Controlled Study of Mycetoma: Development of Diagnosis, Treatment And Controlled Programme Northern India

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ABSTRACT
INTRODUCTION: Mycetoma is also known as Madura foot, is a patient fungal infection of the skin and the tissues just under the skin. Mycetoma is also known as Madura foot, is a patient fungal infection of the skin and the tissues just under the skin.
ETIOLOGY: The most prevailing causative agent of mycetoma worldwide is *Mycetoma Mycetomatis*. Etiologic agents of eumycetoma can be classified based on the type of grain they produce, generally classified as black, white or pale unstained or yellow- to -yellow- brown grains.
PATHOGENESIS: The pathogens including both bacteria and fungi, infection leads to the causative microorganisms spreading through the fascial planes to the underlying muscles and bones and accordingly to the destruction and deformity of the osseous and muscular tissues and disfiguration.
DIAGNOSIS: Diagnosed based on clinical aspects and grain colour. Culture and histopathology are the gold standard methods. Identification of the causative agent can be made by bacteriological culture, biochemical characteristics and a series of technical phenotypic tests.
TREATMENT: *Eumycetoma* is treated with antifungal agents in combination with surgical excision whereas *actinomycetoma* is treated with antibacterial agents.
CONTROL PROGRAMMES OF MYCETOMA: Therapies that work against mycetoma are limited. *Actinomycetoma* is generally treatable with antibiotics and *Eumycetoma* is generally treated with long- term antifungal medicine.
CONCLUSION: The clinical overview of mycetoma is necessary to raise awareness about its presence due to the large population of immigrants from endemic regions. Since no standard outlined treatment measure has been given by World Health Organization (WHO).

KEY WORDS: Mycetoma, Madura Foot, Actinomycetoma, World Health Organization (WHO).

INTRODUCTION

Mycetoma is also known as **Madura foot**, is a patient fungal infection of the skin and the tissues just under the skin, affecting most generally the bases, although it can do in hands and other body.[1] It starts as a painless wet nodules, which may be present for times before ulceration, swelling, coarse discharge and bleeding from sinuses and fistulae followed by bone deformity, Mycetoma describes a miscellaneous group of cutaneous and subcutaneous infections caused by either fungi (*eumycetomas)* or bacteria (*actinomycetomas)*.[2] It is characterized by a trio of clinical symptoms painless subcutaneous symptoms - like swelling, multiple sinuses ,fistulas, and discharged grains in pus.[3] Carter established fungi as the cause of the diseases and used " **mycetoma**" to describe the tumorous enlargement in **1860.**[4] Based on the causative pathogens in **1913 Pinoy** first divided mycetoma into two introductory types Actinomycosis and true mycetoma (caused by true fungi or molds).[5] The bacterial and fungal pathogens get into subcutaneous tissue through fragmented skin barrier, locally incubate and gain and also progress to visible clinical lesions.[5] *Nocardia brasiliensis* and *Nocardia asteroides* are considered the most constantly reported species worldwide still, there are reports of uncommon species being intertwined, including *Nocardia otitidiscaviarum*, *Nocardia transvalensis, Nocardia mexicana, Nocardia harenae*, and *Nocardia takedensis* whereas *Nocardia brasiliensis* is the most reported etiologic agents, here have been many cases associated with *Nocardia mexicana* since also, which have involved different anatomical regions and pathological conditions, similar as brain abscess, cerebral nocardiosis, cutaneous botryomycosis, pulmonary infections, as well as a tenosynovitis and arthritis in bovines.[6] The infection progresses slowly over the times, leading to the development of painless swelling and discharging sinuses, frequently the infection and increased morbidity.[5] Diagnosis is generally verified through a combination of clinical evaluation, radiological imaging, and histopathological examination of the excised lesions.[7] The treatment options of Mycetoma is consider delicate as it is dependent on the causative organism, it involves a combination of surgical excision and dragged antifungal or antibacterial remedy, acclimatized grounded on

the linked causative organism.[8] The geographical distribution of mycetoma depends on a range of environmental factors, similar as downfall ,moisture, and temperature agent.[9] The disease is most constantly reported in young adults aged 20 – 40 years but people of all ages are at risk, males are reported to be at advanced risk but a community study showed nearly equal risk for both sexes.[10] Mycetoma generally affects those who work in close contact with the environment, similar as farmers and shepherds.[11] Affected communities are generally of low socioeconomic status and under developed infrastructure to provide clean water and sanitation.[12] There are currently no devoted control programs for mycetoma and the only available tools to reduce the disease burden are early case chancing and applicable operation.[13] These are hampered by challenges in the diagnosis and treatment of the disease and knowledge gaps surroundings its prevalence, frequence and determinants of susceptibility.[14] Diagnosis requires multitudinous invasive and time consuming examinations led by an educated physicians and available treatment options are limited and precious, take a long time to prompt cure and have a high recurrence rate.[15] The creation of early case discovery is expensive and relies on applicable public health messaging and community education.[16] Being knowledge surroundings the route of infection, factors favoring transmission and determinants of susceptibility to the disease stymie the design and perpetration of effective preventive strategies.[17]

ETIOLOGICAL AGENT

Etiologically, more than 70 species of fungi and bacteria have been reported, ***Nocardia Actinomycetomas*** to be responsible for the development of mycetoma and the total number of species is likely increasing with the appearance of advanced molecular methods.[1] The first ultramodern description of **Madura foot** was made in **1842** from **Madurai** (the city after which the disease was named **Madura- mycosis**) in India, by **Gill.**[3] The fungal cause of the disease was established in **1860** by **Carter**.[4] The most prevailing causative agent of mycetoma worldwide is ***Mycetoma Mycetomatis***.[5] Etiologic agents of eumycetoma can be classified based on the type of grain they produce, generally classified as black, white or pale unstained or yellow- to -yellow- brown grains.[1]

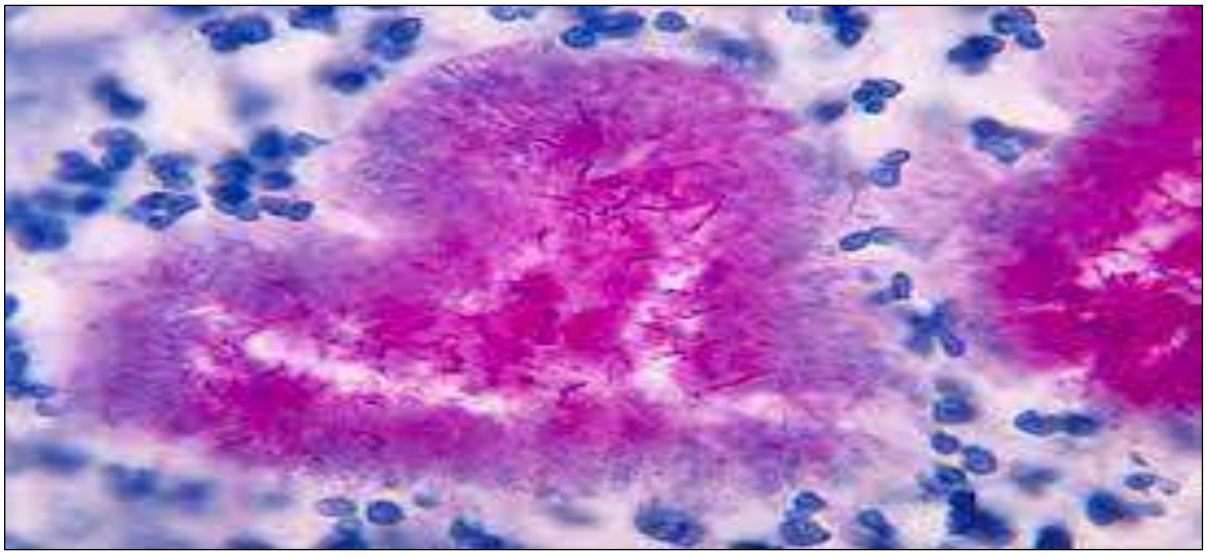

Fig no:1 Microscopic view of *Actinomycetoma*

PATHOGENESIS

The pathogens including both bacteria and fungi, found in soil and water enter the human body through broken skin, caused by either thorn pricks, wood splinters, accidental cuts, and inoculate and gain in the subcutaneous tissues, eliciting local and systemic inflammatory responses from the host.[1] The cycle of infection, healing and reinfection continues without treatment, In the late stage the infection leads to the causative microorganisms spreading through the fascial planes to the underlying muscles and bones and accordingly to the destruction and deformity of the osseous and muscular tissues and disfiguration.[1] Mycetoma is caused by frequent saprotrophs found in the soil and on thorny shrubs in semi-desert climates.[16] Some common causative agents are:

- *Madurella mycetomatis* (fungus)
- *Nocardia brasiliensis* (bacteria)
- *Actinomadure madura* (bacteria)
- *Streptomyces somaliensis* (bacteria)
- *Actinomadura pelletieri* (bacteria)

DIAGNOSIS

The diagnosis of mycetoma can be made based on the clinical symptoms in endemic regions.[1] Diagnosed based on clinical aspects and grain colour.[1] Culture and histopathology are the gold standard methods.[17] Identification of the causative agent can be made by bacteriological culture and biochemical characteristics but this process can be slow

because of the 2 to 3 week incubation period and a series of technical phenotypic tests.[1] The diagnosis of suspected cases should include a series of tests including a direct microscopic examination of the discharge, imaging studies with conventional radiography, ultrasonography and MRI; bacterial and fungal cultures; biopsy for histopathological evaluation with special staining including Periodic Acid Schiff (PAS) and Grocott Methenamine Silver (GMS) for fungi and Gram and Acid- Fast Bacilli (AFB) for bacteria and molecular profiling to confirm the diagnosis and identify the species of the causal microorganism.[1]

Fig no:2 Clinical Features of Madura Foot

TREATMENT

During the treatment of Mycetoma patient monitoring depends on the regimen used but treatments for *eumycetoma* and *actinomycetoma* are different, *Eumycetoma* is treated with antifungal agents in combination with surgical excision whereas *actinomycetoma* is treated with antibacterial agents.[1] Recommended agents for *eumycetoma* include **Voriconazole**, **Posaconazole** and **Terbinafine**.[14] Other agents that cause eumycetoma may respond intermittently to **Itraconazole** or **Amphotericin B**.[15] Surgical options for *eumycetoma* include wide original excision, amputation and debridement. Surgical intervention is most suitable for localized lesions. *Actinomycetoma* is generally treated with antibacterial agents. Several drugs including **Amikacin**, **Dapsone (Diaminodiphenyl Sulphone**), **Trimethoprim - Sulphamethoxazole** and **Streptomycin Sulphate** are used in different combinations to treat *actinomycetoma* depending on the infecting species.[1]

CONTROL PROGRAMMES OF MYCETOMA

Therapies that work against mycetoma are limited. The treatment for mycetoma depends on whether it is caused by bacteria (*actinomycetoma*) or fungi (*eumycetoma*).[1] *Actinomycetoma* is generally treatable with antibiotics and surgery is usually not needed. *Eumycetoma* is generally treated with long- term antifungal medicine.[16]Since there are no outlined prevention or control programs for mycetoma by World Health Organization(WHO), we recommend aggressive formal and informal health education and sensitization in endemic areas for community members regarding protection of exposed parts of the body ,by using rubber boots and gloves during work that are in contact with the habitat of offending organisms.[16] Early recognition and reporting of suspected cases will reduce severity of complication and improve treatment outcome.[16]

CONCLUSION

The clinical overview of mycetoma is necessary to raise awareness about its presence due to the large population of immigrants from endemic regions.[1] The accurate diagnosis of mycetoma requires a detailed clinical history, including immigration status and travel history to endemic regions; a thorough physical examination; imaging studies including X-ray, ultrasound and Magnetic Resonance Imaging (MRI); analyses of discharge or aspiration with visual observation; direct microscopic examination; mycological and bacterial culture; molecular sequencing; and histopathological evaluation with special staining.[1]The suggested algorithm may assist health workers to suspect and recognise mycetoma amidst other differentials in their community. Since no standard outlined treatment measure has been given by World Health Organization (WHO).[17]

DATA AVAILABILITY

The data sets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

DECLARATIONS

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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