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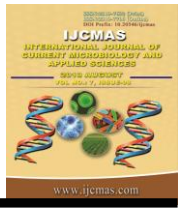

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Distribution of Candida Species amongst Various Clinical Samples from Immunocompromised Patients attending Tertiary Care Hospital, Assam

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A B S T R A C T

Candidiasis is the commonest fungal disease found in humans affecting mucosa, skin, nails and internal organs. It is caused by various species of yeast like fungi belonging to genus Candida with *Candida albicans* as the representative species. This study was undertaken to find out the prevalence of candidiasis in immunocompromised patients in this part of the country as well as to identify the different species isolated. History was elicited from all the patients enrolled in this study after taking informed consent from the patient. A total of 92 immunocompromised patients which include (45 cases of diabetes mellitus, 30 cases of HIV/AIDS, 10 cases with hematological malignancy and 7 cases with renal transplant surgery. A total of 130 samples were taken from the study group of which (47 blood, 40 urine, 11 sputum, 23 oral swabs and 9 pus). The specimens were subjected to direct microscopy in 10% KOH mount, culture in Sabouraud's dextrose agar supplemented with Chloramphenicol (0.05 mg/ml). They were then incubated at 22^0 C and 37^0 C and observed for fungal growth. Special tests were done to isolated Candida species. They were Gram staining, Germ tube test, Hi Chrome Agar, Corn Meal agar morphology, sugar fermentation and sugar assimilation test. The overall prevalence of Candidiasis among the study population was found to be 40%. *Candida spp* was isolated in 48.2% of diabetic population, 44.74% of individuals with HIV/AIDS, 18.1% in patients with hematological malignancy and 25% in patients undergoing renal transplant ($p<0.02$). The maximal number of patients positive for *Candida* spp were in the age group of 31-40 years (30.7%) followed by 51-60 years (25.6%) age group. The sex distribution showed a male preponderance with 77% males and 23% females. Majority of the (58.97%) patients came from rural area. ($p< 0.01$) and were from a low socioeconomic status with 25.6% having completed education up to twelve standard and 53.84% belonging to low income group. Clinically the patients presented with fever in 74.3% of patients while the rest 25.7% manifested other clinical features ($p<0.01$). The CD4 cell counts were between 51-100 cells/mm^3in 43% of HIV seropositive patients while 28.6% had counts between 101-150 cells/mm^3. The species profile of Candida reveals that non-albicans Candida (77%) outnumbered the *C. albicans* (23%) group. Among the non albicans group, *C. tropicalis* (n = 24, 46.15%) was the most frequent isolate in al clinical specimen followed by *C. parapsilosis* (n=5, 9.61%), *C. krusei* (n = 4, 7.69%), *C. guilliermondii* (n = 2, 3.84%), *C. rugosa* (n = 2, 3.84%), *C. dubliniensis* (n = 1, 1.92%), *C. glabrata* (n = 1, 1.92%) and *C. zeylonaides* (n = 1, 1.92%). This study highlights the diverse manifestations caused by Candida species and throws light on the species prevalent locally and also emphasizes on the need for introduction of mycological examination into the panel of methods.

Introduction

Candida are thin-walled, small yeasts (4 to 6 microns) that reproduce by budding. Even though there are more than 150 species of Candida, no more than ten cause disease in humans with varying frequency (Kwon Chung *et al.*, 1992). Candida species are the most frequent cause of fungal infections in the immunocompromised host. Species most commonly recovered include *Candida albicans, Candida tropicalis, Candida (Torulopsis) glabrata*, and *Candida parapsilosis*. Others such as *Candida lusitaniae*, *Candida rugos*a, and *Candida pseudotropicalis* have been reported to be associated with disseminated infection. Some are considered part of the usual flora, which makes the clinical significance of an isolate difficult to determine. *Candida* spp. are also competing with the bacteria as one of the leading causes of nosocomial infections (Banerjee *et al.*, 1991; Edmond *et al.*, 1999). During the 1990's *Candida* spp. was the fourth most common agent causing nosocomial bloodstream infection. In addition, the ability of *Candida* spp. to produce oropharyngeal candidiasis in patients with HIV-AIDS has made candidiasis the leading fungal infection in this immunosuppressed population (Sangeorzan *et al.*, 1994).

The varied manifestations of candidiasis often create for the physician a dilemma in both diagnosis and treatment, and are frequently major contributors to or are the actual causes of death in the patient. Several studies from different parts of the country have reported prevalence of candidiasis in different immunocompromised patients (Xess *et al.*, 2007; Kothari and Sagar, 2009). A number of studies have investigated the prevalence and epidemiology of candidiasis in immunocompetent as well as immunocompromised groups of people. From India, a few studies have been reported in respect of different etiological species, clinical presentations, risk factors and age and sex. The prevalence rates of candidiasis in immunocompromised individuals and species identification have been found to be varying depending on the study design, geographical location, population group, and the associated risk factors.

The objective of this study was to find out the prevalence of candidiasis in immune compromised patients attending Gauhati Medical College Hospital as well as to identify the different species from different clinical specimen.

Materials and Methods

Study area

The present study was conducted for a period of one year (July 2008- June 2009) at the Gauhati Medical College Hospital, Guwahati, Assam.

Study group

Immunocompromised patients of different categories like HIV seropositive individuals, diabetes mellitus, patients with hematological malignancies with total leukocyte count of less than 4000 transplant patients, patients receiving immunosuppressive drugs were included in the study. Patients (male and female of all age groups) with history and clinical features suggestive of fungal infection were selected for the study. Informed consent was taken from the patient before conducting the study. The socioeconomic status of the patients was ascertained according to the standard guideline (Mahajan, 1997).

Collection of specimen

Clinical specimens was collected by using aseptic measures in sterile container

comprised mainly of urine, sputum, pus, oral swab, blood and these were collected depending on the clinical manifestations of the patient. If delay in processing than the specimens were stored under refrigeration at 4° C with the following exception: blood which was stored at 30-37° C.

Laboratory investigations

Routine blood examination for hemoglobin, total and differential leukocyte count and erythrocyte sedimentation rate were done in all cases. Serological Examination was done in HIV cases by using rapid test kits.

Two rapid tests HIV COMB (Span Diagnostics Ltd. Surat, India) and Signal HIV (Span Diagnostics Ltd) and one ELISA, MICROELISA (J. Mitra & Co. Pvt. Ltd.) for HIV antibodies.

Candida isolates were screened for, 10% KOH Potassium Hydroxide mount, Indian ink, Lacto phenol Cotton Blue preparation (Milne, 1996), gram staining (Dugoid, 1996**)**, culture characteristics on Sabouraud's dextrose agar (SDA) supplemented with Chloramphenicol (0.05 mg/ml), Mac Conkey agar, Blood Agar was used in this study by following the standard procedure.

Special tests for further identification different Candida Species like Germ tube test (Forbes, 2002), Corn Meal Agar with Tween 80 Morphology, Chrome Agar (Forbes, 2002), sugar fermentation and sugar assimilation test was done.

The candida isolates which were obtained further speciated by the germ tube test, chlamydospore formation on cornmeal agar, inoculation on chromogenic medium (HiMedia CHROM agar), sugar fermentation and sugar assimilation test.

Statistical test

Chi-Square test was used in this study (Mahajan, 1997).

Results and Discussion

A dramatic change in the epidemiology of infectious diseases has taken place with the advent of new chemotherapeutic agents, new immunosuppressive agents, organ transplantation, parenteral alimentation, broad-spectrum antibiotics and advanced surgical techniques. In this new scenario, fungal infections have emerged as a critical issue in the compromised host. Among these, Candida spp. is the most common fungal pathogens (Bodey, 1988).

Clinical profile of study population

A total of 130 clinical samples from 92 immunocompromised patients with varied clinical manifestation attending different departments of Gauhati Medical College & Hospital from July 2008 to June 2009 were studied for prevalence of candidiasis. The clinical profile of the immunocompromised patients that constituted the study population is shown in Table 1. Out of a total of 92 patients, as many as 45 (48%) were diabetic. On the other hand, there were 30 (32.6%) either HIV seropositive or full blown AIDS cases, 10 (10.8%) patients with hematological malignancies and 7 (7.6%) who underwent renal transplant. There were 66 (71.74%) males and 26 (28.26%) females.

Clinical samples

The distribution of 130 clinical samples collected from the study population is shown in Table 2. Out of 130 samples studied, 47(36.15%) were blood 23 (17.69%) oral swab, 9 (6.92%) pus, 11 (8.46%) sputum and 40 (30.76%) urine samples.

Prevalence of candidiasis

The prevalence of candidiasis in different groups of the study population of 92 immunocompromised patients with varied clinical manifestations was found to be 40.7% as shown in Table 3; Figure 1 with 52 out of 130 samples yielding positive culture ($p< 0.02$). Candida spp. was isolated in 28 (48.27%) out of 58 different clinical samples from 45 diabetic patients, 17(44.74%) out of 38 samples from 30 HIV/AIDS patients, 4(18.18%), out of 22 samples from 10 patients with hematological malignancy and 3 (25%) out of 12 samples from 7 patients who underwent renal transplant.

Profile of Candida species

Table 4 reveal the profile of different Candida spp isolated from the 52 culture positive cases. It is evident that non albicans Candida (species (n=40, 77%) outnumbered the *C. albicans* species (n=12, 23%). Not shown in table). Among the non albicans spp. *C. tropicalis* was the most common isolate (n = 24, 46.15%), followed by *C. parapsilosis* (n = 5, 9.61%), *C. krusei* (n = 4, 7.69%), *C. guillermondii* (n = 2, 3.84%), *C. rugosa* (n = 2. 3.84%), *C. dubliniensis* (n = 1, 1.92%), *C. glabrata* (n = 1, 1.92%) and *C. zeylonaides* (n = 1, 1.92%).

Profile of Candidiasis patients

Table 5 gives the break up of number of Candidiasis positive patients in different groups of study population. It was observed that 20 (51.2%) out of a total 45 patients of diabetic group were positive for Candida spp. Similarly 14 (35.9%) out of 30 HIV/AIDS patients, 3 (7.7%) out of 10 patients with hematological malignancy, 2 (5.2%) out of 7 patients who underwent renal transplant were positive for Candida spp.

Age and sex of culture positive patients

This study revealed the age and sex distribution of the candidiasis patients. The age of the patients ranged from 7-75 years. The table shows that the maximal number of patients positive for *Candida* spp. were in the fourth decade of life (n=12, 30.7%), comprising of 9 HIV/AIDS patients and 2 diabetic patients.

The patients with diabetes mellitus in whom candidiasis was detected belonged mostly to the age group 51-60 years (n=10, 25.6%), whereas patients with malignancy were seen mostly in the age group 0-10 years (n=2, 5%) and that of transplant in the age group (31-40 years (n=1, 2.5%) and 61-70 years (n=1, 2.5%). The sex distribution shows a male preponderance with 13 (76.95%) males and 9 (23.07%) females.

Habitat of the culture positive cases

Habitat of 39 candida positive cases patients were seen to belong mostly to rural areas (n = 23, 58.97%), whereas only 16 (41.03%) were from urban areas ($p<0.01$).

Clinical presentation in culture positive cases

Table 6 reveals the clinical aspect of fever in patients where Candida spp. was isolated the overwhelming majority of 29 (74.3%) presented with fever.

On the other hand, 10 (25.7%) patients did not manifest fever ($p<0.01$).

Of the other clinical features, dysuria, burning and frequency of micturition was present in the highest number of cases (33 each) followed by headache in 27, cough in 26 and local lesion 16 cases (Table 7).

CD4 Cell counts in HIV seropositive culture positive cases

Table 8 reflects the CD4 cell counts of HIV seropositive patients in whom Candida spp was isolated. The maximum number of 6 (43.6%) patients had counts between 51-100/µL. while there were 2 (14.2%) patients with low counts of less than 50 cells/µL.

Blood sugar level in culture positive patients

Table 9 shows the range of random blood sugar level in the diabetic population in whom Candida spp. was isolated. Majority of 5(25%) the patients had blood sugar in the range 401-450 mg/dL followed by 4(20%) in the range of 351-400 mg/dL.

Culture of clinical specimens

Table 10 reveals the breakup of culture results in different clinical specimens. Out of a total of 52 isolates, 17 (32.69%) urine, 17 (32.69%) blood, 11 (21.15%) comprised of oral swab, 4 (7.69%) sputum and 3 (5.76%) pus.

Profile of species in various specimens

Table 11 shows the breakup of different species isolated in 52 different clinical samples. The table depicts that *Candida tropicalis* (24) was the most frequently isolated species in all clinical specimens. *Candida albicans* was isolated in less number of specimens (12) than non albicans species (40).

Profile of *Candida* species in culture positive cases in Diabetic group

Table 12 reflects the distribution of culture positive cases in different samples in diabetic population. The overall prevalence of candidiasis in this study group was found to be 48.2% *Candida spp*. was isolated in 10 (55.6%) 3 (33.3%), and 15 (48.3%) of blood, pus and urine samples, respectively.

Table 13 shows the different species isolated from different clinical specimen *C. albicans* constituted only 7(25%) of the total isolates whereas *C. tropicalis* (n=11, 52.3%) was the most common species in all specimen; (n=2, 9.5%), *C. glabrata* (n=1, 4.7%) *C. rugosa* (n=1, 4.7%) and *C. zeylonaides* (n=1, 4.7%).

Profile of *Candida* species in culture positive cases in HIV/AIDS group

Table 14 reflects the distribution of culture positive cases in different samples in HIV/AIDS group. Candida spp. was isolated in 10 (58.82%), 4 (23.52%), and 3 (17.62%) of oral swab, sputum and blood respectively. The overall prevalence of candidiasis in this group was found to be 44.74%.

Table 15 shows the different species isolated from different clinical specimen. *C. albicans* comprised only 3 (17.6%) out of 17 clinical isolates. On the other, hand *C. non-albicans* constituted 14 (82.3%) of the total isolates C. *tropicalis* (n = 10, 71.4%) seemed to be the most frequent isolate followed by *C. guillermondii* (n = 2, 14.2%), *C. dubliniensis* (n=1, 7.1%) and *C. krusei* (n = 1, 7.1%).

Profile of *Candida* species in culture positive cases in Hematological Malignancy group

Table 16 shows the distribution of culture positive cases in different samples in hematological malignancy group. Candida spp. was isolated in 2(50%), 1(25%), 1(25%) of blood, urine and oral swab respectively. The overall prevalence of candidiasis in this group was found to be 18.18%.

Table 17 and 16 reflects the different species isolated from different clinical specimen. *C. albicans* comprised only 1 (25%) out of 4

clinical isolated 75% of the isolates. The various species isolated were *C. tropicalis* (n=1, 25%), *C. krusei* (n=1, 25%), *C.parapsilosis* (n=1, 25%).

Profile of *Candida* species in culture positive cases in Transplant group

Table 18 gives a breakup of the culture positive cases in different samples in transplant recipient. Candida spp. was isolated in 2 (66.7%), 1 (16.7%) of blood and urine respectively. The overall prevalence of candidiasis in this group was found to be 33.3%.

Tables 19 reflect the different species isolated from different clinical specimen. *C. albicans* constituted 1(33.3%) of the total culture positive cases. On the other hand, *C. tropicalis* was the most frequent species in all clinical specimens.

Candidiasis has emerged as a significant medical problem owing to indiscriminate long-term use of antibiotics, immunosuppressive agents and cytotoxic therapies, immune defects and more recently in AIDS and AIDS related complex.

Prevalence of candidiasis

The overall prevalence of Candidiasis among the study population of 92 immunocompromised patients with varied clinical manifestation was found to be 40%. (Table 3) (P<0.02). Among the total isolates, non albicans Candida comprised of 77% of the total isolates. Among the non albicans species, *C. tropicalis* (46.15%) was the most common isolate in all the specimen followed by *C. parapsilosis* (9.61%), *C. krusei* (4, 7.69%), *C. guillermondii* (3.84%), *C. rugosa* (3.84%), *C. dubliniensis* (1.92%), *C. glabrata* (1.92%) and *C. zeylonaides* (1.92%) (Table 4).

Tritipwanit *et al.*, (2005) reported a 6.14% prevalence of candidiasis in blood stream infection, of which 57.1% belonged to the non albicans species. Among the non albicans species, *C.tropicalis* was the most common isolate followed by *C. parapsilosis* and *C. guilliermondii*. Kremery and Barnes (2002) reported a 35-65% prevalence of non-albicans Candida species in the general patient population.

The present study noted a prevalence of 32.69% in blood stream infections of which non albicans species constituted 77.7 % (Table 10 and 11). Present study is corresponds to few Indian studies as they also reported the prevalence of candidiasis in different study population. Xess *et al.,* (2007) reported a 79-80% incidence in both male and female population. A study done in Sir Gangaram Hospital, New Delhi reported an incidence of 27% in blood stream infections, of which 75.4 % belonged to the non albicans group. Malini *et al.*, (2005) reported a 28.17 % incidence of which 75.4% isolates belonged to the non albicans group.

Álvarez-Lerma *et al.*, (2003) reported 22% prevalence in urine of critically ill patients, of which *C. albicans* was the most frequent species. This is in contrast to the present study which reported a prevalence of 32.69% in urine of the study group, of which non albicans Candida species outnumbered the albicans group (Table 10 and 11).

In the present study, *C.tropicalis* was the most common isolate in blood accounting for 46.5% of the cases. *C. rugosa* (1.92%) was also among the rare isolates in the present study (Table 11).

Tritipwanit *et al.*, (2005) observed a 57.1% prevalence of non albicans species, whereas *C. albicans* constituted 42.9% of the isolates. Among the non albicans, *C. tropicalis* (9.9%)

was the most frequent isolate followed by *C. parapsilosis* (1.52%) and *C. guilliermondii* (0.76%).

Chakrabarti *et al.,* (2005) and Shivprakash *et al.,* (2007) reported *C.tropicalis* (38% & 35.6%, respectively) as the most frequent isolate followed by *C. parapsilosis, C. glabrata* and *C. pelliculosa*. On the other hand, Somansu *et al.,* (2003) reported *C.albicans* as the predominant isolate from various clinical specimen followed by *C. tropicalis, C. parapsilosis, C. krusei, C. kefyr, C. guilliermondii* and *C. glabrata.* This compares with the present study, which also noted a similar finding in the patients (Table 11).

Candidiasis and Diabetes

Candida spp was isolated in 28(48.2 %) out of 58 varied clinical specimen from 45 diabetic patients (Table 12). Drozdowska *et al.,* (2008) also reported a prevalence of 35-65% of Candida infection in diabetic patients, which is similar with the present study. Missoni *et al.,* (2005) reported an incidence of 4.3% in diabetic foot ulcer, which comprised of 59.1% males and 40.9% females. Among the isolates, *C. parapsilosis* was the most common isolate followed by *C. tropicalis* (22.7%), *C. albicans* (9.1%) and *C. glabrata* (9.1%). However in the present study, the incidence of foot infection was found to be 10.71% (Table 12). The distribution of species parallels the above mentioned study except that *C. parapsilosis* was not isolated in foot ulcer patients.

Dorko *et al.,* (2005) reported *C. albicans* as the major species isolated from most of the specimen comprising 64.4% of the isolates followed by *C. parapsilosis* (19.62%), *C. tropicalis* (9.3%), *C. krusei* (3.73%), and *C. guilliermondii* (1.8%). But in the present study, *C. albicans* comprised only 25% of the total isolates. *C. tropicalis*(n = 11/28, 39.2%) was the most frequent isolate in all the clinical specimen(followed by *C. parapsilosis* (n = 4/28, 14.2%), *C. krusei* (n = 2/28, 7.1%), *C. rugosa* (n = 2/28,7.1%) *C. glabrata* (n = 1/28, 3.5%) and *C. zeylonaides* (n = 1, 7.1%) (Table 13). Thus, the present study highlights the correlation between candidiasis and diabetes mellitus.

Candidiasis and HIV

Candidiasis is known to be the most common opportunistic infection in persons infected with HIV. In the present study, 17(44.74%) out of 38 samples from 30 HIV seropositive patients were found to be associated with candidiasis, the overall prevalence being 44.74 % (Table 14).

Costa Cr *et al.,* (2006) reported 62.6% prevalence of oral candidiasis. *C. albicans* was the prevailing species comprising of 50% of the isolates. *C. dubliniensis* was however not isolated in the study. The present study however noted a prevalence of 58.82% in patients with oropharyngeal candidiasis. However *C. tropicalis* was the most prevalent species (40%) followed by *C. albicans* (30%), *C. guilliermondii* (20%) and *C. dubliniensis* (10%) (Table 15).

Tumbarello *et al.,* (1999) reported candidiasis to be more common in patients with advanced HIV disease. *C. albicans* (48%) was the most frequently isolated pathogen followed by *C. tropicalis* (19%) and *C. glabrata* (11%). On the contrary, in the present study, candidemia was found in 17.62% of cases, and *C.tropicalis* was the only species isolated (Table 14 and 15).

An Indian study done by N Sud *et al.,* (2009) found the prevalence of Candidiasis as 35.33%. It was also reported that manifestations were seen with mean CD4 count of 196.33 cells/µL.

Males outnumbered females. Baradkar *et al.,* (1999) and Arora *et al.,* (2009) reported *C. albicans* as the most frequent species isolated. The findings of our study corresponds to that of the above-mentioned studies and lends credence to the view suggested in many studies that HIV predisposes to candidiasis.

Candidiasis and malignancy

The present study found candidiasis in 4 out of 22 samples from 10 patients with hematological malignancy, the overall prevalence being 18.1% (Table 16).

Several studies have reported on the species profile of Candida in malignancy patients. Kremery V Jr *et al., (*1999) reported an increase in prevalence of non-albicans species. Of the cases of nosocomial fungemia due to species, other than *Candida albicans*, *C. parapsilosis* was the most frequent isolate. Wingard *et al.,* (1979) reported *C. tropicalis* as the major pathogen in patients with hematological malignancy.

The present study however noted an equal isolation rate of *C. tropicalis* and *C. krusei* in blood, 1 isolate of *C. parapsilosis* in urine and 1 isolate of *C. albicans* in oral swab, constituting only 25% of the isolates (Table 17).

Candidiasis and transplantation

The present study isolated Candida species from 3 out of 12 clinical samples from 7 transplant patients, the overall prevalence being 25 % (Table 18). *C. tropicalis* was the most common species isolated in all clinical specimens whereas *C. albicans* comprised of 33.3% of the isolates (Table 19).

Paya (1993) reported an incidence of 5-40% in transplant patients. This can be correlated with the present study, which recorded 25% prevalence.

Profile of candidiasis patients

Age and sex distribution

The maximal number of patients positive for candida were in their fourth decade of life (30.7%),followed by patients in the age group 51-60 years (25.6%) and 21-30 years (12.9%). The age of the patients ranged from 7 years to 75 years; the sex distribution revealed a male preponderance with 77.5% males and 22.5% females.

Tritipwanit *et al.,* (2005) reported the median age of the patients as 37 years with male preponderance. In a study conducted at Kolkata by Chakrabarti *et al.,* (2008) the age of the candida positive patients ranged from 31-40 years followed by 21-30 years. The age distribution in the present study corresponds to the above mentioned studies. The same study noted an absence of yeast infection in the female population. This can be correlated with the present study, which noted a male preponderance.

Missoni *et al.,* (2005) noted higher incidence of candidia infection in the male population. Aggarwal *et al.,* (2005) also reported a higher incidence of the disease in the reproductive age group (16-45 years) with a male preponderance.

Thus, the present study corresponds to the previously mentioned observations in terms of age and sex.

Socioeconomic status

In the study it was observed that majority of the patients had completed education upto twelve standard (25.6%). On the other hand, most of the patients belonged to low income group (53.84%) followed by middle-income group (38.46%). It was observed that majority of the Candida positive patients were residents of rural area ($p < 0.01$).

Poor socioeconomic condition, inadequate nutrition and poor hygiene have been observed to have a bearing on the incidence of the disease (Daniela Moreira *et al.,* 2004; Chakrabarti *et al.,* 2008).

Clinical presentation of fever

It is evident from Table 16 that 74.3% of the Candida positive patients had manifested fever as a clinical feature. On the other hand, 25.7% had clinical features other than fever ($p<0.01$).

Aggarwal *et al.,* (2005) in their study noted that 56% of the patients had presented with fever while the rest 44% had varied clinical manifestations. Ayyagari *et al.,* (1999) and Talib and Singh (1998) noted similar finding.

The present study can be correlated with these studies as the patients here also presented with multiple clinical features other than fever alone (Table 7).

CD4 T cell count in the HIV seropositive Candidiasis patients

The maximum number of HIV seropositive candidiasis patients in the present study had CD4 T cell counts between 51-100 cells/mm^3 (43.0%) while there were 28.6% patients with counts between 101-150 cells/mm^3 (Table 10).

Caroline *et al.,* (1991) observed that the risk of candidiasis infection increases in more profoundly immunosuppressed HIV seropositive persons. Sud *et al.,* (2009) noted that increased number of cases was seen with a mean cluster of differentiation (CD4) T cell count of 196.33 cells/mm^3. Chakrabarti *et al.,* (2008) noted a greater prevalence in patients with CD4 cell count below 200 cells/mm^3. Singh *et al.,* (2007) also reported the increased risk of oropharyngeal candidiasis in patients with CD4 cell count<200 cells/$mm^{3.}$ The findings of the present study parallel the previously mentioned observations.

Random blood glucose level in candidiasis positive diabetic patients

Majority of the candidiasis positive diabetic patients had blood sugar above 250mg/dl with majority (n = 5, 25%) in the range of 401-450mg/dl (Table 9).

Mazen and Bader *et al.,* (2004) in their retrospective study correlated on the impact of hyperglycemia on hospital mortality in diabetic patients with candidemia. The study reported severe hyperglycemia (>13.9mmol/dL or >250mg/dL) as a marker of increased mortality among hospitalized patients with candidemia. As stated above, the present study results parallels the above-mentioned finding. Goswami *et al.,* (2000) suggested significant correlation between hyperglycemia and vulvovaginal candidiasis and the role of pathogens other than *C. albicans*

Table.1 Clinical profile of study population

Study population	No (%) of patients		
	Male	**Female**	Total (%)
Diabetes mellitus(DM)	29	16	**45 (48)**
HIV/AIDS	27	3	**30 (32.6)**
Malignancy	7	3	**10 (10.8)**
Transplant	3	4	**7 (7.6)**
Total	**66 (71.74)**	**26 (28.26)**	**92 (100)**

Table.2 Distribution of 130 clinical samples of the study population

Study Population	Blood	Oral Swab	Pus	Sputum	Urine	Total	Percentage (%)
Diabetes Mellitus	18	0	9	0	31	58	**44.6%**
HIV/AIDS	16	11	0	11	0	38	**29.3%**
Malignancy	10	9	0	0	3	22	**16.9%**
Transplant	3	3	0	0	6	12	**9.2%**
Total	**47(36.15%)**	**23(17.69%)**	**9(6.92%)**	**11(8.46%)**	**40(30.76%)**	**130**	**100%**

Table.3 Candidiasis among the study population

Immunocompromised groups	No of samples cultured	No (%) of Culture positive
DM	58	**28 (48.27)**
HIV/AIDS	38	**17 (44.74)**
Malignancy	22	**4 (18.18)**
Transplant	12	**3 (25)**
Total	**130**	**52 (100%)**

Table.4 Profile of Candida Species in Study Population

Species	Total	Percentage (%)
Candida albicans	12	**23**
C. tropicalis	24	**46.15**
C. parapsilosis	5	**9.61**
C. krusei	4	**7.69**
C. guillermondii	2	**3.84**
C. rugosa	2	**3.84**
C. dubliniensis	1	**1.92**
C. glabrata	1	**1.92**
C. zeylonaides	**1**	**1.92**

Table.5 Number of patients culture positive for Candida in different study population

Study Population	No of patients (n=92)	Culture Positive (n=39)	Percentage (%)
DM	45	20	**51.2**
HIV/AIDS	30	14	**35.9**
Malignancy	10	3	**7.7**
Transplant	**7**	**2**	**5.2**

Table.6 Clinical presentation with fever

Clinical Presentation with fever	Number of Patients				
	DM	**HIV**	**Malignancy**	**Transplant**	Total No (%) of patients
Present	15	9	3	2	**29 (74.3)**
Absent	**5**	**5**	**0**	**0**	**10 (25.7)**

Table.7 Other clinical features

Symptoms	DiabetesMellitus	HIV/AIDS	Malignancy	Transplant	Total (%)
Local Lesion	7	10	1	0	**18(19.5)**
Cough	9	13	4	0	**26(28.2)**
Headache	4	18	4	1	**27(29.3)**
Frequency Micturition	21	5	3	4	**33(35.8)**
Burning Micturition	23	4	3	3	**33 (35.8)**
Dysuria Micturition	**23**	**5**	**3**	**2**	**33(0)**

Table.8 CD4 cell counts in HIV seropositive Candidiasis patients

Cell Count (/µL)	Number of cases	Percentage (%)
<50	2	**14.2**
51-100	6	**43.0**
101-150	4	**28.6**
151-200	2	**14.2**
Total	**14**	**100**

Table.9 Random blood sugar in Candidiasis patients

Random Blood Sugar (mg/dL)	Number of Patients	Percentage (%)
151-200	0	**0**
201-250	1	**5**
251-300	2	**10**
301-350	3	**15**
351-400	4	**20**
401-450	5	**25**
451-500	3	**15**
501-550	2	**10**
Total	**20**	**100**

Table.10 Break up of culture results in different clinical specimen

Specimen	Total no cultured	Culture Positive	
		No.	Percentage (%)
Blood	47	17	**32.69**
Oral swab	23	11	**21.15**
Pus	9	3	**5.76**
Sputum	11	4	**7.69**
Urine	40	17	**32.69**
Total	**130**	**52**	**100**

Table.11 Profile of different species isolated in various specimens

Specimen	*C. albicans*	Non albicans candida spp.							
		C. tropicalis	***C. parapsilosis***	***C. krusei***	***C. rugosa***	***C.guillermondii***	***C. glabrata***	***C. zeylonaides***	*C. dublinensis*
Blood	3	9	2	2	1	0	0	0	**0**
Oral swab	4	4				2	0	0	**1**
Pus	1	1	0	0	0	0	1	0	**0**
Sputum	0	3	0	1	0	0	0	0	**0**
Urine	4	7	3	1	1		0	1	**0**
Total	**12**	**24**	**5**	**4**	**2**	**2**	**1**	**1**	**1**

Table.12 Distribution of culture positive cases in diabetic population

Specimen	Total	Culture Positive	Percentage (%)
Blood	18	10	**55.6**
Pus	9	3	**33.3**
Urine	31	15	**48.3**
Total	**58**	**28 (48.2%)**	**100**

Table.13 Distribution of different species in 28 culture positive samples in diabetic population

Spécimen		*Non albicans candida spp.*					
	C. albicans	***C. tropicalis***	***C.parapsilosi***	***C. krusei***	***C.glabrata***	***C. rugosa***	*C. zeylonaide*
Blood	2	4	2	1	0	1	**0**
Pus	1	1	0	0	1	0	**0**
Sputum	0	0	0	0	0	0	**0**
Urine	4	6	2	1	0	1	**1**
Total	**7**	**11**	**4**	**2**	**1**	**2**	**1**

Table.14 Distribution of 17 culture positive cases in HIV/AIDS

Specimen	Total	Culture positive	Percentage (%)
Blood	16	3	**17.62**
Oral swab	11	10	**58.82**
Sputum	11	4	**23.52**
Total	**38**	**17 (44.74%)**	**100**

Table.15 Distribution of different species in 17 culture positive samples in HIV/AIDS group

Specimen	*C. albicans*	*Non Albicans Candida*			
		C. krusei	***C. tropicalis***	***C. guillermondii***	*C. dubliniensis*
Blood	0	0	3	0	**0**
Oral Swab	3	0	4	2	**1**
Sputum	0	1	3	0	**0**
Total	**3**	**1**	**10**	**2**	**1**

Table.16 Distribution of 4 culture positive cases in Hematological Malignancy

Specimen	Total	Culture positive	Percentage (%)
Blood	10	2	**50**
Urine	3	1	**25**
Oral swab	9	1	**25**
Total	**22**	**4 (18.18%)**	**100**

Table.17 Distribution of Candida spp. in 4 different clinical specimens in hematological malignancy patients

Specimen	*C. albicans*	*Non albicans*		
		C. tropicalis	***C.krusei***	*C.parapsilosis*
Blood	0	1	1	**0**
Urine	0	0	0	**1**
Oral Swab	1	0	0	**-**
Total	**1**	**1**	**1**	**1**

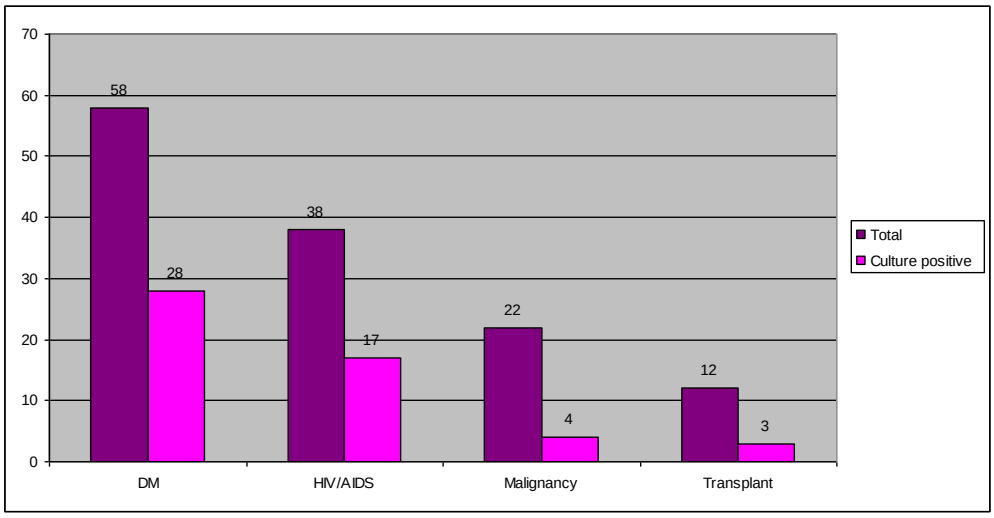
Table.18 Distribution of 3 culture positive cases in transplant group

Specimen	Total	Culture	Positive %
Blood	3	2	**66.7**
Urine	6	1	**16.7**
Oral Swab	3	0	**0**
Total	**12**	**3 (25%)**	**100**

Table.19 Distribution of Candida spp. in 3 different clinical specimen in transplant patients

Specimen	*C. albicans*	*C. tropicalis*
Blood	1	**1**
Urine	0	**1**
Total	**1**	**2**

Fig.1 Bar diagram showing prevalence of Candidiasis among the study population



Glycosuria is recognized as a risk factor of fungal urinary tract infections with *C. albicans*, *C. tropicalis* and *C. krusei* being the commonest etiological pathogens.

It may be concluded from this study that people who are immunosuppressed are at higher risk for Candida infection. The study highlights the diverse manifestations caused by Candida species and throws light on the species prevalent locally. This study also emphasizes on the need for introduction of mycological examination into the panel of methods evaluating the clinical condition of this category of patients and the need for formulating preventive and prophylactic measures.

Despite the moderate (n=130) number of samples included in the study, the data here provide some background information that can form the basis of future, more elaborative and systematic studies. Apart from this, it can also potentially have an immediate impact on patient care by suggesting appropriate interventional measures based on the results.

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