Original Article

Current Scenario of Geriatric Fungal Infections: A Prevalence Study from a Tertiary Care Hospital

Bineeta Kashyap[1], Shukla Das[2], Tanu Sagar[3], Kavita Gupta[4]

Abstract

Aims and Objectives: Elderly persons are highly susceptible to infectious agents and they acquire infectious diseases easily, compared with the general population. Normal physiological changes of aging, coexistence of chronic diseases, alteration of host defense mechanisms and environmental exposure are the major factors associated with increased frequency and poorer prognosis of infectious diseases in these patients. The study was undertaken to assess the prevalence and the current status of fungal infections in the geriatric population from a tertiary care hospital located in East Delhi.

Materials and Methods: A retrospective study was conducted over a period of one year among geriatric patients presenting with clinically suspected fungal infections from various clinical departments in the mycology laboratory. All samples were analysed on direct microscopy by 40% KOH in nails and 10% KOH for other samples and Gram staining for yeast. For fungal culture all samples were inoculated on two isolation media; one sabouraud's dextrose agar (SDA) without antibiotics and the other SDA with chloramphenicol and cycloheximide.

Results and conclusions: Total of 453 samples received from 420 geriatric patients were analysed. Among the study subjects 66.90% patients belonged to age group 60–65 years, only 2.85% were 81 years onwards and 71.42% were males. The most frequent received sample was nail 57.17%. A total of 197 samples were positive for fungal elements, of which yeast were 44(22.33%) and 153 (77.66%) were hyphae positive on direct examination. Out of total 66 fungal isolates obtained from all samples, 22 isolates (33.33%) were with Trichophyton, 13 isolates with Candida spp. (20/66) 30.30% and 6 isolates with *Aspergillus* spp. (9.09 %) as the most frequent growth.

(Journal of The Indian Academy of Geriatrics, 2017; 13:156-161)

INTRODUCTION

Aging is now becoming a foremost concern for health-related policy makers all over the world both for developed and developing countries as the geriatric population has limited regenerative abilities and is more prone to disease. Aging is a multi-factorial process influenced by both genetic and environmental parameters. Size of the elderly population (persons > 60 years) is fast growing in India (from 5.6% in 1961 it is projected to rise to 12.4% of population by the year 2026) although it constituted only 7.4% of total population at the turn of the new millennium (5.2% geriatric share for Delhi).[1] This share of the aged in the total population is increasing further due to significant improvement in life expectancy throughout the world together with steadily declining birth rate and fertility trends especially in a developing country like India.

Elderly persons are highly susceptible to any infectious agents and they acquire infectious diseases easily, compared with the general

1.Associate Professor, 2. Director Professor, 3. Ex-Senior Resident, 4. Senior Resident

Department of Microbiology UCMS & GTB Hospital, New Delhi

Corresponding Author: Dr. Bineeta Kashyap, C-402, Vimal CGHS Ltd., Plot 3, Sector 12, Dwarka, New Delhi-78. Email: dr_bineetakashyap@yahoo.co.in

population. Normal physiological changes of aging, coexistence of chronic diseases, alteration of host defense mechanisms and environmental exposure are the major factors associated with increased frequency and poorer prognosis of infectious diseases in these patients.

Fungal infections are frequently observed in the elderly population. Superficial cutaneous infections are common in this age group. Age-related changes heighten the risk of cutaneous infections in elderly patients. Skin of older persons is drier, thinner, fragile and possesses fewer hair follicles and sweat glands than that of young or middle-aged persons. Hence, it is more susceptible to any injury that leads to penetration and spread of the microorganisms. Therefore, both superficial and deep fungal infections are common in older people. Candida, a normal skin flora can give rise to superficial and deep fungal infections in these conditions.[2] Now a days because many older patients undergo frequent and prolonged treatment in hospitals and in the intensive care unit opportunistic fungal infections are very common in this population.[3]

Prognosis of any invasive endemic opportunistic infections is very poor in older patients as they are less able to handle it.[4] There is a paucity of data regarding the prevalence of the fungal infections in the older population. This study was undertaken to know the current status of fungal infections in the geriatric population.

MATERIAL AND METHODS

A retrospective study was conducted in the mycology division of department of microbiology of UCMS and GTB hospital, New Delhi over a period of one year. Total of 453 samples were received from 420 geriatric patients presenting with clinically suspected fungal infections from various clinical departments in the mycology laboratory. All samples were collected in separate sterile containers and analyzed by direct microscopy and culture.

For direct microscopy 40% KOH for nails and 10% KOH for other samples was used to visualize presence of any fungal element. Gram staining was done for any suspected yeast infection. For fungal culture all samples were inoculated on two isolation media; one sabouraud's dextrose agar (SDA) without antibiotics and the other SDA with chloramphenicol and cycloheximide. The culture tubes were incubated at 25^0 C and 37^0 C and examined daily up to 4 weeks. Presumptive identification of fungi was done by colony characterstics, lactophenol cotton blue mount and by slide culture technique. The characteristics considered for fungus identification were macroscopic aspects of texture, colour, growth rate and microscopic aspects such as mycelium and conidium types, relationship between hyphae and fructification organs by lactophenol cotton blue mount. The yeast isolates were identified by standard tests like germ tube, different spore production on corn meal agar (CMA), colour on Hi chrome agar, sugar fermentation and assimilation tests In case of clinical suspicion of Cryptococcus, India ink preparation, antigen detection by commercially available kits as per standard laboratory techniques and culture on SDA was done for its identification.

RESULTS

Total of 453 samples were received from 420 geriatric patient's in the mycology division of department of microbiology of UCMS and GTB hospital. Among the 420 subjects, (281/420) 66.90% patient's were from age group 60 – 65 yrs of age followed by (63/420) 15% in 66 – 70 yrs, (47/420) 11.19% in 71 – 75 yrs of age, (17/420) 4.04% in 76 – 80 yrs of age and only (12/420) 2.85% were from 81 yrs onwards. A total (300/420) 71.42% were males as compared to females (120/420) 28.57% only.

Table 1: Frequency distribution of clinical specimens & microscopic fungal findings in elderly patients.

SAMPLE	NUMBER(%)	KOH Examination	
		Hyphae	Yeast
Nail	259 (57.17)	121	30
Skin	82 (18.10)	12	0
Hair	6 (1.32)	2*, 2**	
Sputum	30 (6.62)	9	11
Cornea	35 (7.72)	6	1
CSF	5(1.10)	0***	
Pus	3 (0.66)	1	1
Oral Tissue	3 (0.66)	0	0
Urine	6 (1.32)	0	1
Blood	24 (5.29)	-	-
Total	453	149+4	44

*endothrix, ** ectothrix, ***india ink

Table 2. Frequency distribution of fungal isolates in different clinical samples. (n=66 isolates)

Fungal isolate sp.	Superficial Infections					Deep/Invasive infections						
	Nail	Skin	Hair	Cornea	Oral Tissue	sputum	CSF	pus	Urine	Blood	Total isolates	Percentage
Tricophyton	22	0	0	0	0	0	0	0	0	0	22	22/66(33.33)
Candida	7	1	0	1	0	4	0	1	0	6	20	20/66 (30.30)
Aspergillus	2	0	0	2	0	2	0	0	0	0	6	6/66 (9.09)
Bipolaris	0	0	0	2	0	0	0	0	0	0	2	2/66 (3.03)
Trichosporon	1	0	0	0	0	0	0	0	0	0	1	1/66 (1.51)
P.boydii	0	0	0	2	0	0	0	0	0	0	2	2/66(3.03)
Scopuloropsis	1	0	0	0	0	0	0	0	0	0	1	1/66(1.51)
Yeast (excluding Candida)	7	0	0	0	0	0	0	0	0	0	7	7/66(10.60)
Fusarium spp	0	0	0	2	0	0	0	0	0	0	2	2/66 (3.03)
Curvularis	0	0	0	1	0	0	0	0	0	0	1	1/66 (1.51)
Alternaria	0	0	0	1	0	0	0	0	0	0	1	1/66 (1.51)
Scytalidium	1	0	0	0	0	0	0	0	0	0	1	1/66 (1.51)
Total	41	1	0	11	0	5	0	1	0	0	66	100
Culture positivity (%) each sample (in percentage)	41/259 (15.8)	1/82 (1.2)	0/6 (0)	11/35 (31.4)	0/3 (0)	6/30 (20)	0/5 (0)	1/3 (33.3)	0/6 (0)	6/24 (25)	66/453 (14.56)	

The frequency distribution of samples from clinically suspected fungal infections in geriatric patients are listed in Table 1. The most frequent obtained sample was nail 57.17% followed by skin, corneal scraping, Sputum and blood in 18.10%, 7.72%, 6.62% and 5.29% respectively. A total of 197 samples were positive for fungal elements, of which yeast were 44 (22.33%) and 153 (77.66%) were hyphae positive.

All samples were subjected to culture. Sixty six fungal isolates (14.56%) recovered from 453 samples. Table 2 depicts frequency distribution of fungal isolates in different clinical specimens. Out of total 66 fungal isolates obtained from all samples, 33.33% (22) isolates were with Trichophyton, 30.30% (20) isolates with Candida spp. and 9.09 % (6) isolates with Aspergillus spp. as the most frequent growth.

Among dermatophytes, *Trichophyton mentagrophytes* 50% (16), *Tricophyton rubrum* 47% (5) and *Tricophyton verrucosum* 3% (1) were isolated. Among Candida spp. *C. albicans* was the most common isolate 40% (8) followed *by C. tropicalis. C. parasilosis* and *C. glabrata* as 30% (6), 20% (4) and 10% (2) respectively. *C. tropicalis* (4/6) was mainly isolated from blood. Isolates *Aspergillus flavus* 67% (4) *A. terreus* and *A. fumigatus* 17% (1) each were the frequently isolated amongst the hyaline hyphae.

DISCUSSION

The phenomena of aging includes changes in various physiological and morphological functions, rendering older patients more prone to infections especially from fungal pathogens. Since age is a well-documented predisposing factor, its impact on mortality has become a major problem in older adults[4-6]. Fungal infections can involve all parts of body in elderly. However, with age related changes in the growth rate and morphology of the nail plate makes it more vulnerable to exogenous fungal infections.[7, 8] Our study reveals that most frequent fungal infection in the study group was fungal nail infections. Onychomycosis in elderly age group was predominantly caused by Trichophyton spp (22/41) followed by Candida (7/41) in our study. *Trichophyton mentagrophyte* was the most common dermatophyte isolate closely followed by *Trichophyton rubrum, Trichophyton verrucosum*. Similar finding was observed by Gupta et al where *Trichophyton rubrum* and *Trichophyton mentagrophytes* were responsible more than 90% of onychomycosis cases.[9] Bhatia et al reported Tricophyton spp (98.6%) as most common fungal

agent compared to Microsporum species (1.35%) in dermatophytosis. Hot and humid environment of our country gives a favourable climate for growth of dermatophyte infections. Besides, the use of effective and prolonged antifungal therapy to treat the patients, the incidence of *T. rubrum* varies in different parts of our country.[10]

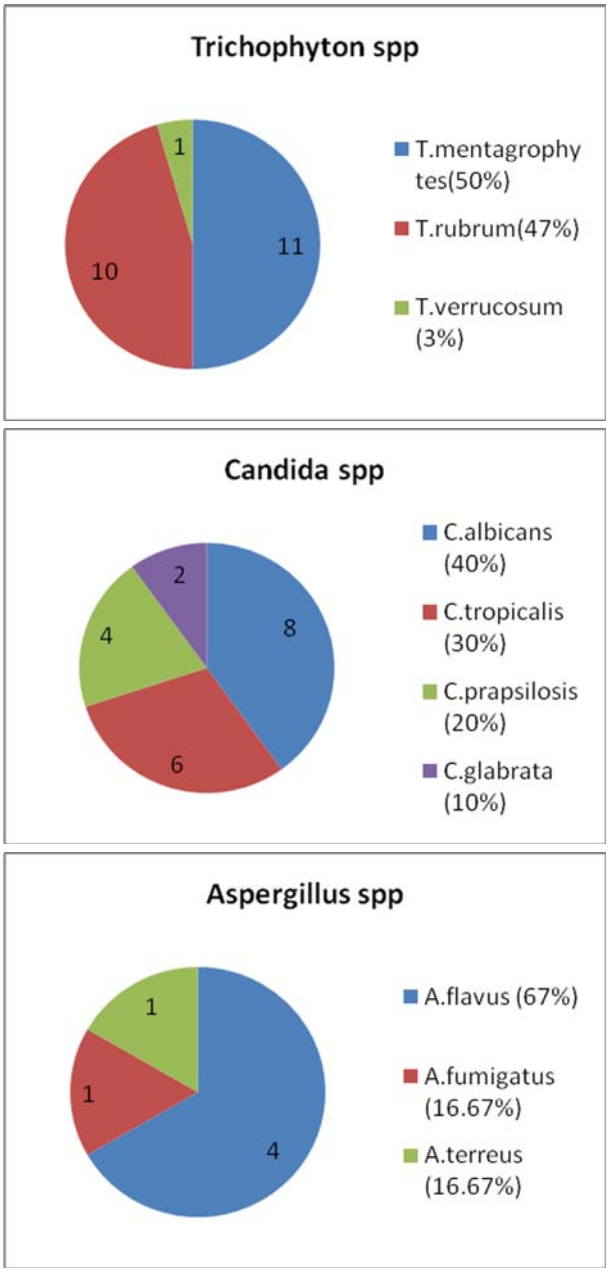

Figure 1: Frequency distribution of most common fungal isolates (Trichophyton spp = 22, Candida spp = 20, Aspergillus spp = 6)

There has been dramatic increase in incidence of opportunistic fungal infections by Candida spp with older patients undergoing surgical procedures, indewelling devices, patients on total parenteral nutrition, frequent and prolonged treatment in hospitals and use of broad-spectrum antibiotic during treatment.[3, 11]

Most candida infections are mainly acquired as the result of overgrowth and subsequent invasion by indigenous *Candida* species of the host. However, acquisition of exogenous strains also has been documented in hospitalized patients.[11] The primary factor in the colonization of candida is adherence to host surfaces; this process is controlled and induced by several cell-signalling cascades in both the fungus and the environment. Although *C. albicans* is the most prevalent species involved in invasive fungal infections, the spectrum is shifting towards non albicans candida spp now a days.[12]

In a study by Xie et al *C. albicans* was most frequently isolated (58%), followed by *C. tropicalis* (17%) and *C. glabrata* (15%) from patients of severe sepsis. [13] Concern is rising about the high incidence of infections caused by non-albicans species and the emergence of antifungal resistance.[14] Current study demonstrated *Candida albicans* as the most common isolate among Candida sp (40%). Candida glabrata and candida tropicalis was recovered from blood and sputum samples while Candida parapsilosis was isolated from pus samples. Incidence of non albicans candida spp especially *C. glabrata* is markedly higher among patients of blood stream infections who are more than 60 years of age.[15] In our study both the *C. glabrata* isolates were recovered from blood samples. In contrast to earlier study done in our centre where only Candida albicans was isolated from patients of severe sepsis.[16] Current study demonstrated prevalence of non albicans Candida species in septicemic patients. Resistance to antifungal agents among non albicans candida spp especially for *Candida krusei* which is intrinsically resistant to fluconazole and needs to be treated with amphotericin B, which has an increased risk of nephrotoxicity is of prime concern in the older population. Occurrence of opportunistic filamentous fungal infections are less common than candidiasis in older age groups, but invasive infections by theses fungal agents are associated with an exceedingly high mortality rate. *Aspergillus* species most frequently cause infections in hospitalized patients who are markedly immunosuppressed because of the benign neoplasms and pre-cancerous lesions of skin in the older population.[17.18] In our study *Aspergillus flavus* was the most common isolate (67%) followed by *Aspergillus terreus* and *Aspergillus fumigatus*. *Aspergillus niger* was not found in geriatric nail samples which was in contrast to a study done by Xess et al where *Aspergillus niger* was found as a predominant one in nail samples.[19] Apart from

Dermatophytes, Aspergillus and Candida, dematiceaous fungal agents were found as an important agent in our geriatric study population. Surprisingly majority of these dematiceous agents such as Bipolaris, Curvularia, Alternaria were found in corneal samples. The reason may be during traumatic implantation and common occupational hazard with farmers because organisms are widespread in the environment, being found in soil, wood, and decomposing plant debris. Dematiaceous agents can cause cutaneous, subcutaneous, corneal and infections. These dematiaceous fungi occur worldwide, but are more common in tropical and subtropical climates. Rising incidence of dematiceous agents pose a great challenge in therapy of patients. Antifungal treatment is not usually of benefit, but post-operative itraconazole may reduce the need for reoperation. The development of new antifungal agents and combination treatment may help to improve the management of these infections.

Current study highlights various fungal pathogens found in geriatric population. Older patients are also less able to handle cutaneous, subcutaneous as well as invasive endemic or opportunistic infections, and outcomes of infection in this age group are frequently worse for patients who are elderly. Opportunistic fungal infections are increasing as older patients are now receiving transplanted solid organs or bone marrow transplantation, undergoing aggressive treatment of malignancies, taking immunosuppressive medications for dermatologic and rheumatologic diseases. With age immunosenescence also increases risk of invasive infections. Diabetes mellitus (DM) is seen commonly in old age groups, incidence is as much high as 40% in persons above 80 years while half of population remain undiagnosed with diabetes mellitus.[20,21] Elderly patients with increased serum glucose levels are more vulnerable to fungal infections compared to normal serum glucose levels. Conditions like oral candidiasis, esophageal candidiasis and rhinocerebral mucormycosis are seen commonly in diabetics. An estimated 50%–75% of cases of rhinocerebral mucormycosis occur in patients with DM, including elderly individuals.[22,23]

In current study direct microscopy (43.48%) appeared as better diagnostic tool compared to culture (14.56%). Traditional diagnostic laboratory methods may fail to detect it even in cases of strong clinical suspicion due to prior administration of antibiotics. Although direct microscopy alone is not very helpful in these circumstances but higher positive yield in comparison to culture make it an important tool especially in rural areas. It was also supported by our previous studies where 95% of fungal infections diagnosed based on the findings from microscopy alone.[16]

The major limitation of our study was being a retrospective analysis of specimens, correlation with co-morbid condition or predisposing factors was not feasible; hence more elaborate studies are required to determine the associated risk factors. Very less numbers of blood cultures were received in this study from geriatric population. Similar observation was seen in our earlier study conducted in the same settings. Other studies done in other parts of India have also revealed the similar finding. In a study conducted in Chandigarh only 5 culture positive patients (canadidemia) were detected during 6 years of study.[24] This could be possibly explained due to low index of suspicion for fungal infections in the elderly population. Because fungal infections occurring in older patients with diabetes may be life threatening, hence clinicians must be vigilant of any atypical manifestations of illness. Early detection and treatment of such type of infections is crucial to lower morbidity and mortality.

Overall, our study supports the opinion that nail diseases are a common in the elderly. These nail changes can either cause serious symptoms, which may impair the daily routine activities or may be asymptomatic with considerable cosmetic problem, leading to negative psychological effects. Epidemiological data on the prevalence of fungal infections in elderly age group is scarce. High index of suspicion for early detection, appropriate management, and prevention should be encouraged to reduce incidence in these age group.

REFERENCES

1. Situation Analysis of the Elderly in India, June 2011. Central Statistics Office Ministry of Statistics & Programme Implementation Government of India.
2. Noah S. Scheinfeld. Skin Disorders in Elderly Persons: Identifying Fungal Infections *Infect Med*. 2007; 24: 509-515
3. Fridkin SK, Jarvis WR. Epidemiology of nosocomial fungal infections. Clin Microbiol Rev 1996; 9:499–511.
4. Carol A. Kauffman. Fungal Infections in Older Adults. *Clinical Infectious Diseases* 2001; 33:550–55
5. Pfaller MA, Diekema DJ. Epidemiology of invasive candidiasis: a persistent public health problem. *Clin Microbiol Rev*. 2007; 20:133–163.
6. Dimopoulos G, Koulenti D, Blot S, et al. Elderly critically ill patients with infection: Analysis of the Extended Prevalence of Infection in Intensive Care

Unit (EPIC II) Study. *J Amer Geriatr Soc.* 2013 (In press)

7. Cohen PR, Scher RK. Geriatric nail disorders: diagnosis and treatment. *J Am Acad Dermatol* 1992; 26(4):521-31.
8. Singh G, Haneef NS, Uday A. Nail changes and disorders among the elderly. *Indian J Dermatol Venereol Leprol* 2005; 71(6):386-92.
9. Gupta AK, Ricci MJ. Diagnosing onychomycosis. *Dermatol Clin* 2006; 24(3):365-9.
10. Vikesh Kumar Bhatia1 and Prakash Chand Sharma Bhatia and Sharma Epidemiological studies on Dermatophytosis in human patients in Himachal Pradesh, India Springer Plus 2014, 3:134
11. Wey SB, Mori M, Pfaller MA, et al. Risk factors for hospital-acquired candidemia. *Arch Intern Med* 1989; 149: 2349–53.
12. Horn, D. L., Neofytos, D., Anaissie, E. J., Fishman, J. A., et al. Epidemiology and outcomes of candidemia in 2019 patients: data from the prospective antifungal therapy alliance registry. *Clin Infect Dis* 2009; 48: 1695–1703.
13. Xie, G. H., Fang, X. M., Fang, Q., Wu, X. M., et al. Impact of invasive fungal infection on outcomes of severe sepsis: a multicenter matched cohort study in critically ill surgical patients. *Crit Care* 2008; 12, R5.
14. Pereira, G. H., Mu¨ ller, P. R., Szeszs, M. W., Levin, A. S. & Melhem, M. S. Five-year evaluation of bloodstream yeast infections in a tertiary hospital: the predominance of non-*C. albicans* Candida species. *Med Mycol* 2010; 48, 839–842.
15. Malani PN, Bradley SF, Little RS, Kauffman CA. Trends in species causing fungemia in a tertiary care medical center over 12 years. Mycoses 2001 (in press).
16. Kashyap B, Das S, Kaur I R, Jhumb R, Singhal R. Fungal profile of clinical specimens from a tertiary care hospital. *Asian Pacific Journal of Tropical Biomedicine* 2012; S401-S405
17. Vanden Bergh MFQ, Verweij PE, Voss A. Epidemiology of nosocomial fungal infections: invasive aspergillosis and the environment. *Diagn Microbiol Infect Dis* 1999; 34:221–7.
18. Abbas Darjani, Zahra Mohtasham-Amiri, Kiarash Mohammad Amini, Javad Golchai, Shahryar Sadre-Eshkevari, and Narges Alizade, "Skin Disorders among Elder Patients in a Referral Center in Northern Iran (2011)," *Dermatology Research and Practice*, vol. 2013, Article ID 193205, 4 pages, 2013. doi:10.1155/2013/193205
19. Xess I, Mohanty S, Jain N, Banerjee U. Prevalence of Aspergillus species in clinical samples isolated in an Indian tertiary care hospital. *Indian J Med Sci*. 2004 Dec; 58(12):513-9.
20. Harris MI, Hadden WC, Knowler WC, et al. Prevalence of diabetes and impaired glucose tolerance and plasma glucose levels in US population aged 20–74 years. *Diabetes* 1987; 36:523–34.
21. Harris MI. Epidemiology of diabetes mellitus among the elderly. *Clin Geriatr Med* 1990; 6:703–19.
22. Joshi N, Caputo GM, Wietekamp MR, Karchmer AW. Infections in patients with diabetes mellitus. *N Engl J Med* 1999; 341:1906–12.
23. Sapico F, Bessman A. Infections in the diabetic patient. *Infect Dis Clin Pract* 1995; 1:339
24. Chander J, Singhla N, Sindhu S K. Epidemiology of *Candida* blood stream infections: experience of a tertiary care centre in North India. *J Infect Dev Ctries* 2013; 7(9):670-675.

.