

# Diagnostic Accuracy of Non Contrast CT Scan in Detection of Fungal Sinusitis by Taking Culture for Fungal Sinusitis as Gold Standard

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## ABSTRACT

**Objective:** To determine the diagnostic accuracy of non-contrast CT scan in detection of fungal sinusitis by taking culture for fungal sinusitis as gold standard.

**Material and Method:**

**Study design:** Cross-sectional study.

**Setting:** The study was conducted at Advance diagnostic Centre, Bilawal Medical College LUMHS Jamshoro

**Duration of study:** This study was conducted during one year from March 2019 to February 2020.

**Methods:** All the patients of age from 18 to 60 years having recurrent rhino-sinusitis and either of gender were included. All the study subjects underwent non contrast CT scan of paranasal sinus by using Toshiba Asteion multislice CT scanner in the coronal and axial planes, with the patients lying prone and supine. Procedures were properly performed and followed by culture test. Culture tests were taken by expert pathologist with the contribution of ENT specialist and immediately were sent to the Hospital diagnostic laboratory. All the data was recorded via study proforma. Data was analyzed by using SPSS version 20.

**Results:** Total 63 patients were studied, their mean age was  $41.82 \pm 11.33$  years and mean duration of symptoms was  $4.58 \pm 3.56$  years. Males were found in majority 34(54.0%). Fungal sinusitis was found in 23.8% of cases on non-contrast CT scan and 30.2% was observed by culture report. Non-contrast CT scan showed sensitivity of 95% and specificity of 68% including positive predictive value (PPV) of 87% and negative predictive value (NPP) of 86%, in the diagnosis of fungal sinusitis by taking culture test as gold standard.

**Conclusion:** Non-contrast CT scan was observed to be a reliable, safe and non-invasive diagnostic tool for the fungal sinusitis, with 95% sensitivity and 68% specificity by tacking culture test as gold standard.

**Keywords:** Fungal sinusitis, CT, sensitivity, specificity

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## INTRODUCTION

Rhinosinusitis is characterized as inflammatory disorder of the paranasal sinuses and nose that affects 20% of the human population.<sup>1</sup> The presence of normal fungi in the sinuses has always been a matter of debate.<sup>1</sup> It is a frequent condition affecting nearly 20% of individuals at some stage of their lives.<sup>2</sup> out of those patients who experienced surgical procedure for chronic sinonasal condition, around 6-9% were the allergic cases of fungal sinusitis.<sup>3</sup> Acute invasive fungal sinusitis remains an uncommon disease. It is very rare. It usually affects the patients who have low immunity.<sup>4,5</sup> Antibiotics prolonged usage, moist and dark environment, poor ventilation and low immunity disturb the pathways of sinus to fight against fungi.<sup>4</sup>

Fungal rhinosinusitis (FRS), previously believed to be an infrequent condition, dramatically increased in terms of prevalence these days.<sup>6</sup> Rise in Fungal disease, as a global, occurred due to rise in populace with a declined immune systems. Raised expectancy of life with an upsurge of conditions such as diabetes mellitus (DM), advancements medical field with invasive procedures, use of chemo-radiotherapy and immunosuppressive drugs resulted in distinctive risk conditions.<sup>6</sup> Colonization of Fungus in the lower airway and upper airway is frequent and secondary to the pervasive occurrence of fungal spores within the air. Sinuses is most predominantly colonized by *Aspergillus* species.<sup>7,8</sup> Due to the higher mortality rates, early diagnosis and management are

crucial for such infections. Nowadays, CT scan is the preferred technique for most pathologies to visualize paranasal sinuses.<sup>10</sup> However, on other hand it was reported that Eosinophilic chronic rhinosinusitis is mostly mistaken with the CT findings of AFS with nasal bilateral polyps, and all of these cases display hyperattenuating content on CT scan because of eosinophilic mucus.<sup>10,11</sup> Another study observed reasonable specificity and higher rates of sensitivity of CT imaging in fungal sinusitis diagnosis.<sup>2</sup> After taking above controversial literature findings and inadequate local data of non-contrast CT scan, this study had been conducted to determine diagnostic accuracy of non-contrast CT scan in detection of fungal sinusitis taking culture for fungal sinusitis as gold standard.

## MATERIAL AND METHODS

This cross-sectional study was performed at Advance diagnostic Centre, Bilawal Medical College LUMHS Jamshoro. Study duration was one year from March 2019 to February 2020. All the patients of age from 18 to 60 years having recurrent rhino-sinusitis and either of gender were included in this study. Patients, who were presented with acute sinusitis, DNS diagnosis, patients who had other causes of nasal obstruction and those who were already diagnosed by histopathology were excluded from current study. Complete clinical examination was done in each patient by senior ENT specialist having experience minimum more than 5 years. Well-versed consent was

received from each patient. All the study subjects underwent non contrast CT scan of paranasal sinus by using Toshiba Asteion multislicing CT scanner without contrasts in axial and coronal planes and patients were positioned supine and prone. Procedures were properly performed and followed by culture test. Culture tests were taken by expert pathologist with the contribution of ENT specialist and immediately were sent to the Hospital diagnostic laboratory. All the data was recorded via study proforma. For data analysis SPSS-20 was used. For quantitative parameters, such as age, the standard deviation and mean were measured. For categorical parameters frequency & percentage were measured. The specificity, sensitivity, positive & negative predictive values (PPV & NPV) and reliability of the 'CT scan without contrast' were measured using histopathology as the gold standard in the 2X2 table.

**RESULTS**

Total 63 subjects were studied their mean age was 41.82±11.33 years and mean duration of symptoms was 4.58±3.56 years. Males were found in majority 34(54.0%) and females were 29(46.0%). Table 1

According to frequency, fungal sinusitis was 23.8% on non-contrast CT scan and 30.2% by culture report. Table 2.

Non-contrast CT scan showed sensitivity 95% and specificity 68% including PPV 87% and NPP 86% in the diagnosis of fungal sinusitis by taking culture test as gold standard. Table 3.

Table 1: Statistical description of age and gender n=63

Variables	Statistics
Age (Mean ± SD)	41.82 ± 11.33 years
Duration of symptoms (Mean ± SD)	4.58 ± 3.56 years
Gender	Male (frequency(%))
	Female (frequency(%))
	34(54.0%)
	26(41.3%)

Table 2: Frequency of fungal sinusitis according to non-contrast CT scan and culture, n=63

Variables	Frequency	Percentage
Non-contrast CT scan		
Negative	15	23.8%
Positive	48	76.2%
Culture report		
Negative	19	30.2%
Positive	44	69.8%

Table 3: Diagnostic accuracy of non-contrast CT for fungal sinusitis n=63

CT findings	Culture findings		Total
	Positive	Negative	
Positive	42	06	48
Negative	02	13	15
Total	44	19	63

Sensitivity: TP/TP+FNx100 = 95%      Specificity: TN/FP+TNx100 = 68%  
 PPV: TP/TP+FPx100 = 87%          NPV: TN/FN+TNx100 = 86%

**DISCUSSION**

In this study mean age of the patients was 41.82±11.33 years; males were found in majority 34(54.0%) and females were 29(46.0%). Consistently, Iqbal J et al<sup>12</sup> reported 35.2±11.61 years of mean age for their patients was, while

49(41%) of 120 patients were female and remaining 71 (59%) were males. On the other hand, Kanwar SS et al<sup>13</sup> reported that the patients in 21–30 years of age group were in majority with male gender predominance (56.2%), where females were 43.8% with male-female ratio as 1.3:1.

In this study fungal sinusitis was found in 23.8% of cases on non-contrast CT scan and 30.2% was observed by culture report. However, Suresh S et al<sup>14</sup> reported that out of 100 chronic rhinosinusitis cases, 30% were found to have fungal etiology and its highest prevalence was recorded at the age of 30 or 40 years, and male gender was in preponderance (43.3%). These findings were almost similar to this study. However, Krishnan K U et al<sup>15</sup> reported that out of 52 sinonasal specimens, 23 (44%) were culture-positive for fungus.

In this study non-contrast CT scan showed sensitivity 95% and specificity was 68% in diagnosing fungal sinusitis, by taking culture test as benchmark. Similarly Naz N et al<sup>2</sup> reported that CT scan had 89.3% sensitivity and 86.9% specificity in fungal sinusitis detection. On other hand Sharifian et al<sup>18</sup> reported 95% sensitivity and 92.5% specificity, which supports our findings. Kandukuri R et al<sup>16</sup> reported higher specificity, sensitivity, NPV and PPV of CT scan in diagnosing numerous sinonasal condition as compared to clinical identification; with 97.8% specificity and 98.3% sensitivity in chronic sinusitis detection. While in the study of Gupta K, et al,<sup>17</sup> 15 (93%) patients, out of 16 cases with fungal sinusitis diagnosis on CT, were diagnosed correctly as shown by histopathology, while they did not analyze the results in the form of sensitivity and specificity.

In this study non-contrast CT scan showed PPV 87% and NPP 86% in the diagnosis of fungal sinusitis by taking culture test as gold standard. Naz N et al<sup>2</sup> reported that CT scan showed 86% PPV and 70% NPV. However, Sharifian et al<sup>18</sup> demonstrated 96.2% PPV and 90.2% NPV for CT scan diagnosis. Iqbal J et al<sup>12</sup> reported 93.33% specificity, 96.19% sensitivity, 99.01% PPV and 77.77% NPV of CT. On other hand Lutfi IA et al<sup>9</sup> observed that CT had 93.6% sensitivity, 77.7% specificity, 91.6% PPV, 82.3% NPV and 89.2% accuracy. Multiple sinuses are usually involved when no rhinitis and pansinusitis is present. The disease is bilateral, and a recurrent nasal factor is present. Most sinuses are extended and exhibit nearly-complete opacification. Hyper-attenuating allergic mucin inside the paranasal sinus lumen is shown by non-contrast CT.<sup>19</sup> Therefore, CT contributes significantly in the diagnosis of paranasal sinus in patients and also in presenting valuable findings for effective management of cases.<sup>20</sup> Especially in comparison to MRI, CT is time-saving and cost-effective modality, and hence a preferred modality.<sup>20</sup>

**CONCLUSION**

Non-contrast CT scan was observed to be a reliable and non-invasive diagnostic tool for the diagnosis of fungal sinusitis, with 95% sensitivity and 68% specificity by tacking culture test as gold standard. This diagnostic tool can be used for early detection of such infections without waiting because culture is long time consumer. However, this study was a small size study, thus larger sample size and multicenter studies are suggested on this subject.

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