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## RESEARCH ARTICLE

# PREVALENCE AND SPECTRUM OF OPPORTUNISTIC FUNGAL INFECTIONS AMONG POST COVID PATIENTS

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### ABSTRACT

Opportunistic fungal infections (OFI) following respiratory viral infections has been recognized since 1918 Influenza pandemic. Major risk factors for OFI include neutropenia, hematological malignancies, transplantation, prolonged treatment with corticosteroids, diabetes, prolonged stay in ICU, major surgery. POST COVID 19 associated fungal infections like candidiasis Mucormycosis, Aspergillosis are on the rise during the second spike of corona, as they exhibit immunosuppression with decrease in CD4+ and CD8+ T cells. CORONA is associated with an increase in pro inflammatory markers such as IL1,IL-6 TNF alpha which predisposes to bacterial and fungal infections. CORONA in diabetic patient leads to immune dysregulation and with steroid usage leads to immunosuppression and high risk for OFI.

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## INTRODUCTION

**AIM:** The present study was undertaken with aim to study the spectrum and prevalence of various OFI in POST COVID patients with an emphasis on immune status of the patient before COVID is analyzed.

## MATERIALS AND METHODS

This prospective study conducted for a period of 3 months May to July 2021 in the Department of Microbiology, Sri Venkateswara Medical College, Tirupati, after obtaining permission from the Institutional Ethical Committee. The study included 260 study participants. Patients included in the study are with either RT-PCR confirmed positive for COVID -19 or those who recovered from COVID 19 infection, and with signs and symptoms of invasive fungal infection from various departments. The diagnosis and demographic details of the patients were analyzed and recoded.

**SAMPLE COLLECTION:** Various clinical samples with suspicion of Fungal infections like sputum, corneal scrapings, nasal cavity specimens, CSF, BAL, nail clippings collected from the patients were sent to the Microbiology laboratory as early as possible, based on clinical symptoms and organ system involved. Samples were subjected to KOH Mount, Gram staining, India ink preparation. Further fungal culture was done on Sabouraud's Dextrose Agar (SDA) slopes and incubated in Biological oxygen demand for 5 days. Species identified by growth on SDA, colony morphology on Lactophenol cotton blue and Biochemical reactions.

## RESULTS

The present study included 260 samples among which 179 (68.8%) are male Table 1 and most affected age group are 30-60 years(64.6%) TABLE 2. Among various departments were the specimens collected 152 (58.4%) are from department of ENT followed by Department of Pulmonary medicine 55 (21.1%) Table 3.

Most of specimens were collected from patients with COVID positive with suspected Fungal infection (82.6%).The Common Specimens received are Nasal cavity specimens (65.3%) followed by Sputum(25.3%) Table 4.Among total samples (260) received patients with COVID positive (215) in them 154 samples (71.6%) are with comorbidities Table 5.

**Table 1. Gender wise distribution of COVID positive samples**

GENDER	FREQUENCY (%)	COVID POSITIVE	COVID STATUS UNKNOWN
MALE	179(68.8%)	152(84.9%)	27(15%)
FEMALE	81(31.15%)	63(77.7%)	18(22%)
TOTAL	260(100%)	215(82.6%)	45(17.3%)

**Table 2. Age wise distribution of cases**

AGE(YEARS)	NO OF PATIENTS	PERCENTAGE
10-30	58	22.4%
30-60	168	64.6%
60-80	34	13.0%
TOTAL	260	100

**Table 3. Department wise distribution of cases**

DEPARTMENT	NO OF SAMPLES (PERCENTAGE)
ENT	152(58.4%)
PUL MED	55(21.1%)
OPHTHAL	10(3.8%)
IDH	8(3.07%)
PAEDIATRIC	5(1.9%)
GEN MED	15(5.7%)
CASUALITY	3(1.15%)
GEN SURGERY	3(1.15%)
NEURO SURGERY	5(1.9%)
SKIN	10(3.8%)

**Table 4. Type of specimen received**

TYPE OF SPECIMEN	NO OF SPECIMENS RECEIVED
Nasal cavity scrapings	172
Sputum	66
Tissue from sinuses	5
Nasal swabs	3
Broncho alveolar scrapings	2
Corneal scrapings	1
Aspirate from lung abscess	1
Blood	1
Pleural fluid	1
Pus	1
Vitreous fluid	1
Ear swab	1
FNAC from Rt lung cavity lesions	1
Skin scrapings	4
TOTAL	260

**Table 5. Samples positive for fungal elements in COVID positive and unknown subjects with comorbidities**

gender	covid positive	overall positive for fungal elements	co morbidities present	covid status unknown	overall positive for fungal elements	comorbidities present
MALE	152 (68.8%)	135 (75.4%)	127 (83.5%)	27 (15%)	04 (2.23%)	02 (7.4%)
FEMALE	63 (77.7%)	19 (23.45)	09 (14%)	18 (22.2%)	02 (0.79%)	01 (5.55%)
TOTAL	215 (82.6%)	154 (59.2%)	136 (63.25%)	45 (17.3%)	06 (2.03%)	03 (6.66%)

- About KOH and fungal culture ,Total samples processed are 260 ,Total samples negative for both fungal culture and KOH are 100 Both fungal culture and KOH positive are 47,KOH positive are 104 among

153 samples on which KOH performed ,fungal culture positive are 56 among 107 fungal culture performed.

- Most common fungal isolate isolated is Candida species with 73 (41.7%) fig1 followed by Rhizopus with 42 (24%) fig 2 followed by Mucor fig 3, Aspergillus fig 4, Syncephalastrum fig 5, Cunninghamella fig 6 Table 6

**Table 6.**

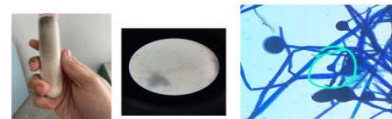
FUNGAL ISOLATE	NO OF ISOLATES
CANDIDA SPECIES	73(41.7%)
RHIZOPUS	42(24%)
MUCOR	39(22.2%)
ASPERGILLUS	12(6.85%)
SYNCEPALASTRUM	5(2.8%)
CUNNIGHAMELLA	4(2.28%)

**CANDIDA on SDA,KOH,GRAM STAIN**



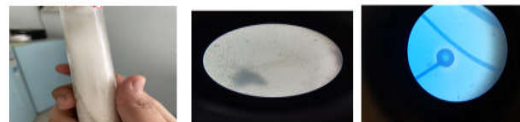
**Figure 1. Candida On Sda,Koh, Gramstain**

**RHIZOPUS ON SDA KOH and LPCB**



**Figure 2. Rhizopus On Sda Koh & Lpcb Mount**

**MUCOR ON SDA AND KOH LPCB**



**Figure 3. Mucor On Sda & Koh Lpcb Mount**

**ASPERGILLUS on SDA ,KOH,LPCB**



**Figure 4. Aspergillus on sda,koh,lpcb mount**

**SYNCEPALASTRUM ON SDA KOH LPCB**



**Figure 5. Syncephalastrum on sda koh lpcb mount**

CUNNINGHAMELLA on KOH LPCB

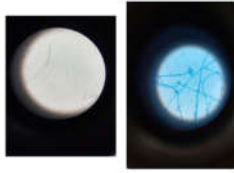


Figure 6. Cunninghamella on koh lpcb mount

## DISCUSSION

COVID 19 particularly second spike is associated with Opportunistic fungal infections around the world particularly more in India. The present study includes 260 specimens from various departments among them 160 (61.5%) were positive for fungal elements. Among this 160 samples males are more affected 135/160 (75.4%) this correlates with the study by Singh et al where 78.9% of males are affected. The most common organ affected was nasal cavity and sinuses (75%) in the present study similar to Singh et al. The most common persons affected are with comorbidities here among 160 positive samples 139 (85%) are with comorbidities which correlates with Mishra et al (87.5%). Most common organism isolated in this study is *Candida* (41.7%) followed by *Rhizopus* spp (24%) which correlates with Chen et al, Tehran et al Iran. In the study among 260 samples collected direct microscopy positive is (67.7%) while culture positive is (51%) correlates with Patel et al study where direct microscopy was 87.3% positive and 62.4% positive for culture

**LIMITATION:** Anti-fungal susceptibility testing and molecular methods like PCR, Automated methods like MALDI TOF are not performed to confirm the diagnosis.

## CONCLUSION

POST COVID patients may exhibit immunosuppression due to the disease itself, further with usage of steroids, and with preexisting comorbidities. Early identification and aggressive management with Antifungals and surgical debridement will reduce the morbidity and mortality with OFI. Emphasis should be made to rule out super and co infections due to bacteria, fungi, parasites, viruses among POST COVID patients particularly with comorbidities to prevent pathogenic invasion and adverse outcomes.

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