at early stage because the sign and symptoms of AIFS are al-most the same as observed in bacterial and viral infection of rhino sinusitis. These non specific symptoms prevail for four weeks or less which hinders diagnosis on time. It means when the disease is diagnosed its growth has spread and can worsen the condition of patients in days and in hours. This happens when the invasion of fungi involve local anatomy. Symptoms of invading local anatomy include erythema, numbness, diplopia, face swelling, headache, neurological deficit, vision loss and proptosis. Cavernous sinus involvement indicates the signs of nerve deficit. At early stage the mucosal changes are observed as odematous mucosa or pale. As the time passes the pale mucosa become darker and more avascular. It eventually forms crust or eschar. Changes in the cavity of sinus take place and hence changes can also be observed in septum which may lead to the spetal perforation[3].

Blood tests are suggested to diagnose the suspect of acute invasive fungal sinusitis. Iron level, tests for HIV, Neutropenia, Renal functions, and blood sugar are performed. These tests can help to diagnose the causes of low immunity for better treatment.

As the symptoms are overlapping therefore the histopathology of fungus invading nasal tissues are important[9,10]. Surgical biopsy is required by obtaining the nasal tissue to analyze the disease widespread[12]. The higher risk patients can develop the complications in intra operative and in post operative time. The patients risk increases due to thrombocytopenia. It is vital to adopt the non invasive technique for diagnosing the AIFS in patients who are at high risk and are immunocompromised. The early detection can help to avoid the unnecessary surgeries in patients. In the study the non invasive imaging modality used is magnetic resonance imaging (MRI). MRI

with contrast is suggested for diagnosis of acute invasive fungal sinusitis. Soft tissues are best observed under MRI. The MRI can even detect the changes in the extra occular muscles, change in mucosa and fat at early development of disease[5]. MRI prognostication is high when the contrast is used.

MRI scan demon-strate the AIFS as infiltration or obliteration of periantral fat. Inflammation was observed in extra ocular muscles, orbital fat and enhancement in leptomeningeal. These changes are observed in advance stage of AIFS. The purpose of the study is to analyze the diagnostic accuracy of MRI in predicting the AIFS in patients.

METHODOLOGY

The restrospective study was performed in Radiology department of Doctor's Trust Teaching Hospital affiliated with. Rai Medical College, Sargodha, from March 2019 to August 2019 in Radiology Department. The inclusive criterion for the study was clinically suspected AIFS and immune compromised patients were included. The patients who were found positive in MRI were included and histopathology was set as a gold standard. Demographic data of the patients were also recorded. The scans were carefully evaluated by senior radiologist. All scans of MRI were perfor-med on 1.5 Tmagnets. Sinus views were obtained with routine imaging sequences. Axial T1 weighted images and coronal and axial T2 weighted images with fat saturated and Axial and coronal post contrast T1 weighted images with fat saturated. These images confirmed the presence of AIFS in patients. The histopathology results and endoscopy results were obtained for analyzing the accuracy of diagnosing AIFS with the help of MRI scans in patients. Sensitivity, specificity, positive predictive value and negative predictive value of the MRI scan results were calculated.

RESULTS

Total of 17 patients who were AIFS positive in MRI scan were included. These patients have the history of hematopoietic malignancy, bone marrow transplant or organ transplant. From the total 17 patients 12 were those who have neutropenia. The organisms found in the microbiological reports in AIFS were Aspergillus and Rhizopus. From the results it was found that the sensitivity of MRI in predicting AIFS was high. Extra sinus invasion was the individual parameter which found sensitive in MRI scan (83%). From the table, it is clear that sensitivity of MRI was

Table: Indicators of MRI for AIFS.

Indicators	Outcome
Sensitivity of MRI	85%
Specificity of MRI	96%
Positive Predictive Value	94%
Negative Predictive Value	96%
Diagnostic Accuracy	98%

85% and the specificity of MRI was 96%. Positive predictive value was 94% and negative predictive value was 96%.

DISCUSSION

The most important parametere observed was the invasion of extrasinus in the images of MRI. High sensitivity is reqyured when immuno-compromised patients are involved in the selection of imaging modality for timely treatment. MRI is a better imaging modality as compare to the CT described in other studies. Theebenefit of MRI is its exposure to radiation is lacking. CT is usually recommended in cases where surgical procedures are involved in adults and children for anterior skull base and paranasal sinuses. In order to avoid the radiation MRI is sugeested for the patients suspecting acute invasive fungal sinusitis. The images can also be used as a guidance for surgical intervention.

Focal area of MRI in the study was supposed to be linked with sinus mucosal ischemia. The endoscopic early signs of invasive fungal sinusitis was pale and dusky mucosa with necrosis of gross tissues which develeops as the disease advances. The endoscopic findings also confirms the inavsion of fungi to blood vessels which causes ischemia and vascular congestion.With the progression of disease vascular invasion can

result in the involvement of extra sinus observed in the images of MRI.

Disease early identi-fication can help to save the life. Late detection of disease can result in bone destruction and high mortality rate up to 80%. The obvious infection development can be observed from the abnor-malities of sinuses soft tissues. The manifestation is observed in posterior, anterior and maxillary sinus walls[12,13]. These findings were observed in earlier disease detection. Extra sinus involvement may help to diagnose the disease and help to increase the survival of the patients[8,9]. Early MRI scans help to find changes occurring in the soft tissues of sinus and MRI contrast resolution has the ability to detect changes in soft tissues. Extra sinus inva-sion in MRI is an imaging parameter which is evaluated. From the study among 2 cases the extra sinus invasion was failed to be identified. The one false positive outcome was diagnosed as AIFS but actually it was found sinonasal lym-phoma which is also another invasive kind of disease. If the sensitivity of chosen diagnostic tool is high then the diagnostic accuracy will also be high. MRI is a non invasive and non ionizing technique which leads to no exposure to radia-tion which is better for immuneocompromised patients. The limitation of the study is the small sample size which shows that the disease is rare.

CONCLUSION

There is no standard criterion for radiology of acute invasive fungal sinusitis. On the basis of suspects medical consultant suggest radiography of the immune compromised patients to analyze the disease presence and its progression having common sign and symptoms of sinusitis. There-fore for diagnosis of sinusitis the radio graphical evaluation is necessary. As the disease is rare and the patients have already poor immunity, sugges-tion to opt for MRI is considered best diagnostic option for these immuno compromised patients. MRI is highly sensitive in diagnosing the diseses and there is no exposure to radiation. MRI images helps to identify the AIFS at early stage by infil-tration of facial fat posterior or anterior to the maxillary sinus walls. Specificity and diagnostic accuracy of MRI is also high which is suggestive of its future recommendation for evaluation of AIFS. Histopathology is still a gold standard for analyzing the accuracy of the result.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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