A mycological study of onychomycosis was undertaken in 88 patients. The nails were judged to be infected by their clinical appearance. Direct microscopy of the nail clips in 20% KOH solution was positive in 72 (81.8%) and culture was positive in 43 (48.8%) cases. Out of the samples cultured, dermatophytes were grown in 26 cases (29.5%), non dermatophyte moulds in 12 (13.6%) and Candida spp. in 5 (5.6%) while 45 (51.1%) samples yielded no growth. Amongst dermatophytes, T. rubrum was found to be commonest etiological agent (57.6%) followed by T. mentagrophyte. Amongst the non-dermatophyte mould (NDM), Aspergillus spp. was the most prevalent species followed by Alternaria spp, Curvularia spp. and Fusarium spp. Commonest age group affected was above 31 years. Males were predominantly affected (65%), male to female ratio being 1.8:1. Fingernails were affected more frequently than toe nails with the ratio of 3:1. Distal and lateral subungual onychomycosis (DLSO) was more common (50%) than other clinical pattern followed by proximal subungual onychomycosis (PSO) (20.4%), white superficial onychomycosis (SWO) (2%), total dystrophic onychomycosis (TDO) (14%) and paronychia (10.2%).

Keywords: Fungi, nails, onychomycosis
Onychomycosis accounts for up to 50% of all nail infections.[1] In onychomycosis, infected nails serve as a chronic reservoir of infection which can give rise to repeated mycotic infections of the skin. It is of significance to suspect onychomycosis, perform mycological diagnosis and undertake treatment. This may help to prevent nail dystrophy and the spread of infection. Clinical and mycological features of onychomycosis show variation with time and place.[2]

This disease is more frequent among men than women and it increases with age.[2] Several factors have been implicated to the increase in disease such as reduced peripheral circulation, diabetes, nail trauma and difficulty to maintain proper nail hygiene.[2]

The aim of our study was to determine the incidence, contributing factors, associated diseases and occupational consequences related to onychomycosis, to isolate the causative pathogen, to determine the various clinical patterns and to identify opportunistic nail infections caused by fungi.

~ Materials and Methods

The study population comprised of 88 suspected cases of onychomycosis, attending Skin and VD, Outpatient Department of Government Medical College and Hospital, Aurangabad, during January 2005 to January 2006. Nail scrapings/clippings were obtained according to standard procedures.

Detailed history of trauma, infection, occupation, diabetes, personal habits (smoking etc.) were taken. Different clinical patterns (DLSO - Distal and lateral subungual onychomycosis, PSO - Proximal subungual onychomycosis, SWO - White superficial onychomycosis, TDO - Total dystrophic onychomycosis) were recorded separately.[Figure - 1][Figure - 2][Figure - 3]. All specimens were subjected to direct microscopy in 20% KOH solution for the presence of fungal mycelia and spores.[Figure - 4][Figure - 5].

Nail scrapings and clippings were inoculated on antibiotic containing Sabourand dextrose agar with and without cycloheximide at 27oC and at 37°C. The fungal growth was identified by standard procedures. At least three samples from each patient were processed. Those who grew dermatophytes were classified as dermatophytosis patient.[3]

Those who grew a particular mould other than dermatophyte consistently on two or more successive occasions with consistent filaments by direct microscopy at least once and continued to grow the same mould consistently thereafter from the same nail and without growing a dermatophyte on any occasion were classified as opportunistic onychomycosis patient.[3]

Those who grew a dermatophyte on one or more occasions and also grew a mould with the same consistency, site specificity and direct microscopic variability as indicated for opportunistic onychomycosis, were classified as mixed infection patients. Because of difficulty in discerning pathogens from contaminants, the guidelines followed were: 1) If a dermatophyte was isolated on culture, it was a pathogen. 2) If a nondermatophyte mould (NDM) or yeast was cultured, it was significant only if direct microscopy was positive and 3) NDM required repeated isolation.[2]

Patients with filaments or spores by direct microscopy but no dermatophyte or consistent mould growth were also included in the study.

~ Results
There were a total of 88 suspected cases of onychomycosis. Of these 88 cases, 72 (81.8%) were positive by direct microscopy and 43 (48.86%) were culture positive [Table - 1].

Of these 88 cases, 58 (65%) were male and 30 (35%) were female, male to female ratio being 1.8:1. The commonest age group was 31 to 40 years followed by 41 to 50. Infections were less common in the age group below 30 years.

The fingernails were more frequently involved i.e., 56 (63%) cases followed by toenails 19 (21%) and both in 13 (14%) cases. Ratio of fingernail to toenail infection was 3:1 [Table - 2].

Distal and lateral subungual onychomycosis (DLSO) was the commonest clinical pattern (50%) followed by proximal subungual onychomycosis (20.4%) and then total dystrophic onychomycosis (14%), paronychia (10.2%) and SWO (2%) [Table - 3].

The most common fungal isolates were dermatophytes (29.54%) of which 15 (57.64%) were T. rubrum, 11 (42.3%) were T. mentagrophyte. NDM constituted 13.63% of the fungal isolates of which 50% were Aspergillus spp, followed by Scopulariopsis spp. (16.66%), Alternaria spp. (16.66), Fusarium spp. and Curvularia spp. (8.3%) each. Out of the total fungal isolates 5 (5.6%) were Candida infections and 45 (51.13%) of the samples showed no growth [Table - 4].

Onychomycosis was found to be commonest in agricultural workers (19.31%), followed by labourers and housewives. Occlusive footwear was the commonest predisposing factor (2%), followed by diabetes.

~ Discussion

Onychomycosis is a common infection of nails in adults and accounts for prevalence rate of 2 to 50% worldwide and the incidence increases with age.[4]

In the present study, onychomycosis was found to be commonest in the age group 31-40 years in accordance with most of the studies.[1,4,5,6] Our study reveals that incidence of onychomycosis is increasing with advancing age. Antecedent disease such as diabetes (six cases), peripheral vascular disease (five cases), personal habits such as chronic smoking (seven cases), trauma to the aged nails (four cases) have greater predilection for onychomycosis.

Higher incidence was noted amongst males (65%) than females, the ratio being 1.8:1, which compares well with most of the studies.[4,5] Higher incidence in males may be because they are more exposed to outdoors with greater physical activity and are more prone to trauma.

Various authors have reported high incidence of onychomycosis of the toenail. In the present study we have come across more cases of fingernail onychomycosis, than toenails[1,4,6] with a ratio of 3:1, which compares well with other studies. Incidence of increased finger nail onychomycosis may be because of the increased chances of occupation related trauma, also fingernail infection is more likely than the toenail infection to arouse the patients concern, driving them to seek medical attention.

In various studies,[2,4] right thumb was the commonest fingernail involved. We observed that, ring finger and index finger were commonly involved. Greater toenail onychomycosis has been reported frequently, this is in agreement with other studies.[2,4] because of its bigger size predisposing to increased trauma.

The high incidence of DLSO pattern has been reported by various studies. Incidence in and around Aurangabad is about 50% comparable with Garg et al[6] 64.4%.

In the present study anthropophilic dermatophytes have been isolated from 29.6% of culture positive cases which is comparable with various studies [1,5,6] T. rubrum was the common isolate i.e., 57.6% in accordance with other studies.[1,5] NDM were 13.6%, especially Aspergillus niger comparable with Grover.[5]

Candida albicans is reported as the commonest cause of paronychial onychomycosis.[7] This is reflected in our study where all the paronychial cases grew Candida albicans on culture. Previously regarded as contaminant, yeast is now increasingly recognized as pathogen in fingernail infections.[4]

To conclude, DLSO was the commonest clinical presentation in this study, however TDO and PSO were not uncommon. T. rubrum and Candida were major pathogens. This study also stresses the role of NDM associated onychomycosis.
~ References


Figures

[Figure - 1], [Figure - 2], [Figure - 3], [Figure - 4], [Figure - 5]

Tables

[Table - 1], [Table - 2], [Table - 3], [Table - 4]

This article has been cited by

1. Onychomycosis in Israel: epidemiological aspects
   Rina Segal, Avner Shemer, Malca Hochberg, Yoram Keness, Rima Shvarzman, Marina Mandelblat, Michael Frenkel, Esther Segal
   Mycoses. 2015; : n/a
   [Pubmed] [DOI]

2. Public health significance of dermatophytes in Ismailia and Port Said Provinces, Egypt
   Aboueisha, A.M. and El-Mahallawy, H.
   [Pubmed]

3. The prevalence of fungi in fingernail onychomycosis
   Gelotar, P. and Vachhani, S. and Patel, B. and Makwana, N.
   [Pubmed]

4. Onychomycosis in Eastern India - study in a peripheral tertiary care centre
   [Pubmed]

5. Public Health Significance of Dermatophytes in Ismailia and Port Said Provinces, Egypt
   Abdelkarim Mahmoud Aboueisha, Heba El-Mahallawy
   [Pubmed] [DOI]

6. Onychomycosis: Multicentre epidemiological, clinical and mycological study [Onicomicosis: estudio multicéntrico clínico, epidemiológico y micológico]
   [Pubmed]

7. Fusarium solani: A causative agent of skin and nail infections
   Kuruvilla, T. and Dias, M.
   Indian Journal of Dermatology. 2012; 57(4): 308-309
   [Pubmed] [DOI]
<table>
<thead>
<tr>
<th>Study Title</th>
<th>Authors</th>
<th>Journal</th>
<th>Year</th>
<th>Volume</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinico-mycological evaluation of dermatophytes and non-dermatophytes isolated from various clinical samples: A study from north India</td>
<td>Sharma, Y. and Jain, S. and Chandra, K. and Khurana, V.K. and Kudesia, M.</td>
<td>Journal of Research in Medical Sciences</td>
<td>2012</td>
<td>17(8)</td>
<td>817-818</td>
</tr>
<tr>
<td>Isolation of Fusarium sp. from a Claw of a Dog with Onychomycosis</td>
<td>Kazuko NAMITOME, Rui KANO, Maiko SEKIGUCHI, Toshiroh IWASAKI, Takashi KANESHI, Koji NISHIFUJI</td>
<td>Journal of Veterinary Medical Science</td>
<td>2011</td>
<td>73(7)</td>
<td>965</td>
</tr>
<tr>
<td>Onicomicosis: estudio clinico, epidemiologico y micologico multicentrico</td>
<td>Revista Iberoamericana de Micologia</td>
<td></td>
<td>2011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-dermatophyte moulds as skin and nail foot mycosis agents: Phoma herbarum, Chaetomium globosum and Microascus cinereus</td>
<td>Vivian Tullio,Giuliana Banchi,Valeria Allizon,Janira Roana,Narcisa Mandras,Daniela Scalas,Michele Panzone,Omela Cervetti,Sergio Valle,Nicola Carlone,Anna Maria Cuffini</td>
<td>Fungal Biology</td>
<td>2010</td>
<td>114(4)</td>
<td>345</td>
</tr>
<tr>
<td>Onychomycosis in iran: Epidemiology, causative agents and clinical features</td>
<td>Aghamirian, M.R., Ghiassian, S.A.</td>
<td>Internet Journal of Dermatology</td>
<td>2010</td>
<td>8(1)</td>
<td></td>
</tr>
<tr>
<td>Fungal infections of nails - Family physicianæs point of view</td>
<td>Rzewuska, D.</td>
<td>Dermatologia Kliniczna</td>
<td>2010</td>
<td>12(4)</td>
<td>273-278</td>
</tr>
<tr>
<td>Study of onychomycosis in Isfahan, Iran</td>
<td>Mostafa Chadeganipour, Shahi Nilipour, Gholamreza Ahmadi</td>
<td>Mycoses</td>
<td>2010</td>
<td>53(2)</td>
<td>153-157</td>
</tr>
</tbody>
</table>
20 Relationships between the incidence of onychomycosis and nail psoriasis [Oничомикозы—s ir nagi(ogonek)]
Medicina. 2010; 46(3): 180-184
[Pubmed]

21 Cutaneous Alternaria infectoria infection in a dog in association with therapeutic immunosuppression for the management of immune-mediated haemolytic anaemia: Cutaneous Alternaria infectoria infection in a dog
Carla Dedola, Alasdair P. G. Stuart, Alison E. Ridyard, Roderick W. Else, Adri H. M. Van Den Broek, Jong Soo Choi, G. Sybren de Hoog, Keith L. Thoday
Veterinary Dermatology. 2010; 21(6): 626
[VIEW] | [DOI]

22 Fungal infections of nails - Family physicians point of view [Grzybicze zaka(ogonek)enia paznokci - Punkt widzenia lekarza rodzinnego]
Rzewuska, D.
[Pubmed]

23 Onychomycosis in S(ogonek)â£o Paulo, Brazil
[Pubmed]

24 Fungal nail infections in Tehran, Iran
Zaini, F., Mahmoudi, M., Mehbod, A.S.A., Kordbacheh, P., Safara, M.
[Pubmed]

25 In vitro susceptibility of nondermatophyte molds isolated from onychomycosis to antifungal drugs
Trovato, L., Rapisarda, M.F., Greco, A.M., Galat(ogonek) F., Oliveri, S.
[Pubmed]

26 Candidal onychomycosis: A mini-review
Jayatilake, J.A.M.S., Tilakaratne, W.M., Panagoda, G.J.
Mycopathologia. 2009; 168(4): 165-173
[Pubmed]

27 NB-002, a novel nanoemulsion with broad antifungal activity against dermatophytes, other filamentous fungi, and Candida albicans
Pannu, J., McCarthy, A., Martin, A., Hamouda, T., Ciotti, S., Fothergill, A., Sutcliffe, J.
[Pubmed]

28 Candidal onychomycosis: A Mini-Review
J. A. M. S. Jayatilake, W. M. Tilakaratne, G. J. Panagoda
Mycopathologia. 2009; 168(4): 165
[Pubmed] | [DOI]

29 Onychomycosis in Sâ£o Paulo, Brazil
Mycopathologia. 2009; 168(3): 111
[Pubmed] | [DOI]

30 Onychomycosis in Sâ£o Paulo, Brazil
[Pubmed]

31 Non-dermatophyte moulds and yeasts as causative agents in onychomycosis
Malik, N.A., Raza, N., Nasiruddin
[Pubmed]

32 Epidemiologic and clinicomycologic profile of onychomycosis from north India
Sarma, S., Capoor, M.R., Deb, M., Ramesh, V., Aggarwal, P.  
[Pubmed]

33 Epidemiologic and clinicomycologic profile of onychomycosis from north India  
Smita Sarma, Malini R. Capoor, Monorama Deb, V. Ramesh, Pushpa Aggarwal  
[Pubmed] [DOI]

34 Successive mycological nail tests for onychomycosis: A strategy to improve diagnosis efficiency  
Fernandes Meireles, T.E., Gadelha Rocha, M.F., Nogueira Brilhante, R.S., de Aguiar Cordeiro, R., Costa Sidrim, J.J.  
[Pubmed]

35 Dermatomycosis caused by common and rare fungi in Mumbai  
Mathur, M., Baradkar, V., De, A., Taklikar, S., Gaikwad, S.  
[Pubmed]

36 A clinico-epidemiological study of dermatophytoses in Northeast India [4]  
Sarma, S., Borthakur, A.  
[Pubmed]

37 A clinical and mycological study of onychomycosis in HIV infection  
Surjushe, A., Kamath, R., Oberai, C., Saple, D., Thakre, M., Dharmshale, S., Gohil, A.  
Indian Journal of Dermatology, Venereology and Leprology. 2007; 73(6): 397-401  
[Pubmed]