

## Original Research Article

# Fungal infection profile in burn patients at a tertiary care centre of India

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### ABSTRACT

**Background:** Burn patients are at high risk of infections and burn wound infection is one of the most important factor responsible for their morbidity and mortality. Burn patients have increased incidence of fungal infection in comparison to others. Fungal infection is difficult to diagnose because it has similar symptoms like bacterial infections. Common fungal organism causing burn wounds infections are *Candida sp.*, *Aspergillus sp.*, *non albicans Candida*, *Zygomycetes* etc.

**Methods:** This prospective study was carried out in Department of Burn, Plastic and Reconstructive Surgery, J.N.M.C.H., Aligarh Muslim University, India from December 2015 to June 2017. Patients having 20 to 60% body surface area involvement with more than 5 years of age with no comorbidity were included in this study.

**Results:** In our study, total 126 patients were included, 9 male patients (18.37%) were found fungal culture positive whereas 14 females (18.18%) were culture positive. 12 patients (9.52%) were found to be positive for *Candida albicans*, 6 patients (4.76%) were *Aspergillus flavus* positive, 3 patients (2.38%) were positive for *Non Candida albicans* and 2 patients (1.59%) were positive for *Aspergillus niger*.

**Conclusions:** Fungal burn wound infections are one of the most common cause of late onset morbidity and mortality in burn patients. So, high level of suspicion and tissue culture are essential in making early diagnosis and treatment. Judicious use of antibiotics are also necessary for decreasing its incidence.

**Keywords:** Antibiotic, Burn, Fungal profile

### INTRODUCTION

Burn patients are at high risk of infections and burn wound infection is one of the most important factor responsible for their morbidity and mortality. Dermal tissue injury leads to suppression of both humoral and cellular immunity which in turn predispose the patients to infection by bacterial, viral and fungal pathogens. Bacterial infections, monobacterial or polybacterial, play the major role in burn wound infections. Fungal infections are responsible for late onset morbidity and mortality. Burn patients have increased incidence of fungal infection in comparison to others.

Fungal infection is difficult to diagnose because it has similar symptoms like bacterial infections. Use of broad spectrum antibiotics had caused upsurge in fungal infections. Common fungal organism causing burn wounds infections are *Candida sp.*, *Aspergillus sp.*, *non albicans Candida*, *Zygomycetes* etc. *Aspergillus sp.* are the most common cause of fungal burn wound infection.<sup>1,2</sup> *Candida albicans* is the main cause among the yeast species.<sup>2-4</sup> Many environmental factors play role in increasing infection incidence. Warm and humid weather, moisturized wound covers, air filter membranes of air conditioner, external heat and wound itself provide environment that increases the risk of microbial

colonization and thus burn wound infection. Open burn dressings are associated with increased infection rate due to more environmental airborne fungi than the close dressings.<sup>5</sup> Yeast infection is more associated with close dressings due to wet environment that enhances the yeast growth and helps in their establishment.<sup>6</sup> Regular surveillance of all the environmental factors are mandatory to decrease the microbial infection rate.

Surface dermatophytes can become pathogenic in high risk patients. High risk factors for fungal infections are increasing age, deep burns involving large body surface area, inhalational injury, uncontrolled diabetes mellitus and other immune deficiency conditions. In a study done by American Burn Association, reported fungal growth in 6.3% cases of burn associated with inhalational injury.<sup>7</sup> Hovarth et al, has conclude from their study that fungal infection has more than 3 times the impact of inhalational injury on mortality.<sup>8</sup> Gastrointestinal tract may act as a dormant reservoir of *Candida* and in gastric ulcer patients, it may cause systemic candidiasis.

Pre hospital exposure to ubiquitous fungus, shared use of dressing instruments, dressing tubs, late or incomplete surgical excision of eschar or necrotic tissue, prolonged hospital stay, steroid treatment, central venous catheters, long artificial ventilation are the other factors responsible for increased risk for fungal infections.

There is a decreasing trend in bacterial infections due to better burn care and availability of effective antibiotics, and consequently increase in fungal burn wound infection.

Aim of this study is to assess the fungal infection profile, its epidemiology and its correlation with burn surface area, burn wound depth and mortality.

## METHODS

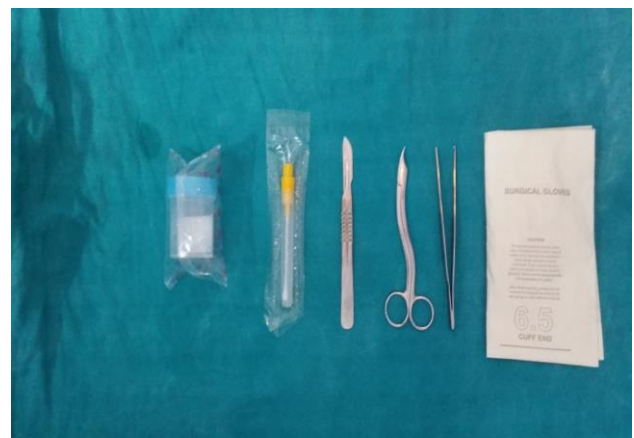
This Prospective study was carried out in Department of Burn, Plastic and Reconstructive Surgery, J.N.M.C.H., Aligarh Muslim University, India from December 2015 to June 2017. Patients having 20 to 60% body surface area involvement with more than 5 years of age with no comorbidity were included in this study. Total 126 patients (n =126) were presented to our side fulfilling the inclusion criteria.

### Sampling method

The surface scrapings samples were collected by sterile technique. Tissues biopsy were taken from under the eschar tissue from the multiple sites under local anaesthesia at multiple times and sent to laboratory as soon as possible (within 1 hour). Surface scrapings and tissue biopsy were taken on 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>th</sup>, 28<sup>th</sup> day after burn. For fungal colonisation pus swab from the surface, blood culture, subseschar swab, throat swabs were also taken.

## Diagnosis

Biopsy were processed by standard microbiological process and studied under direct microscopy on KOH mount and Gram's stain and it was further confirmed by histopathological examinations. Inoculation of sample on sabouraud dextrose agar was done. If direct microscopy showed yeast then identification done by Dalmau technique on cornmeal agar, sugar fermentation, germ tube test and assimilation. If mould came then identification done by slide culture. When the most deep level of invasion is in eschar or in neo eschar (non viable tissue) then it is known as fungal wound colonisation whereas when deepest level of invasion is into viable tissue with local signs of inflammation then it is known as fungal wound infection.



**Figure 1: Instruments required for tissue biopsy and surface scrapings collection.**

## Management

Fungal wound colonisation needed surgical excision whereas fungal wound invasion needed surgical intervention as well as intravenous antifungal therapy. Once the patient were suspected of fungal infection, then we have adjusted or stopped using the broad spectrum antibiotics. For bacterial infection we used the antibiotic according to pus culture and sensitivity report. We have used amphotericin B or caspofungin as intravenous antifungal drug followed by voriconazole or itraconazole or fluconazole, according to fungal species.

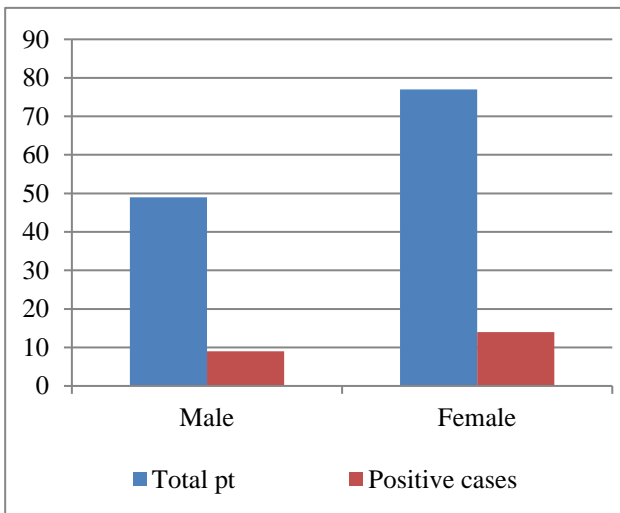
## RESULTS

In our study, total 126 patients were included, out of which 49 were male (38.89%) and 77 were females (61.11). 9 male patients (18.37%) were found fungal culture positive whereas 14 females (18.18%) were culture positive (Figure 2). 81 patients (64.28%) sustained flash thermal burn out of which 16 patients (19.75%) were culture positive, 32 patients (25.40%) suffered from scald thermal burn having 4 cases (12.5%) positive and 13 patients (10.32%) were presented with

high tension electric burn with 3 cases (23.08%) culture positive for fungus (Table 1).

**Table 1: Gender and mode of burn distribution.**

Gender	Number	Percentage	+ve cases
Male	49	38.89	9 (18.37)
Female	77	61.11	14 (18.18)
Type of burns	Number	Percentage	
Flash burn	81	64.28	16 (19.75)
Scald	32	25.40	4 (12.5)
Electric	13	10.32	3 (23.08)



**Figure 2: Sex distribution and positive cases in our study.**

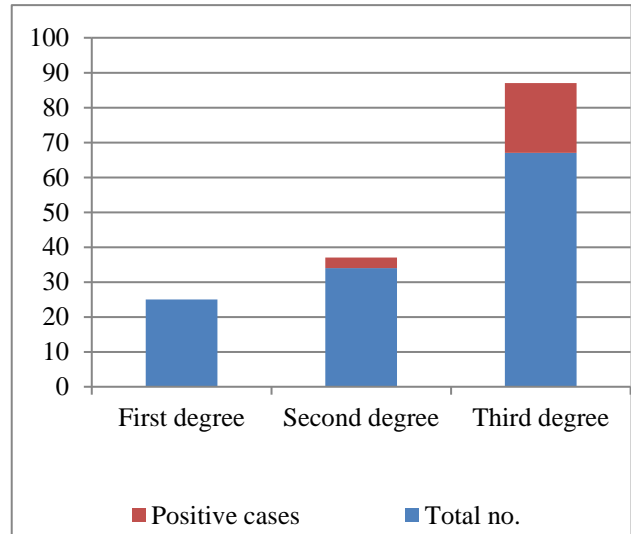
Total 25 patients (19.84%) were having first degree burn in which none were positive on fungal culture, 34 patients (26.98%) were having second degree burn with 3 patients (8.82%) having fungal infection and rest 67 patients (53.17%) were presented with third degree burn having 20 cases (29.85%) positive for fungal culture (Table 2, Figure 3).

**Table 2: Fungal growth distribution in each degree of burn.**

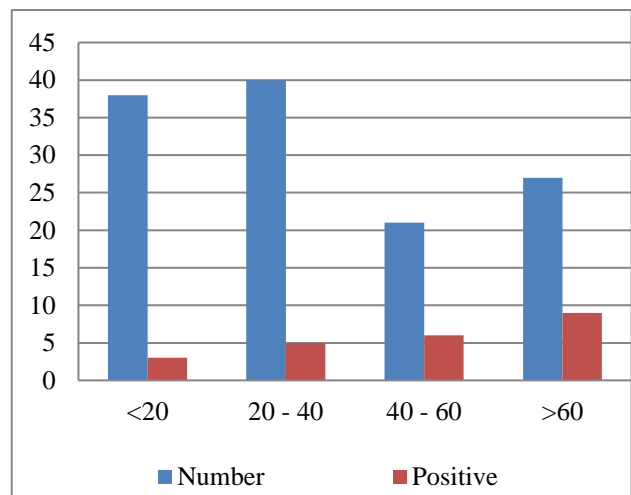
Burn Depth	Patient no. (%)	+ve cases (%)
First degree	25 (19.84)	0 (0)
Second degree	34 (26.98)	3 (8.82)
Third degree	67 (53.17)	20 (29.85)

We have categorised the patients in four age groups. In group having less than 20 years of age patients, total 38 patients (30.16%) were presented and 3 patients (7.89%) were fungal culture positive. In group having 20 years to 40 years range, 40 patients (31.75%) were presented and 5 patients (12.5%) were positive for fungal growth. In group having 40 years to 60 years of age patients, total 21 patients (16.67%) were presented out of which 6 patients (28.57%) were fungal culture positive (Figure 4). In

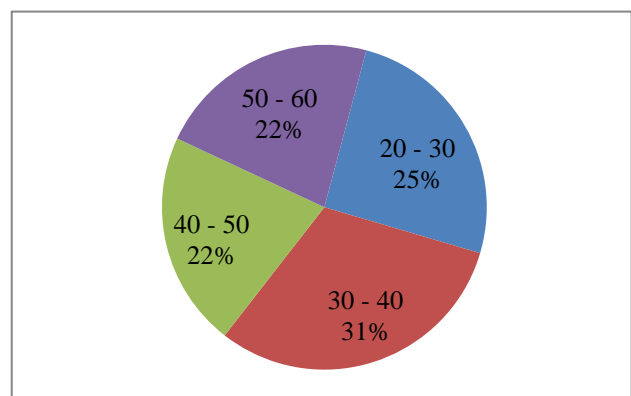
group having patients more than 60 years of age total 21 patients presented, in which 9 (33.33%) had showed fungal growth on culture (Table 3).



**Figure 3: Depth of burn and positive cases.**



**Figure 4: Positive cases and their age distribution in our study.**



**Figure 5: TBSA and fungal positive cases our study.**

**Table 3: Fungal growth and their distribution in age groups.**

Age (years)	No. (Percentage)	+ve (Percentage)
<20	38 (30.16)	3 (7.89)
20-40	40 (31.75)	5 (12.5)
40-60	21 (16.67)	6 (28.57)
>60	27 (21.42)	9 (33.33)

We have classified the patients on the basis of total burn surface area involvement into four groups (Figure 5). Maximum number of patients were presented with 30% to 40% burn and maximum number of patients (10 cases) showing fungal growth were have more than 50% burn surface area involvement (Table 4).

**Table 4: Fungal growth distribution according to total body surface area (TBSA) of burn.**

TBSA (%)	Pt. no.(%)	+ve cases (%)
20 - 30	32 (25.40)	2 (6.25)
30 – 40	39 (30.95)	3 (7.69)
40 - 50	27 (21.43)	8 (29.63)
50 - 60	28 (22.22)	10 (35.71)

We have send the surface scrapings and tissue biopsy on first week, second week, third week and on fourth week. The samples were examined under direct microscopy and by fungal culture using standard techniques. On 1<sup>st</sup> week no sample was found positive (Figure 6). On 2<sup>nd</sup> week two samples came positive on direct microscopy and three samples were found positive on culture. Maximum number of samples were found positive in fourth week, seven by direct microscopy and eleven on culture (Table 5).

**Table 5: Fungal growth detected every week by different methods.**

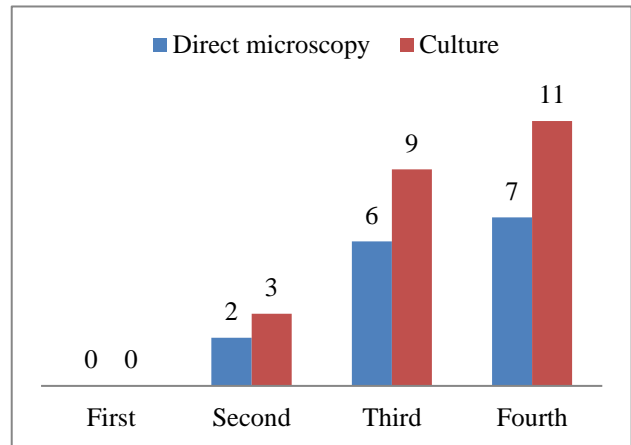
Week	Direct Microscopy	Culture
First	0	0
Second	2	3
Third	6	9
Fourth	7	11

**Table 6: Different fungal species detected and their percentage in our study.**

Fungus	No.	%	Expired cases
<i>C. albicans</i>	12 (52.17)	9.52	2
<i>As. flavus</i>	6 (26.08)	4.76	1
<i>Non Candida albicans</i>	3 (13.04)	2.38	0
<i>Asp. niger</i>	2 (8.70)	1.59	0

Twelve patients (9.52%) were found to be positive for *Candida albicans* (Figure 7), 6 patients (4.76%) were *Aspergillus flavus* positive, 3 patients (2.38%) were

positive for *Non Candida albicans* and 2 patients (1.59%) were positive for *Aspergillus niger* (Figure 8). Two patients infected with *Candida albicans* were expired and one patient infected with *Aspergillus flavus* was expired (Table 6).



**Figure 6: Weekly distribution of fungal positive cases.**



**Figure 7: Candida albicans growth.**



**Figure 8: Growth of Aspergillus niger.**



## DISCUSSION

Burn is non mechanical injury to the skin and it is a devastating form of trauma. Burn wound infection is one of the major cause of burn related mortality and morbidity. Fungal infection is an important cause of late burn related complication. The incidence of fungal infection in our study was 18.25% whereas in a study done by Mousa et al, they have found it 20%.<sup>5</sup> In a multicentric trial done by American Burn Association have found the incidence is 6.3%.<sup>2</sup> The reason for increased incidence in our study is due to absence of specialised burn care, delayed presentation of cases, inadequate and improper treatment in remote areas. The incidence of fungal infection increases with age in our study. It was maximum (33.33%) in patients with age >60 years. This is probably due to decreased immunity level with age. The deep burn in old patients have increased incidence of fungal infection.

In our study, maximum number of patient having third degree burn were found to be fungal culture positive. In a study done by Bruck et al, maximum number of fungal culture positive cases were of third degree burn followed by second degree burn.<sup>10</sup>

The incidence of fungal infection increased with the total body surface area involvement in our study like maximum number of cases (35.71%) of fungal growth positive were having burn area involvement more than 50% and patients having less than 30% TBSA were only positive in 6.25% cases. In the review of American Burn Association, 435 patients out of 6918 patients developed fungal BWI had burn size of >30% TBSA.<sup>2</sup>

This is in accordance with the study of Bruck et al, who observed the maximum number of positive fungal cultures in patients with >30% of body surface area.<sup>10</sup> Increase in incidence of fungal infection with increase in body surface area involvement is due to the decreased cellular and humoral immunity with large burn body surface area involvement and loss of more protective layer of skin as well. Increased incidence may be due to injudicious and use of broad spectrum antibiotics in large burn size.

We have found in our study that, the maximum number of patients (86.96%) were positive in third and fourth week of burn injury. No positive culture was seen in the first week and 13.04 % positive fungal cultures were seen in second post-burn week. Similar results were found by Bruck et al. in their study, which showed colonisation of burn wound with fungi increased after first post-burn week with peak incidence during third and fourth post-burn week.<sup>10</sup> Similar results were found by Ibrahim et al in their study.<sup>11</sup>

In our study, *Candida albicans* was the most predominant fungal organism (52.17%) in burn wound infections with mortality of two patients. The main risk factor identified

for the development of Candidemia was use of inappropriate empirical antibiotic therapy in burn patients.<sup>2,7</sup> *Nonalbicans Candida* species were much less frequent (13.04%) than *C. albicans*. However, since they have a low susceptibility to azoles, this might cause them to be a serious forthcoming threat. Development of azole resistance has been also observed in *Candida albicans* warranting antifungal susceptibility in such patients.<sup>9,12</sup>

In our study, *Aspergillus* spp. infection was observed in 34.78% of total fungal infection cases. *Aspergillus* spp. are commonly exist in water, soil and decaying foods so the hospitals reservoirs of *Aspergillus* are places such as, ventilation system, exhausted water pipe system, air exposed to dust from wards.<sup>13</sup> So, the nosocomial *Aspergillus* infections are usually connected to environmental disturbances like hospital being near to the highways or streets, or unsterility of patient contacts.<sup>13,14</sup>

## CONCLUSION

Fungal burn wound infections are one of the most common cause of late onset morbidity and mortality in burn patients. According to our study increased age with large burn surface area involvement are particularly prone to fungal infections. Fungal infections are associated with high morbidity and mortality and have clinical features similar to bacterial infection. So, high level of suspicion and tissue culture are essential in making early diagnosis and treatment. Judicious use of antibiotics are also necessary for decreasing its incidence.

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