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The Hazard of Histoplasmosis for Breeders of Ornamental Birds

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ABSTRACT

Recently, the demand for birds in cages has increased significantly, driven by the desire to enjoy the beauty of birds and their songs and the pressure of individuals, especially children, to raise and tame them so they can live in their homes. The most popular pet birds are cockatiels, canaries, budgerigars, and lovebirds. Inhalation, vector-borne, and fecal-oral pathways are how zoonotic illnesses are spread. Humans can contract zoonotic infections from direct or indirect contact with contaminated bird droppings, cages, or food sources. Histoplasmosis is one of the most important fungal diseases affecting humans, and it originated in birds. Subclinical or moderate respiratory illnesses are among its clinical symptoms, as is progressive disseminated histoplasmosis (PDH), a potentially fatal sickness whose precise identification is still difficult and scarce in many nations where it is widespread. One way to help avoid zoonosis in humans and birds is to use human protective equipment, clean and sanitize bird cages, and practice biosecurity and hygiene.

Keywords: Histoplasmosis; bird breeder; PDH; risk; occupational exposure

INTRODUCTION

A common endemic mycosis worldwide is histoplasmosis, sometimes known as Darling's or Spelunker's disease. It is considered the most common invasive opportunistic fungal disease. Histoplasmosis can kill both immunocompetent and immunocompromised people [1]. In Brazil, this disease has been described since 1946, reaching a remarkable incidence in the population, especially during the HIV-ADIS pandemic [2]. Immunocompromised patients without HIV infection had the worst outcomes with a mortality rate of 32% [3]. The main symptoms of histoplasmosis include respiratory and systemic infections [4]. *Histoplasma capsulatum* is a dimorphic fungus with two recognized varieties-*H. capsulatum var. capsulatum* and *H. capsulatum var. Dubois*- and is the source of histoplasmosis, a zoonotic mycotic infection [5]. Dimorphic fungi, which grow as molds in the environment and assume a different structure when

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they cause infection in the host. They thrive in an environment that contains a high percentage of nitrogen [6]. Histoplasmosis should be considered a possible cause of acute respiratory or influenza-like illness contracted by exposure to bird droppings, which may contain Histoplasma capsular spores [7]. To enhance flock management and meet the concerns of government agencies and the humane community, the Model Aviculture Program (MAP) is a voluntary inspection and certification program for bird breeders in the United States [8]. Bird breeders and avian veterinarians realized that the National Cage and Aviary Bird Improvement Plan (NCABIP) placed more emphasis on safeguarding the public and the poultry industry from potential harm from exotic bird diseases than it did on the needs of the birds or their keepers. This realization led to the creation of MAP [9]. Histoplasmosis should be regarded as a differential diagnosis even in areas where it is not common, especially in immunocompromised patients with gastrointestinal symptoms [10].

HISTORY OF HISTOPLASMOSIS

Histoplasmosis is more common than first thought. It is mainly a non-contagious disease of the reticuloendothelial system and can cause a wide range of clinical symptoms, from a self-limited or asymptomatic infection in immunocompetent patients to a potentially fatal, disseminated illness in these patients [11]. The pathologist Samuel Darling identified *H. capsulatum*, a thermally dimorphic intracellular fungus, as the cause of death in 1906 after studying the tissues of a young man whose death was misdiagnosed as miliary tuberculosis [12]. Since then, six continents have been reported to have high and low endemicity zones for histoplasmosis [13]. The fungus *H. capsulatum* is found in soil and is frequently found in temperate river valleys where bat and bird guano are present [14]. After being inhaled, saprophytic spores transform into pathogenic yeast in the lungs, where *H. capsulatum* overcomes numerous barriers to injure the host [15]. Three types have historically been identified based on geographic distribution, morphology, and clinical symptoms; two of them (var. *capsulatum* and var. *duboisii*) are human pathogens, while the third (var. *farciminosum*) has mostly been identified as an equine infection [16].

METHODS OF TRANSMISSION OF HISTOPLASMOSIS

Respiratory histoplasmosis can be caused by inhalation of fungal spores or through skin wounds and is phagocytized by tissue-resident macrophages [17]. Spores undergo intracellular replication within phagocytes that are transmitted to yeasts [18]. Infected macrophages undergo lysis, which results in the release of pathogenic yeast cells into the surrounding tissue[19]. As a result, yeast-rich purulent secretions are produced, which can be considered a means of contamination. The yeast cells germinate in the mycelial form, and the whole process begins from the beginning [20]. However, it is likely to cause serious, perhaps fatal, infections in immunocompromised patients, such as recipients of hematopoietic cell transplants (HCT) and solid organ transplants (SOT) [21]. Histoplasmosis may result from endogenous reactivation of latent infection, de novo post-transplant acquisition, and donor-derived infection. Infections that spread widely are prevalent [22].

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Histoplasmosis symptoms

The initial symptoms frequently resemble those of tuberculosis in the abdomen. Patients with widespread infections may present with a septic picture; however, fever is the most prevalent symptom, and clinical characteristics are frequently nonspecific [23]. Early in the course of the illness, other symptoms, including pancytopenia and hepatosplenomegaly, might not be noticeable. Histoplasmosis can present with a variety of clinical symptoms that can mimic those of other prevalent illnesses such as tuberculosis, sarcoidosis, Crohn's disease, community-acquired pneumonia, or cancer [24].

Diagnosis of Histoplasmosis

Histoplasmosis diagnosis is still difficult, especially in underdeveloped nations, mostly because there are insufficiently qualified medical professionals and limited access to diagnostic equipment [25]. The WHO Essential Diagnostics List now includes testing for histoplasma antigens. By cultivating and/or seeing the yeast cells using particular stains, cytology or histopathology can provide the definitive diagnosis of histoplasmosis [26]. Nevertheless, cultures take time, and both methods have a low sensitivity for identifying the illness. Assays for antibody detection work well for both the chronic and subacute clinical forms of histoplasmosis [27]. However, in the immunocompromised host, they are not very sensitive. Although several molecular "in-house" tests were also created and demonstrated encouraging outcomes, none of them are yet commercially available, and there is an ongoing need to standardize and validate them [28]. Although cross-reactivity with other related fungi is widespread, antigen detection techniques are very useful for the follow-up of patients with histoplasmosis and have good sensitivity in PDH cases. Furthermore, this test is costly and only used in a small number of labs. Instead of using the present crude extracts or unspecific antigens for histoplasmosis diagnosis, DNA-recombinant approaches have recently found and created novel protein antigen candidates to provide standardized and specific reagents [29]. Culture is still the most reliable method for diagnosing disseminated histoplasmosis, but it takes one to six weeks to grow, which delays the start of treatment [30]. Another diagnostic technique, histoplasma antigen detection, has not become widely used in environments with limited resources, most likely because of its expensive cost [31]. Disseminated histoplasmosis can also be diagnosed with great sensitivity using molecular techniques; however, these methods are very costly and not readily available. In addition to the methods mentioned above, peripheral blood films can also show Histoplasma; however, this is not frequently used to diagnose widespread histoplasmosis. Every patient undergoing evaluation for disseminated histoplasmosis should have a blood smear performed. It is still a useful and reasonably priced diagnostic technique for disseminated histoplasmosis [32]. Histoplasmosis has been successfully diagnosed using radiography and ELISA tests (such as serum quantitative antigen assays) [33]. Other serological methods for identifying *H. capsulatum* var. *capsulatum* antibodies have also been developed, including hemagglutination, the complement fixation test (CFT), radioimmunoassay (RIA), etc. [34]. A 210 bp segment unique to *H. capsulatum* is highlighted by nested PCR, according to other publications [35]. Histoplasma antigen levels can be used to track how well a treatment is working and have prognostic significance [36].

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Avoiding Histoplasma Exposures at Work

Construction of roads, roofs, bridges, water towers, demolition, and masonry are among the occupational risk factors for histoplasmosis [37]. The hierarchy of controls is used by occupational health and safety experts to decide how to apply workable and efficient control solutions for workplace hazards. Figure (1).

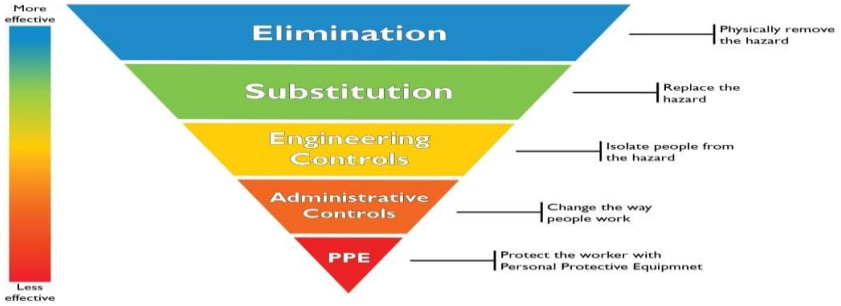

Figure (1): The Control Hierarchy is Used to Limit Exposure to Potential Dangers at Work. According to This Framework, The Techniques at The Top of The Graphic are More Protective and Effective Than Those at Bottom. Source: National Institute for Occupational Safety and Health (NIOSH)[38]

1. Elimination (remove the hazard)
2. Substitution (replacing the hazard) is the best method to lower occupational risks, but it can be challenging to apply for infection agents like *Histoplasma*. A significant amount of bird or bat droppings may occasionally need to be cleaned up by a qualified business that handles hazardous waste.
3. Engineering controls are tangible adjustments made to work procedures to eliminate risks or create a barrier between employees and dangers. Administrative controls are techniques that alter how tasks are carried out.
4. Personal protective equipment (PPE): offers a tangible separation between the worker and the risk. Because it necessitates a thorough program and a high degree of worker involvement and commitment for proper use, PPE is regarded as the least effective control tool.

Measures to avoid occupational exposure to Histoplasma

One crucial element in reducing exposures at work is creating a site safety plan involving management, employee representative, and health and safety experts' participation [39]. Potential risks are identified, and the steps required to prevent, control, and lessen those risks are described in a thorough plan. Engineering and administrative controls as well as PPE use should be part of the measures. By using this framework, occupational exposure to histoplasmosis can be avoided [40].

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Prevention Measure include:

Elimination: excluding bats or birds from a building.
Engineering controls: controlling dust generation and aerosolized disposal of waste.
Administrative controls: developing a site safety plan, posting health risk warnings, and hazard communication and training.
Personal protective equipment (PPE): NIOSH-approved respirations. Other PPE: Eye protection, gloves, protective clothing, shoe/boot coverings.

Treatment of histoplasmosis

The use of liposomal amphotericin as an induction treatment for severe or moderately severe illness, followed by a 12-month itraconazole maintenance regimen; If the patient's immunological status has improved and they are clinically stable, a shorter maintenance treatment might be recommended [41]. Patients with histoplasmosis who do not have central nervous system damage should begin antiretroviral medication as soon as possible. The treatment of TB should be started in accordance with the World Health Organization's treatment standards in order to treat co-infection with histoplasmosis [42]. Particularly for the treatment of PLHIV. It is essential to provide professionals with proper health education and clinicians [43].

CONCLUSION

This review's goals are to outline these risk factors, inform medical professionals of the various ways histoplasmosis manifests itself, and provide practical care and preventative techniques. Significant morbidity can arise from histoplasmosis. Improving the prompt identification and treatment of histoplasmosis and halting the spread of the disease will be made possible by a greater understanding of disease risk factors among the general population and the global medical community. It is necessary to conduct comparative studies that clarify how well peripheral blood films function in diagnosing disseminated histoplasmosis in comparison to a culture standard.

Conflict of interests:

There are non-conflicts of interest.

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الخلاصة

في الآونة الأخيرة، زاد الطلب على الطيور في الأقفاص بشكل ملحوظ، مدفوعا بالرغبة في الاستمتاع بجمال الطيور وأغانيها وضغط الأفراد، وخاصة الأطفال، لتربيتها وترويضها حتى تتمكن من العيش في منازلهم. أشهر الطيور الأليفة هي طيور الكوكتيل، والكناري، والببغاء، وطيور الحب. إن الاستنشاق، والمسارات المنقولة بالنواقل، والممرات البرازية عن طريق الفم هي الطريقة التي تنتشر بها الأمراض الحيوانية المنشأ. يمكن أن يصاب البشر بالعدوى حيوانية المنشأ من خلال الاتصال المباشر أو غير المباشر بفضلات الطيور أو الأقفاص أو مصادر الغذاء الملوثة. يعد داء النوسجات من أهم الأمراض الفطرية التي تصيب الإنسان، ومنشأه عند الطيور. تعد أمراض الجهاز التنفسي دون الإكلينيكي أو المعتدل من بين أعراضه السريرية، كما هو الحال مع داء النوسجات المنتشر التقدمي (PDH)، وهو مرض قد يكون مميتًا ولا يزال تحديده الدقيق صعبًا ونادرًا في العديد من الدول التي ينتشر فيها على نطاق واسع. إن استخدام معدات الحماية البشرية، وتنظيف أقفاص الطيور وتعقيمها، وممارسة الأمن البيولوجي والنظافة الصحية يمكن أن يساعد جميعها في منع الأمراض الحيوانية المنشأ لدى البشر والطيور.