

## Searching Candida species in hands of students Qazvin University of Medical Sciences

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**Abstract: Background:** Candida species are major pathogenic in immunocompromised patients that can be present on all medical personnel and find it in infect hands that may be transferred to patients and even can cause their death. **Objective:** This study aimed at the isolation of Candida species from different fields were medical students. **Methods:** This descriptive study was performed duration 6 months from October 2010 to March 2011. In total 385 students from different fields were sampled. Samples on Sabouraud dextrose agar medium with Chloramphenicol were cultured. Candida species were identified by Corna meal gar medium, Chromagar absorbing and different carbohydrates were used. **Results:** 116 out of 385 cases (30.2%) of the hand culture (of the candidates) were positive. The most common species isolated Candida albicans was 70 cases (60.3%). Many species of Candida from hands of nursing students, 17 (37.8%) were isolated. **Conclusion:** In different fields, hands of the medical students could be containing of candidate, worthy people before contact with immunocompromised patients, to wash their hands.

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### 1. Introduction

Candidiasis can occur in chronic, sub-acute or acute forms. It has different clinical signs and symptoms with causative agents including a wide spectrum of endogenous and exogenous species of Candida. Candida species are present in the environment and can colonize on the skin or catheters through contaminated instruments or devices or hand contacts.

Candida species can produce infections in a suitable setting including heat, moisture, burn, immune system deficiency, skin scratches, diabetes, leukemia or immune system suppressing drugs use. Candida species are among the most important causative agents of hospital acquired infections (Rippon, 1988).

Fotedar has conducted a study on probable role of German cork roach as a vector in transmission of fungi, and the most prevalent fungi isolated from cork roaches present in the hospital were Candida (Fotedar and Banerjee, 1992).

Hauer introduces pneumonia, bronchitis, UTI and septicemia as the most common hospital acquired infections in descending order and states that hospital acquired infections are most commonly seen among ICU patients, and this is because most ICU patients have debilitated immune system or use antibiotics (Hauer, 1996).

Alvarez considers long time stay in ICU, over 65 year's age, female gender and antibiotics use as influential in acquiring candiduria (Alvarez-Lerma, 2003).

Conteno has evaluated ICU ward air of Antonio hospital in Venezuela for presence of fungi and has isolated filament fungi like Aspergillus, Fusarium, Candida and ... from ICU ward air, and believes that the number of patients being inflicted with such fungi is on the rise (Conteno and Machado, 2004).

Wisplinghoff has conducted a study and stated that Candida species were an important cause of hematologic nosocomial infections and that had increased mortality rate in these patients significantly. In his investigation, average age of the patients was 52 years, their stay in the hospital before having positive blood culture was 21 days, and 57% of them were in ICU wards (Wisplinghoff, 2006).

Chakrabarti and Kumar conducted another study in Shandigar, India, in search of sources of hospital acquired infections in burn care unit of Nehru hospital. In this study, samples were taken from wounds of the patients and also from surrounding environment and their evaluation showed contaminations with fungi like Aspergillus, penicillium, fusarium, and black fungi and yeasts like Candida albicans, Candida tropicalis, Candida krusei, and Candida parapsilosis (Chakrabarti, 1992).

In the year 2010, Hernandez reported a spread of Candida parapsilosis in NICU of a hospital in Mexico which had caused fungemia in a number of those children. The same species were isolated from palms of therapeutic personnel in that ward, and sameness of both agents was approved through DNA analysis (Hernández-Castro, 2010).

In the year 2010, Gulia stated that candidemia of immune deficient patients developed through the hands of nurses was a non-deniable fact. He evaluated 233 cases of candidemia in a retrospective study and found that one fourth of those patients had got candidemia and hospital acquired infections through their nurses. *Candida glabrata* was the most prevalent agent acquired from their blood cultures (Gulia, 2010).

In the year 2007, Van Asbeck introduced neonatal fungemia as a result of contaminated hands of personnel in NICU ward of the hospital under his surveillance. He reported the *Candida parapsilosis* strains acquired from blood cultures and from hands of personnel to be the same through RFLP method. This study confirms other studies already carried out in this relationship (Van Asbeck, 2007).

In the year 2007, Tamura isolated 23 yeasts from catheters inside vessels and hands of personnel of the hospital under his surveillance and stated that the yeasts isolated from catheters were the same as those isolated from the hands of personnel (Tamura, 2007).

In the year 2005, Bonassoli evaluated the presence of yeasts on the hands of 86 hospital personnel and isolated them from 59.3% those people, *Candida parapsilosis* being the most prevalent species isolated. Colonization of these yeasts on the hands of hospital personnel results in sticking of them on plastic surfaces and increasing their risk of transmission to susceptible people (Bonassoli, 2005).

In the year 2001, Parry reported osteomyelitis with *Candida* after vertebral column surgery which had been developed due to presence of *Candida albicans* under artificial nail of OR technician. Fungi had been transferred to operation field and had caused infection. He proposes that OR personnel refrain from wearing artificial nails during operation (Parry, 2001).

In the year 1995, Pertowski reported some sternal wound infections with *Candida albicans* after open heart surgery due to contaminated hands of a nurse. The nurse in charge of changing dressings of the wounds of these patients had had recurrent vaginal infection with *Candida albicans* and had transmitted the infection to the patients through her contaminated hands (Pertowski, 1995).

Fungi are one of the most important factors in development of nosocomial infections, and always measures should be taken for destroying or reduction of population of them (Fotadar and Banerjee, 1992).

The present study has been carried out in Qazvin city of Iran due to importance of this issue.

## 2. Material and Methods

This is a cross-sectional study carried out in the last quarter of 2010 and the first quarter of 2011,

for 6 months, on 385 male and female students of different fields and different years of medical sciences university (including 75 nursing, 115 medicines, 130 health care and 65 dentistry students). These numbers are proportionate with the population size in each faculty.

Sampling was done through washing hands in 20 ml of brain heart infusion agar culture media placed in sterile nylon bags.

Then the bags were kept in 37 degree incubator for 5 days and afterwards, they were cultured on solid Sabouraud dextrose Agar containing chloramphenicol at mycology lab of faculty of medicine, and were kept at 25 degrees for 5 days for fungal growth.

Then, the grown fungi were identified through routine mycology procedures like using germ tube test, corn meal agar media plus tween 80, CHROM agar and sugar absorption media (api 20 aux). Data were collected in questionnaires and analyzed using descriptive statistic tools (tables, diagrams).

## 3. Results

From 385 students evaluated, 116 cases (30.2%) had at least one culture positive of the *Candida* species of their hands. Prevalence of positive cultures for *Candida* yeast from hands of the students of different fields of Qazvin medical sciences university were shown in table 1.

Table 1. Prevalence of positive cultures for *Candida* yeast from hands of the students of different fields of Qazvin medical sciences university

Study field	Number	Percent
Management	30	7.8%
Lab sciences	43	11.2%
Nursing	45	11.7%
Midwifery	33	8.6%
Medicine	68	17.7%
Health care	45	11.7%
Emergency	23	6%
Anesthesiology	24	6.2%
Dentistry	51	13.3%
Operating room	22	5.8%
Total	384	100%

Prevalence of *Candida* species isolated from hands of the students of Qazvin medical sciences university was shown in table 2.

From 145 male students evaluated, 45 cases (31%) had at least one culture positive *Candida* species of their hands, which was 29.7% in female students (table 3).

Table 2. Prevalence of *Candida* species isolated from hands of the students of Qazvin medical sciences university

Study field	Number	Percent
<i>Candida albicans</i>	70	60.3%
<i>Candida parapsilosis</i>	24	20.7%
<i>Candida tropicalis</i>	14	12.1%
<i>Candida krusei</i>	5	4.3%
<i>Candida glabrata</i>	3	2.6%
Total	116	100%

*Candida albicans* species was the most prevalent species isolated from the hands of male and female students, where 70 cases of the whole 116 positive cases (60.3%) belonged to this species (table 4), 74 cases of the whole 116 positive cases (63.8%) belonged to B.Sc. students (table 5).

Table 3. Distribution of evaluated students in accordance with presence of *Candida* yeast on the hands and gender

Presence of <i>Candida</i>	Yes	No	Total
Female	71(18.5%)	168(43.75%)	239(62.2%)
Male	45(11.72%)	100(26.04%)	145(27.8%)
Total	116(30.2%)	268(68.8%)	384(100%)

Table 4. Prevalence distribution of *Candida* species isolated from hands of the students according to gender

	Candida species					Total
	<i>Candida albicans</i> Number (%)	<i>Candida parapsilosis</i> Number (%)	<i>Candida tropicalis</i> Number (%)	<i>Candida krusei</i> Number (%)	<i>Candida glabrata</i> Number (%)	
Female	43(37.6%)	15(12.9%)	8(6.9%)	3(2.6%)	2(1.7%)	71(61.2)
Male	27(23.3%)	9(7.7%)	6(5.2%)	2(1.7%)	1(0.9%)	45(38.8%)
Total	70(60.35%)	24(20.7%)	14(12.07%)	5(4.3%)	3(2.6%)	116(100%)

Table 5. Prevalence distribution of different *Candida* species isolated from hands of the students according to educational degree level

	Candida species					Total
	<i>Candida albicans</i> Number (%)	<i>Candida parapsilosis</i> Number (%)	<i>Candida tropicalis</i> Number (%)	<i>Candida krusei</i> Number (%)	<i>Candida glabrata</i> Number (%)	
Associate degree	4(5.7%)	2(8.3%)	1(7.1)	0(0%)	0(0%)	7(6%)
B.Sc.	44(62.9%)	15(62%)	9(64.3%)	3(60%)	3(100%)	74(63.8%)
M.Sc.	3(4.3%)	0(0%)	0(0%)	0(0%)	0(0%)	3(2.6%)
Doctorate	19(27.1%)	7(29.2%)	4(28.6%)	2(40%)	0(0%)	32(27.6%)
Total	70(100)	24(100%)	14(100%)	5(100%)	3(100%)	-

Table 6. Prevalence distribution of different *Candida* species isolated from hands of the students according to educational study field

	Candida species					Total
	<i>Candida albicans</i> Number (%)	<i>Candida parapsilosis</i> Number (%)	<i>Candida tropicalis</i> Number (%)	<i>Candida krusei</i> Number (%)	<i>Candida glabrata</i> Number (%)	
Management	5(7.2%)	2(8.3%)	1(7.1%)	0(0%)	0(0%)	8(6.9%)
Lab sciences	9(12.8%)	3(12.5%)	2(14.3%)	1(20%)	0(0%)	15(12.9%)
Nursing	10(14.4%)	4(16.6%)	2(14.3%)	1(20%)	0(0%)	17(14.7%)
Midwifery	7(10%)	3(12.5%)	0(0%)	0(0%)	2(66.7%)	12(10.3%)
Medicine	12(17.1%)	4(16.6%)	2(14.3%)	0(0%)	0(0%)	18(15.6%)
Health care	7(10%)	2(8.3%)	1(7.1%)	1(20%)	1(33.3%)	12(10.3%)
Emergency	4(5.7%)	1(4.2%)	1(7.1%)	1(20%)	0(0%)	7(6%)
Anesthesiology	4(5.7%)	1(4.2%)	2(14.3%)	0(0%)	0(0%)	7(6%)
Dentistry	8(11.4%)	3(12.5%)	2(14.3%)	1(20%)	0(0%)	14(12.1%)
Operating room	4(5.7%)	1(4.2%)	1(7.1%)	0(0%)	0(0%)	6(5%)
Total	70(100%)	24(100%)	14(100%)	5(100%)	3(100%)	-

From the whole 116 positive cases, 18 cases (15.6%) belonged to students of medicine (table 6). The highest rate of contamination belonged to nursing students with 37.8%, followed by midwifery students (36.4%), lab sciences (34.9%), medical emergency (30.4%), anesthesia (29.1%), dentistry (27.4%), operating room (27.2%), health care (26.7%), management (26.7%), and medicine (26.4%).

#### 4. Discussion and conclusion

In this study, many *Candida* species were isolated from hands of the students of different fields, which can produce hospital acquired infections in susceptible people, and the most prevalent species of which was *Candida albicans*. In this study on the hands of nursing students, Bonassoli identified *Candida albicans* as the most prevalent species too (Bonassol and Svidzinski, 2002).

*Candida albicans* has been introduced as the most prevalent fungal species producing hospital acquired infections in the mentioned articles, which can be easily isolated from hands of ICU and surgery personnel. Presence of yeasts on the hands of these personnel is considered as the most important factor in development of hospital acquired infections.

In the study, 37.7% of nursing students had *Candida* yeasts on their hands; Orozco also stated that 32 percent of nursing students participating in his study had *Candida* yeasts on their hands (Orozco, 2009).

*Candida parapsilosis* was the second yeast isolated from hands of the students in our study, but Yildirin introduced it as the most prevalent *Candida* species found on the hands of hospital personnel under his surveillance (Yildirin, 2007).

Hernandez-Castro also introduced *Candida parapsilosis* as the most common *Candida* species found on the hands of hospital personnel under his surveillance (Hernandez-Castro, 2010).

Martins states that invasive Candidiasis in immune-deficient patients has been on rise in recent years and *Candida albicans* is still the most prevalent species found in fungemia, but infections caused from other non-*albicans* species in susceptible patients are also on rise. Treatment of infections with other non-*albicans* species is difficult due to their resistance against azoles, and they are associated with higher mortality rates.

Martins-Diniz repeatedly isolated yeasts from room door handles of newborns and adults (Martins-Diniz, 2005). In this study, hand washing in liquid Sabouraud dextrose media method was used, same method as used by Yildirin for detecting *Candida* on hands of hospital personnel under his surveillance (Yildirin, 2007).

Orozco also used the same method for isolation of *Candida* on hands of NICU nurses under his surveillance (Orozco, 2009). In this study, for culturing from liquid to solid media, Sabouraud dextrose Agar was used, as it was used in Orozco's study for appearance of yeast colonies on solid culture media (Orozco, 2009).

In this study, corn meal agar api-20C AUX and corn meal agar with shed kits were used for detecting *Candida* species, again, in the same manner as Yildirin used in his study (Yildirin, 2007).

Sahand also used CHROM agar media for detecting *Candida* species (Sahand, 2009).

In this study, nursing students' hands contained the highest number of *Candida* compared to other students, because of their longer presence in hospital; and the same was true in Yildirin's research too (Yildirin, 2007).

Martins-Diniz found 32 species of fungi from a surgery center and ICU including *Candida*

spp. In 10.6% of cases, he isolated *Candida* from pharynx of OR and ICU personnel (Martins-Diniz, 2005). The isolated candid's included *Candida albicans*, *Candida guilliermondii*, *Candida parapsilosis* and *Candida lusitanae*. Critical hospital wards are in a great need for fungal population reduction, since fungi can cause a wide range of illnesses from respiratory allergies to disseminated infections in susceptible people.

Nosocomial infections with fungal origin have been on the rise in recent years, as is mortality from such infections. Fungi causing systemic fungal infections in human usually grow well at 37 degrees centigrade, *Candida albicans* and *Aspergillus fumigatus* being two typical examples of such fungi (Parry, 2001).

Ahmad, having done an investigation, states that *Candida* infection can be exogenous. He isolated *Candida* from hands of nurses in three occasions which had been isolated from blood cultures of ICU patients (Ahmad, 2003).

Fanello also has stated after having done an investigation, that incidence of hospital acquired yeast infections in hospitalized elderly patients were on the rise, which can be due to predisposing factors like having prosthetic denture, poor oral hygiene, using antibiotics, poor nutrition, long stays in hospital, and endocrine diseases (Fanello, 2006).

Vazquez considers *Candida glabrata* infections in his patients as a result of presence of this yeast in hospital environment and on hands of treating personnel (Vazquez, 1998).

In our study, also, this yeast was isolated from hands of the students. Bonassoli, in his research on nursing students evaluated hands and nasal cavity of the 22 students before and 62 days after starting education in hospital and found significant increase in the number of yeasts after starting education in hospital (Bonassol and Svidzinski, 2002).

Holder also insists on importance of regular repeated hand washing in reduction of hospital acquired infections and states that hand washing education, especially for ICU personnel should be considered as a constant concern. After 4 years of education and continual follow up of ICU personnel hand washing, he found a significant reduction in mortality of ICU in-patients in his research.

Air and environment control of wards where immune-deficient patients are being kept, is also an important issue, because such patients are susceptible to environmental fungi and pathogens transmitted to them through personnel (Munoz, 2004). He also insists on environmental disinfection, but it should be noted that eliminated fungi of critical places are replaced after disinfection, and so, disinfection of the

environment should continue constantly (Helder, 2010).

In general, in order to control fungal infections in ICU, OR, and critical wards, disinfecting rooms and devices, cleaning air conditioning systems, minimizing traffic, personnel hand hygiene and improving knowledge of personnel, and hospital environment hygiene are beneficial.

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#### References:

- 1- Rippon JW. Medical mycology, 3rd ed. W.B. Saunders CO, Philadelphia, 1988; 46-68.
- 2- Fotedar R, Banerjee U. Nosocomial fungal infections-study of the possible role of cockroaches (*Blattella germanica*) as Vectors. *Acta Trop* 1992; 50(4): 339-43.
- 3- Hauer T, Lacour M, Gastmeier P, Ruden H. Nosocomial infections intensive care units. A nation-wide prevalence study. *Anaesthesist* 1996; 45 (12): 1184-91.
- 4- Alvarez-Lerma F, Nolla-salas J, Leon C. Candiduria in critically ill Patients admitted to intensive care medical units. *Intensive care Med* 2003; 29(7): 1069-76.
- 5- Conteno S, Machado S. Assessment of airborne mycoflora in critical areas of the principal Hospital of Cumana, state of sucre, Venezuela. *Invest clin* 2004; 45(2): 137-44.
- 6- Wisplinghoff H, Seifert H, Wenzel RP, Edmond MB. Inflammatory response and clinical course of adult patients with nosocomial bloodstream infections caused by candida spp. *Clin Microbiol Infect* 2006; 12 (2): 170-7.
- 7- Chakrabarti A, Nayak N, Kumar PS, Talwar P, Chari PS, Panigrahi D. Surveillance of nosocomial fungal infections in a burn care unit. *Infection* 1992; 20(3):132-5.
- 8- Hernández-Castro R, Arroyo-Escalante S, Carrillo-Casas EM, Moncada-Barrón D, Alvarez-Verona E, Hernández-Delgado L, Torres-Narváez P, Lavallo-Villalobos A. Outbreak of *Candida parapsilosis* in a neonatal intensive care unit: a health care workers source. *Eur J Pediatr* 2010;169(7):783-7.
- 9- Gulia J, Aryal S, Saadlla H, Shorr AF. Healthcare-associated candidemia – a distinct entity? *J Hosp Med* 2010; 5(5):298-301.
- 10- Van Asbeck EC, Huang YC, Markham AN, Clemons KV, Stevens DA. *Candida parapsilosis* fungemia in neonates: genotyping results suggest healthcare workers hands as source, and review of published studies. *Mycopathologia* 2007; 164(6) : 287-93.
- 11- Tamura NK, Negri MF, Bonassoli LA, Svidzinski TI. Virulence factors for *Candida* spp recovered from intravascular catheters and hospital workers hands. *Rev Soc Bras Med Trop* 2007; 40(1):91-3.
- 12- Bonassoli LA, Bertoli M, Svidzinski TI. High frequency of *Candida parapsilosis* on the hands of healthy hosts. *J Hosp Infect* 2005; 59(2):159-62.
- 13- Parry MF, Grant B, Yukna M, Adler – Klein D, McLeod GX, Taddonio R, Rosenstein C. *Candida* osteomyelitis and diskitis after spinal surgery: an outbreak that implicates artificial nail use. *Clin Infect Dis* 2001;32(3):352-7.
- 14- Pertowski CA, Saron RC, Lasker BA, Werner SB, Jarvis WR. Nosocomial outbreak of *Candida albicans* sternal wound infections following cardiac surgery traced to a scrub nurse. *J Infect Dis* 1995; 172(3):817-22.
- 15- Bonassoli LA, Svidzinski TI. Influence of the hospital environment on yeast colonization in nursing students. *Med Mycol* 2002; 40(3):311-3.
- 16- Orozco PA, Cortes JA, Parra CM. Colonization by yeasts in newborns and healthcare personnel in a neonatal intensive care unit at a university hospital in Bogota, Colombia. *Rev Iberoam Micol* 2009, 26(2):108-11.
- 17- Yildirim M, Sahin I, Kucukbayrak A, Ozdemir D, Tevfik Yavuz M, Oksuz S, et al. Hand carriage of *Candida* species and risk factors in hospital personnel. *Mycoses* 2007; 50(3):189-92.
- 18- Hernandez-Castro R, Arroyo-Escalante S, Carrillo-Casas EM, Moncada-Barron D, Alvarez-Verona E, Hernandez-Delgado L, Torres- Narvez, Lavallo- Villalobos A. Outbreak of *Candida parapsilosis* in a neonatal intensive care unit: ahealth care workers source. *Eur J Pediatr* 2010; 169(7):783-7.
- 19- Martins- Diniz JN, da Silva RA, Mendens Giannini MJ. Monitoring of airborne fungus and yeast species in a hospital unit. *Rev Saude Publica* 2005; 39(3):398-405.
- 20- Ahmad S, Khan Z, Mustafa AS, Khan ZU. Epidemiology of *Candida* colonization in an intensive care unit of a teaching hospital in Kuwait. *Med Mycol* 2003; 41(6):487-93.
- 21- Sahand H, Maza JL, Eraso E, Montejo M, Morgues MD, Aguirre JM, Ouindos G, Ponton J. Evaluation of CHROM-Pal medium for the isolation and direct identification of *Candida dubliniensis* in primary culture from the oral cavity. *J Med Microbiol* 2009; 58(11):1437-42.
- 22- Fanello S, Bouchara JP, Sauteron M, Delbos V. Predictive value of oral colonization by candida yeast for the onset of a nosocomial infection in elderly hospitalized patients. *JMed Microbiol* 2006; 55:223-8.
- 23- Vazquez JA, Dembry LM, Sanchez V, Vazquez MA, Sobel JD, Dmuchowski C, Zervos MJ. Nosocomial *Candida glabrata* colonization: an epidemiologic study. *J Clin Microbiol* 1998; 36(2): 421-6.
- 24- Munoz P, Guinea J, Pelaez T. Nosocomial invasive aspergillosis in a heart transplant patient acquired during a break in The HEPA air filtration system. *Transpl Infect Dis* 2004; 6(1): 50-4.
- 25- Helder OK, Brug J, Looman CV, van Goudoever JB, Komelisse RF. The impact of an education program on hand hygiene compliance and nosocomial infection incidence in an urban Neonatal Intensive Care Unit: An intervention study with before and after comparison. *Int J Nurs Stud* 2010;47(10):1245-

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