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Review Article

What is deep tropical mycosis? An underestimated entity with serious problems

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ABSTRACT

There are many fungal infections which have been described in the literature but only a small number of them causes diseases in human being. The clinical manifestation is diverse and the spectrum of severity ranges from simple localized infections to severe systemic disease. Some of these fungal infections characteristically occur more frequently in tropical countries and hence they are called tropical mycosis; however even these kinds of mycotic infections may be seen outside the tropical countries due to migration and travel. In this article we try to review the deep tropical mycosis and highlight the important aspects of diseases classified under this entity, we also try to address some of the issues related to these illnesses and demonstrating their management in summary.

Keywords: Deep Tropical Mycosis, Fungal Infection

INTRODUCTION

There are more than 1.5 million fungal species[1] but only around 100 species are known to cause human diseases.[2] These infections are more common in tropical and subtropical countries,[3] possibly because the climate of these areas is more suitable for growth of these fungi, although these pathogens may cause disease in any part of the world.[4,5]

According to the extent of involvement of tissue and degree of human response to the infective organism, fungi are categorized into superficial, cutaneous, subcutaneous, and systemic infections.[6] The superficial type does not produce any inflammation and it involves stratum corneum (the outmost part of epidermis). The cutaneous category causes inflammation and affects the skin including hair and nails. Subcutaneous fungal infection means infection of inner layer of tissues including deep fascia, bones and muscles.[7]

Deep fungal infections are divided into superficial, which is commonly caused by entrance of the fungus through the skin by trauma, then it may propagate locally to the surrounding tissues, and it may become systemic.[8]

MYCETOMA

Mycetoma; also called Maduromycosis or Madura foot, comprises two groups of diseases: Eumycetoma and Actinomycetoma. The organisms responsible for Eumycetoma are true fungi (Acremonium falciforme, Madurella grisea, Pseudoallescheria boudii and Exophilia jeanselmi. Whereas filamentous bacteria are responsible for actinomycetomas (Actinomyces israelii, Nocardia asteroides, Nocardia brasiliensis, and Streptomyces somaliensis).[9]

Mycetoma is commonly seen in the tropical and subtropical Africa, India and Mexico. It mainly presents between ages of 20 and 50, with male being more commonly affected than female (male to female ratio of 2.2:1).[10]

EUMYCETOMA

Eumycetoma is a fungal suppurative chronic infection, commonly involves the lower limbs and the foot.[11] the organisms enter through penetrating skin trauma and it manifests as subcutaneous mass. Later on it leads to formation of several sinuses that discharge pus and grains.[12-14]

Diagnosis

The diagnosis is made by combination of clinical findings which includes existence of the mass, sinuses, grains and identification of the fungus by laboratory investigations.[14,15]

Treatment

Antifungal drugs (itraconazole and terbinafine) in conjunction with surgical debridement is the treatment of choice, however severe infection might end up with amputation.[16]

ACTINOMYCETOMA

Actinomycetoma is classified into endogenous; which is caused by anaerobic bacteria, a good example of such an organism is Actinomyces israelii, and exogenous actinomycosis; which is caused by aerobic bacteria. Endogenous actinomycosis is further classified into cervicofacial, thoracic and abdominal.[17-18]

The cervicofacial presents as a mass with multiple draining sinuses, grains and trismus. The thoracic type presents as thoracic sinuses, pleural exudate, fever, cough and dyspnea. The abdominal type presents as a palpable mass with draining sinuses.
Exogenous actinomycosis is produced by aerobic bacteria like Nocardia brasiliensis (responsible for 80-90% of cases). It presents as a discharging mass that distorts the affected site.[8]

Treatment

Treatment is with penicillin G.[8]

CHROMOMYCOSIS (CHROMOBLASTOMYCOSIS)

Chromomycosis is caused by dematiaceous fungi; Fonsecae compacta, Fonsecae pedrosi, Cladosporium carionii, Rhinocladialla aquaspera, and Phialophora verrucosa. It is present throughout the world. The disease is more common in farmers and agricultural workers and the organism is present in wood, soil and vegetables.[19] the lesions mainly occur on the lower limb. They initially present as small reddish to pinkish lesions which then change to violet nodules and later on conjoin to form plaques[9].

The diagnosis can be made by microscopic examination and fungal culture. Examination of a 10% KOH preparation of the tissue specimen may show small, thick-walled, round, brownish septate and sclerotic bodies. Confirmation of the diagnosis can be made by mycological culture.[20]

Treatment

When the lesions are small, they can be treated surgically through excision, cryosurgery, and electrodessication.[21] Best medical therapy consists of combination of amphotericin and 5-fluorocytosine.[22,23]

SPOROTRICHOSIS

Sporotrichosis is caused by sporotrix schenkii.[24] Usually it involves the cutaneous and subcutaneous tissues, but in immunocompromised patients it may disseminate to lung, bones and meninges.[12,25]. There are two categories of subcutaneous sporotrichosis: a) fixed cutaneous sporotrichosis, which presents as ulcerative, verrucous, or scaly nodular lesion and it is limited to the site of inoculation of the organism,[26] b) lymphocutaneous sporotrichosis in which there is a subcutaneous nodule that might ulcerate and the infection may disseminate through lymphatics.[12,26]

Diagnosis

Histopathological examination of tissues rarely identifies the cigar-shaped, budding yeast-like cells.[27,28] Paucity of sporotrichosis in tissue makes its identification by special stains like PAS, difficult. Confirmation of the diagnosis is made through culture, which initially reveals white yeast-like, later on changes to buffed color forms and finally to grayish-black growth.[29]

Treatment

Itraconazole is the treatment of choice. Alternative agents include terbinafine and fluconazole.[25]

LOBOMYCOSIS (JORGE LOBO'S DISEASE)

Lobomycosis is a rare chronic subcutaneous fungal infection. The responsible fungus is Lacazia loboi.[30-33] Lobomycosis has been described in humans, especially hunters, rural workers, miners and fishermen, and in Dolphins.[30,31,34] The sites commonly involved in lobomycosis are ears (cauliflower like lesions), distal part of limbs, face and lower part of back. The lesions are single or multiple plaques or nodules, and appear as

keloid. The lesions might ulcerate and result in secondary bacterial infection.[8]

Diagnosis

The diagnosis is mainly dependent on histopathological examination of the affected tissue, since the organism has not yet been cultured.[30,31,35-37] Microscopic examination demonstrates thick walled, round or oval yeast-like organisms. A characteristic feature is the presence of cell chains connected to each other due to sequential budding. Diagnosis of lobomycosis is made based on the presence of chains of thick walled spherical cells connected to each other by tubular connections.[30,31,36,37] The dominant histopathological feature is the presence of granuloma with excessive fibrosis.[31,32]

Treatment

The optimal treatment of localized lesions is either cryosurgery or surgical excision. For patients with disseminated infection, Iitraconazole or clofazimine alone or in combination are used.[38-41]

ENTOMOPHTORAMYCOSIS

Entomophtoramycosis is a noninvasive chronic infection which could occur in immunocompetent or immunocompromised patients; although invasive infections have been reported, as well.[42,43] It includes two conditions: basidiobolomycosis (which is caused by Basidiobolus ranarum) and conidiobolomycosis (which is caused by Conidiobolus coronatus, Conidiobolus lamprauges, and Conidiobolus incongrius).[44] In contrast to basidiobolomycosis in which 88% of cases occur in patients below age of 20 years, conidiobolomycosis is uncommon in children.[45] Entomophtoramycosis occurs commonly in tropical areas of South America, Africa, and Asia. The disease commonly affects skin and soft tissues and visceral involvement is rare.[46]

Basidiobolomycosis is characterized by painless chronic subcutaneous nodule, while conidiobolomycosis mainly affects the nasal mucosa and progressively spreads to the surrounding tissues.[44]

Diagnosis

In case of Conidiobolus species, the hyphae are thin walled, pauciseptate, broad and irregularly branching [47-49] and the colonies appear as radial folds.[51]

In basidiobolomycosis histopathological examination reveals thin walled, wide, hyaline, pauciseptate or nonseptate hyphae in hematoxylin and eosin stained infected tissues.[50] when culture is not available or the fungus is scanty in the specimen, immunofluorescent techniques can be used to identify the hyphae.[51]

Treatment

Regarding conidiobolomycosis there is no consensus on optimal therapy. Several agents have been tried for disseminated infection like amphotericin B, cotrimoxazole, and combination of amphotericin B and flucytosine but with no success.[48,49,52]

In case of basidiobolomycosis treatment consists of medical therapy (potassium iodide or itraconazole) with or without surgical intervention.[53-57]

PARACOCCIDIOIDOMYCOSIS

Paracoccidioidomycosis is a systemic fungal infection which was first recognized in Brazil in 1908. It is caused by Paracoccidioides brasiliensis, and it is endemic in Central and South America.[58] Soil and plants are the natural source of Paracoccidioides brasiliensis; hence infection is more common in people who have been involved in agricultural activities. The main site of infection is lung and the infection is acquired through inhalation.[59-63]

Clinical features

Paracoccidioidomycosis might present as acute, sub-acute or chronic illnesses, with the chronic disease being the most common type, occurring in more than 90% of cases. Chronic paracoccidioidomycosis primarily affects male rural workers, chiefly between the ages of 30 and 50.[58,59,64]

After entry of the organism, it multiplies and affects the adjacent tissues and then spreads to other tissues through hematogenous route. The disease may manifest as acute and sub-acute disease or as a chronic disease. The acute and sub-acute disease may lead to lymphadenopathy, involvement of bone marrow, liver, and spleen. The chronic disease presents as progressive generalized ill health and involvement of either a single or multiple organs.[65]

Diagnosis

Identification of suppurative granulomas with giant cells and blastopores on histopathological examination of affected tissues confirms the diagnosis. Blastopores are 30μm cyst like structures which are commonly surrounded by daughter cells.[66] two types of stain can be used in the histopathological examination; Gomori-Grocott and periodic acid Schiff (PAS).[58,59,64,67] Culture is another method of diagnosis but slow growth rate makes it inconvenient.[66]

Treatment

Several agents can be used in treatment of paracoccidioidomycosis, including itraconazole, fluconazole and sulfamethoxazole-trimethoprim. [67]

Table 1: Summary of deep tropical fungal infection.

Diseases	Causative fungus	Treatment
Eumycetoma	Acremonium falciforme Madurella grisea Pseudoallescheria boudii Exophilia jeanselmi.	Antifungal (itraconazole and terbinafine) + surgical debridement
Chromomycosis	Fonsecae compacta Fonsecae pedrosi Cladosporium carionii Rhinocladialla aquaspera Phialophora verrucosa	Antifungal drugs (amphotericin plus 5-fluorocytosine) in combination with surgical excision
Sporotrichosis	Sporotrix schenkii	Itraconazole
Lobomycosis	Lacazia loboi	Excision for localized lesion Itraconazole or clofazimine alone or in combination for disseminated infection
Basidiobolomycosis	Basidiobolus ranarum	potassium iodide or itraconazole with or without surgical intervention
Conidiobolomycosis	Conidiobolus coronatus, Conidiobolus lamprauges Conidiobolus incongrius	amphotericin B cotrimoxazole or combination of amphotericin B and flucytosine
Paracoccidioidomycosis	Paracoccidioides brasiliensis	Itraconazole fluconazole sulfamethoxazole-trimethoprim
African Histoplasmosis	Histoplasma var. duboisii	Azole antifungals

AFRICAN HISTOPLASMOSIS

African histoplasmosis (or histoplasmosis duboisii) is a rare deep fungal infection that which is predominantly seen in Africa and seldom been seen outside Africa. The tropical area of Africa is the commonest place for this infection, particularly between the tropics of cancer and Capricorn, and in Madagascar.[69-71]. The responsible organism is Histoplasma var. duboisii, which differs from Histoplasma var. capsulatum in cell wall structure.[72] up to 2007, less than 300 cases had been reported.[69,71] In contrast to classical histoplasmosis which primarily affects the lungs, African histoplasmosis may involve different tissues like skin, subcutaneous tissue, lymph nodes, bones, lungs, liver, spleen and gastrointestinal tract.[73-76]

Diagnosis

Diagnosis is made through histological examination of infected tissues, revealing granulomatous lesions, with a large number of multinucleate giant cells, containing thick-walled, 8-15 µm large, lemon or oval shaped yeast cells, while cells of H.capsulatum do not exceed 5 µm. The fungal cells in African histoplasmosis divide by narrow budding. Using stains like PAS or Grocott methenamine-silver, the organism can easily be identified in tissue specimens.[77-80] Despite availability of specific antibodies for staining of H.capsulatum var.capsulatum yeasts in tissue specimens, no such diagnostic serologic test yet available for H.capsulatum var. duboisii.[82]

Treatment

Recommended treatment for disseminated infection is 12 months of azole antifungals.[82]

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REFERENCES

1. Hawksworth D. The magnitude of fungal diversity: the 1.5 million species estimate revisited. Mycological Research. 2001;105(12):1422-32.
2. Martin GS, Mannino DM, Eaton S, Moss M. The epidemiology of sepsis in the United States from 1979 through 2000. N Engl J Med. 2003;348(16): 1546-54.
3. Hay RJ. Fungal infections. Manson's tropical diseases. 22nd edition. Philadelphia: WB Saunders. 2008;71:1169-89.
4. IOM International Organization for Migration. World migration report 2010 the future of migration: Building capacities for change. Available at:http://publications.iom.int/bookstore/free/WMR_2010_english.pdf. Accessed 2013, August 13.
5. World Tourism Organization. Historical perspective of world tourism. Available at: http://www.unwto.org/facts/eng/historical.htm. Accessed 2013, August 16.
6. Baron S. Medical Microbiology. 4th edition.Galveston (TX): University of Texas Medical Branch at Galveston.1996.
7. Walsh TJ & Dixon DM. Spectrum of Mycoses. In: Baron S, editor. Medical microbiology. 4th edition.

Galveston (TX): The University of Texas Medical Branch. 1996, 75. Available at: http://www.ncbi.nlm.nih.gov/books/NBK7902/. Accessed August 29, 2013.
8. Rivitti EA, Aoki V. Deep fungal infections in tropical countries. Clin Dermatol.1999;17(2):171-90.
9. Gross ML, Millikan LE. Deep fungal infections in the tropics. Dermatol Clin.1994;12(4):695-700.
10. Magana M. Mycetoma. Int J Dermatol. 1984;23(4):221-36.
11. Sran HS, Narula IM, Agarwal RK, Joshi KR. History of mycetoma. Indian J Hist Med.1972;17:1-7.
12. Lupi O, Tyring SK, Mc Ginnis MR. Tropical dermatology: fungal tropical diseases. J Am Acad Dermatol. 2005;53(6):931-51.
13. Queiroz-Telles F, McGinnis MR, Salkin I, Graybill JR. Subcutaneous mycoses. Infect Dis Clin North Am. 2003;17(1):59-85.
14. Garnica M, Nucci M, Queiroz-Telles F. Difficult mycoses of the skin: advances in the epidemiology and management of eumycetoma, phaeohyphomycosis and chromoblastomycosis. Curr Opin Infect Dis. 2009;22(6):559-63.
15. Maslin J, Morand JJ, Civatte M. The eumycetomas (fungal mycetomas with black or white grains). Med Trop (Mars). 2001;61(2):111-4.
16. Ahmed AO, van Leeuwen W, Fahal A, van de Sande W, Verbrugh H, van Belkum A. Mycetoma caused by Madurella mycetomatis: a neglected infectious burden. Lancet Infect Dis. 2004;4(9):566-74.
17. Gupta PK, Hollander DH, Frost JK. Actinomycetes in cervico-vaginal smears: an association with IUD usage. Acta Cytol. 1976;20(4):295-7.
18. Henderson SR. Pelvic actinomycosis associated with an intrauterine device. Obstet Gynecol. 1973;41(5):726-32.
19. Wayne Grayson .Pathology of the skin with clinical correlations Vol.2. Infectious diseases of the skin. In: Phillip H. Mckee, Eduardo Calonje, Scott R. Granter, eds. Elsevier mosby, 3rd ed. Philadelphia: Elsevier Limited.2005;965-7.
20. Minotto R, Bernardi CD, Mallmann LF, Edelweiss MI, Scroferneker ML. Chromoblastomycosis: a review of 100 cases in state of Rio Grande do sul, Brazil. J Am Acad Dermatol. 2001;44(4):585-92.
21. Kuttner Bj, Siegle RJ.Treatment of chromomycosis with CO2 laser. J Dermatol Surg Oncol.1986;12(9):965-8.
22. Bopp C. Healing of chromoblastomycosis by new method of treatment. Med Cut ILA.1974;4:285-92.
23. Astorga E, Bonilla E, Martínez C, Mura W. Treatment of chromoblastomycosis with amphotericin B and 5-fluorocytosine. Med Cutan Ibero Lat Am. 1981;9(2):125-8.
24. López-Romero E, Reyes-Montes Mdel R, Pérez-Torres A, Ruiz-Baca E, Villagómez-Castro JC, Mora-Montes HM, et al. Sporothrix schenckii complex and sporotrichosis, an emerging health problem. Future Microbiol. 2011;6(1):85-102.
25. Kauffman CA, Bustamante B, Chapman SW, Pappas PG; Infectious Diseases Society of America. Clinical practice guidelines for the management of sporotrichosis: 2007 update by the Infectious Diseases Society of America. Clin Infect Dis. 2007;45(10):1255-65.
26. Köhler A, Weber L, Gall H, Peter RU. Sporotrichosis-fixed cutaneous and lymphocutaneous form. Hautarzt. 2000;51(7):509-12.
27. Mahajan VK, Sharma NL, Sharma RC, Gupta ML, Garg G, Kanga AK. Cutaneous sporotrichosis in Himachal Pradesh, India. Mycoses. 2005;48(1):25-31.
28. Singh P, Sharma RC, Gupta ML, Mahajan VK. Sporotrichosis in Himachal Pradesh (India). Indian J Med Sci. 1983;37(6):101-3.
29. Kwon-Chung KJ, Bennett JE. Medical Mycology. Sporotrichosis. Kwon-Chung KJ, Bennett JE, editors. Philadelphia: Lea & Febiger.1991;707-29.
30. Talhari S, Talhari C. Lobomycosis. Clin Dermatol. 2012;30(4):420-4.
31. Paniz-Mondolfi A, Talhari C, Sander Hoffmann L, Connor DL, Talhari S, Bermudez-Villapol L et al. Lobomycosis: an emerging disease in humans and delphinidae. Mycoses. 2012;55(4):298-309.
32. Rodriguez-Toro G. Lobomycosis. Int J Dermatol. 1993;32(5):324–32.
33. Taborda PR, Taborda VA, McGinnis MR. Lacazia loboi gen. nov, comb. nov, the etiologic agent of lobomycosis. J Clin Microbiol. 1999;37(6):2031-3.
34. Burdett Hart L, Rotstein DS, Wells RS, Bassos-Hull K, Schwacke LH. Lacaziosis and lacaziosis-like prevalence among wild, common bottlenose dolphins Tursiops truncatus from the west coast of Florida, USA. Dis Aquat Organ. 2011;95(1):49-56.
35. Francesconi F, Francesconi V. Images in clinical medicine. Lobomycosis. N Engl J Med. 2011;364(1):e2.
36. Baruzzi RG, Marcopito LF, Michalany NS, Livianu J, Pinto NR. Early diagnosis and prompt treatment by surgery in Jorge Lobo's disease (keloidal blastomycosis). Mycopathologia. 1981;74(1):51-4.
37. Paniz-Mondolfi AE, Reyes Jaimes O, Dávila Jones L. Lobomycosis in Venezuela. Int J Dermatol. 2007;46(2):180-5.
38. Talhari S, Talhari C. Lobomycosis. Clin Dermatol 2012;30:420-4.
39. Paniz-Mondolfi A, Talhari C, Sander Hoffmann L, Connor DL, Talhari S, Bermudez-Villapol L, et al. Lobomycosis: an emerging disease in humans and delphinidae. Mycoses. 2012 Jul;55(4):298-309.
40. Fischer M, Chrusciak Talhari A, Reinel D, Talhari S. [Sucessful treatment with clofazimine and itraconazole in a 46 year old patient after 32 years duration of disease]. Hautarzt. 2002;53(10):677-81.

41. Elsayed S, Kuhn SM, Barber D, Church DL, Adams S, Kasper R. Human case of lobomycosis. Emerg Infect Dis. 2004;10(4):715-8.
42. Walker SD, Clark RV, King CT, Humphries JE, Lytle LS, Butkus DE. Fatal disseminated Conidiobolus coronatus infection in a renal transplant patient. Am J Clin Pathol. 1992;98(6):559-64.
43. Bigliazzi C, Poletti V, Dell'Amore D, Saragoni L, Colby TV. Disseminated basidiobolomycosis in an immunocompetent woman. J Clin Microbiol. 2004;42(3):1367-9.
44. Chaturvedi VP, Randhawa HS, Khan ZU, Singh N, Kini S. Prevalence of Basidiobolus ranarum Eidam in the intestinal tract of an insectivorous bat, Rhinopoma hardwickei hardwickei Gray in Delhi. Sabouraudia. 1984;22(3):185-9.
45. Kontoyiannis DP, Lewis RE. Principles and practice of infectious diseases. Agents of mucormycosis and entomophthoramycosis. In: Mandell GL, Bennett JE, Dolin R, editors. 7th ed.2010;3257-69.
46. Khan ZU, Khoursheed M, Makar R, Al-Waheeb S, Al-Bader I, Al-Muzaini A, et al. Basidiobolus ranarum as an etiologic agent of gastrointestinal zygomycosis. J Clin Microbiol. 2001;39(6):2360-3.
47. Jaffey PB, Haque AK, el-Zaatari M, Pasarell L, McGinnis MR. Disseminated Conidiobolus infection with endocarditis in a cocaine abuser. Arch Pathol Lab Med. 1990;114(12):1276-8.
48. Walker SD, Clark RV, King CT, Humphries JE, Lytle LS, Butkus DE. Fatal disseminated Conidiobolus coronatus infection in a renal transplant patient. Am J Clin Pathol. 1992;98(6):559-64
49. Walsh TJ, Renshaw G, Andrews J, Kwon-Chung J, Cunnion RC, Pass HI et al. Invasive zygomycosis due to Conidiobolus incongruus. Clin Infect Dis. 1994 Sep;19(3):423-30.
50. Rippon JW. Medical Mycology: The pathogenic fungi and actinomycestes, 3rd edn, Philadelphia: WB Saunders.1988;681-713.
51. Kwon-Chung KJ & Bennet JE. Medical mycology. Philadelphia: Lebiger and Febiger.1992;447-463.
52. Busapakum R, Youngchaiyud U, Sriumpai S, Segretain G, Fromentin H. Disseminated infection with Conidiobolus incongruus. Sabouraudia. 1983;21(4):323-30.
53. Vismer HF, Debeer HA, Dreyer. Subcutaneous phycomycosis caused by Basidiobolus haptosporus (Drechsler, 1947). S Afr Med J. 1980;58:644-67.
54. Pasha TM, Leighton JA, Smilack JD, Heppell J, Colby TV, Kaufman L. Basidiobolomycosis: an unusual fungal infection mimicking inflammatory bowel disease. Gastroenterology. Gastroenterology. 1997;112(1):250-4.
55. Kamalam A, Thambia AS. Entomophthoromycosis basidiobolae-successfully treated with KI. Mykosen. 1979;22(3):82-4.
56. Van Cutsem J, Van Gerven F, Janssen PA. Activity of orally and parentally administered itraconazole in the treatment of superficial and deep mycoses: animal models. Rev Infect Dis. 1987;9 Suppl 1:S15-32.
57. Gugnani HC. A review of zygomycosis due to Basidiobolus ranarum. Eur J Epidemiol. 1999;15(10):923-9.
58. Shikanai-Yasuda MA, Telles Filho Fde Q, Mendes RP, Colombo AL, Moretti ML. Rev Soc Bras Med Trop. 2006;39(3):297-310.
59. Ameen M, Talhari C, Talhari S. Advances in paracoccidioidomycosis. Clin Exp Dermatol. 2010;35(6):576-80.
60. Teixeira MJ, Fonoff ET, Machado Ldos R, Nobrega JP, Sterman-Neto H, Amorim RL. Paracoccidioidomycosis: intralesional therapy. Arq Neuropsiquiatr. 2010;68(3):458-9.
61. Buitrago MJ, Bernal-Martínez L, Castelli MV, Rodríguez-Tudela JL, Cuenca-Estrella M. Histoplasmosis and paracoccidioidomycosis in a non-endemic area: a review of cases and diagnosis. J Travel Med. 2011;18(1):26-33.
62. Odashiro AN, Odashiro PR, Fernandes PI, Leite LV, Odashiro M, Maloney S. Eyelid and conjunctival paracoccidioidomycosis simulating carcinoma. Int Ophthalmol. 2011;31(1):63-7.
63. Paganini CB, Ferreira AB, Minanni CA, Lopes de Pontes FE, Ribeiro C, Silva RA et al. Blastomycosis: a differential diagnosis of periampullary tumors. Pancreas. 2010;39(7):1120-2.
64. Wanke B, Aide MA. Chapter 6-paracoccidioidomycosis. J Bras Pneumol. 2009 Dec;35(12):1245-9.
65. Franco M, Montenegro MR, Mendes RP, Marques SA, Dillon NL, Mota NGDS. Paracoccidioidomycosis: a recently proposed classification of its clinical forms. Rev Soc Bras Med Trop. 1987;20(2):129-32.
66. Barrios JC. Blastomicose sulamericana com localizacao ossea. Relato de dois casos. Rev Bras Ortop.1984;19:117–123.
67. Ferreira MS. Paracoccidioidomycosis. Paediatr Respir Rev. 2009;10(4):161-5.
68. Queiroz-Telles F, Goldani LZ, Schlamm HT, Goodrich JM, Espinel-Ingroff A, Shikanai-Yasuda MA. An open- label comparative pilot study of oral voriconazole and itraconazole for long-term treatment of paracoccidiodomycosis Clin Infect Dis. 2007;45(11):1462-9.
69. Gugnani HC. Histoplasmosis in Africa: a review. Indian J Chest Dis Allied Sci. 2000;42(4):271-7.
70. Nethercott JR, Schachter RK, Givan KF, Ryder DE. Histoplasmosis due to Histoplasma capsulatum var. duboisii in a Canadian immigrant. Arch Dermatol. 1978;114(4):595-8.
71. Loulergue P, Bastides F, Baudouin V, Chandenier J, Mariani-Kurkdjian P, Dupont B, et al. Literature review and case histories of Histoplasma capsulatum var. duboisii infections in HIV-infected patients. Emerg Infect Dis. 2007;13(11):1647-52.

72. Gugnani HC, Muotoe-Okafor F. African histoplasmosis: a review. Rev Iberoam Micol. 1997;14(4):155-9.
73. Dubois A, Janssens PG, Brutsaert P, Vanbreuseghem R. [A case of African histoplasmosis; with a mycological note on Histoplasma duboisii n.sp]. Ann Soc Belg Med Trop. 1952;32(6):569-84.
74. Gugnani HC, Muotoe-Okafor F. African histoplasmosis: a review. Rev Iberoam Micol. 1997;14(4):155-9.
75. Minta DK, Dembele M, Lorre G, Diallo DA, Traore HA, Chabasse D. African histoplasmosis (Histoplasma capsulatum var. duboisii): a case report from Mali. Sante. 2005;15(3):195-9.
76. Binford CH & Dooley JR. Pathology of Tropical and Extraordinary Diseases.Vol. 2. African histoplasmosis.Washington DC: Armed Forces Institute of Pathology. Binford CH, Connor DH, eds;1972;581-3.
77. Weedon D. Weedon's Skin Pathology. 3rd ed. London: Churchill Livingstone Elsevier. 2010 Dermatol Pract Concept. 2012; 2(1): 79–82.
78. McKee PH. Infectious diseases of the skin. In: Pathology of the Skin with Clinical Correlations. Third edition. McKee PH, Calonje E, Granter SR, editors. Vol.1. Philadephia, PA: Elsevier Mosby.2005;837-992.
79. Francis W. Chandler, William Kaplan, Libero Ajello. A Colour Atlas and Textbook of the Histopathology of Mycotic Diseases. 1st edition. London: Wolfe Medical Publications Ltd. 1980; 67-69.
80. Kradin RL. In: Diagnostic Pathology of Infectious Disease.Skin infections. Saunders Elsevier Ed. 1st Edition.2010;519-616.
81. Suvarna KS, Layton C, Bancroft JD. In: Bancroft's Theory and Practice of Histological Techniques. (Immunohistochemistry applications in pathology). Churchill Livingstone Elsevier eds. 2012;493-516.
82. Wheat LJ, Fre ifeld AG, Kleiman MB, Baddley JW, McKinsey DS, Loyd JE, et al. Clinical practice guidelines for the management of patients with histoplasmosis, update by the Infectious Diseases Society of America. Clin Infect Dis. 2007;45(7):807-25.

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