

## Aspergillosis: A Highly Infectious Global Mycosis of Human and Animal

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### Abstract

*Aspergillosis* is an important opportunistic fungal saprozoosis of worldwide distribution. The disease is reported in humans and animals including birds, and is caused primarily by *Aspergillus fumigatus*, a saprobic fungus of ubiquitous distribution. It occurs in sporadic and epidemic form causing significant morbidity and mortality. Globally, over 200,000 cases of invasive *aspergillosis* are reported each year. The source of infection is exogenous and respiratory tract is the chief portal of entry of fungus. A variety of clinical signs are observed in humans and animals. Direct demonstration of fungal agent in clinical material and its isolation in pure growth on mycological medium is still considered the gold standard to confirm an unequivocal diagnosis of *aspergillosis*. The pathogen can be easily isolated on APRM agar. Detailed morphology of fungus is studied in Narayan stain. Numerous antifungal drugs are used in clinical practice to treat cases of *aspergillosis*. Certain high risk groups should use face mask to prevent inhalation of fungal spores from immediate environment. It is recommended that "APRM medium" and "Narayan stain", which are easy to prepare and less expensive than other stains and media, should be routinely used in microbiology and public health laboratories for the study of fungi including *Aspergillus*. Early diagnosis and prompt therapy is highly imperative in immune compromised patients to prevent the fatal consequences of disease.

**Keywords:** APRM medium; *Aspergillosis*; Birds, Human; Narayan stain; Saprobe

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### Introduction

In recent years, several opportunistic fungal infections such as candidiasis, cryptococcosis, *aspergillosis*, zygomycosis, geotrichosis, fusariosis, trichosporonosis, rhodotoruliosis and pneumocystosis have been recognized as an important cause of morbidity and mortality in developing as well as developed nations (Pal, 2007; Brown., *et al.* 2012; Pal, 2017). Among these mycoses, *aspergillosis* is reported with increasing frequency in humans and animals from many regions of the world including India (Dave., *et al.* 2015). There are about 600 species of *Aspergillus*, of which about 27 species of *Aspergillus* are found to be associated in various clinical disorders of humans and animals (Pal., *et al.* 2014). Disease is primarily caused by *A.fumigatus*, however, other species such as *A. amstelodami*, *A. candidus*, *A.chevallieri*, *A.clvatus*, *A.deflectus*, *A.flavus*, *A.glaucus*, *A.nidulans*, *A.niger*, *A.ochraceous*, *A.restrictus*, *A.syowii*, *A.tamari*, *A.terreus*, *A.udagawae*, *A.ustus*,

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and *A. versicolor* are also incriminated in the etiology of disease (Pal, *et al.* 2014; Dave, *et al.* 2015). These fungi are widely prevalent in environment and are recovered from soil, air, water, plant substrates (Pal, 2007; Pal, 2015). The present communication delineates the growing significance of *Aspergillus* infections in humans and animals.

### Transmission

*Aspergillosis* is described in humans and animals including birds. The infection is mainly acquired by inhalation of aerosolized conidia from the environmental sources. Occasionally, infection may be introduced following a trauma to the skin by a fungus contaminated object. The fungus can affect many organs of body such as skin, ear, eye, sinus, lung, bone, kidney, heart and brain (Pal, 2007).

### Clinical Spectrum

Clinical manifestations of disease vary depending on the organ involved. Invasive aspergillosis can occur in acute, disseminated and chronic necrotizing form. The disease in humans is characterized by low grade fever, productive cough, headache, chest pain, and hemoptysis besides keratitis, sinusitis, rhinitis, otitis, dermatitis, osteomyelitis, endocarditis, and meningitis. In hypersensitive persons, severe allergic bronchopulmonary aspergillosis may develop. Otomycosis is the commonest disorder caused by *Aspergillus Niger* (Pal, 2007). In animals, a wide range of signs and symptoms such as rhinitis, sinusitis, pneumonia, otitis, keratitis, cystitis, mastitis, endometritis and abortion are observed. The affected birds mainly chicks show dullness, anorexia, fever, coughing, sneezing, nasal discharge, oedema of eyelids, lachrymation, dyspnea, gasping, diarrhea, torticollis, ataxia, emaciation, convulsion, and death (Pal, 2007). The outbreaks of *aspergillosis* are frequently encountered in young birds. The mortality rate in chicks is very high that may range from 45 to 92%. High mortality in young birds causes a heavy financial loss to the poultry industry. In adult birds, the disease runs a chronic form, which results in decreased egg production (Pal, 2007).

### Diagnosis

Radiography, CT scan and MRI may be useful to locate lesions in organs. Direct microscopy of clinical specimens is done in 10% potassium hydroxide to demonstrate hyaline septate hyphae of fungus. The isolation can be achieved on Sabouraud dextrose agar with chloramphenicol, and APRM (Anubha, Pratibha, Raj, Mahendra) medium. The later medium contained 2.0g of dried marigold flowers, 2.0g agar, 50 mg chloramphenicol and 100 ml distilled water (Dave and Pal., 2015). Cycloheximide should not be incorporated in cultural medium as it inhibits the growth of *Aspergillus*. Suspected colonies should be sub cultured on APRM medium for identification. Detailed microscopic morphology is done in Narayan stain, which contained 4 ml of glycerin, 6.0 ml of dimethyl sulfoxide (DMSO) and .05 ml of 3% solution of methylene blue (Pal, 2004). In addition, immunological, molecular and histopathological techniques are also performed to confirm the diagnosis (Pal, 2007). Murine model is commonly used to perform animal pathogenicity test. *Aspergillosis* should be differentiated with tuberculosis, nocardiosis, cryptococcosis and other pulmonary diseases (Pal, 2007).

### Epidemiology

*Aspergillosis* is an important fungal disease of public health and economic importance. A plethora of factors such as asthma, cystic fibrosis, HIV/AIDS, cancer, neutropenia, and prolonged use of corticosteroids predispose the subject to *aspergillosis* (Pal, *et al.* 2014). The lung is involved in almost 75 % of *Aspergillus* infections (Pal, *et al.* 2014). Haematogenous dissemination of *Aspergillus* infection from the lungs to other sites may occur in about 30 % of patients. Maximum cases of aspergillosis are encountered in immune compromised patients (Pal, 2007). Globally, invasive aspergillosis caused by *Aspergillus fumigatus* is estimated to occur in over 200,000 people annually (Brown, *et al.* 2012). Disseminated aspergillosis carries a high mortality rate of about 90% (Dave, *et al.* 2015). It is estimated that chronic *aspergillosis* affects more than 3 million people worldwide. Allergic bronchopulmonary aspergillosis is encountered in over 4 million people with asthma and cystic fibrosis worldwide (Brwon, *et al.* 2012). Nosocomial outbreaks of *aspergillosis* are recorded in patients housed near the hospital or construction sites (Pal, 2007). Occasional outbreaks of cutaneous *aspergillosis* are traced to the fungal contaminated biomedical devices (Dave, *et al.* 2015). Certain occupational groups such as poultry farmers, agricultural workers, gardeners, brick manufacturers, etc., are at a great risk of acquiring fungal infections (Pal and Rodrigues, 1990; Dave, *et al.* 2015).

### Treatment

Several antifungal drugs such as amphotericin B, caspofungin, itraconazole, posaconazole, terbinafine, and voriconazole have been tried with variable success in the management of human and animal *aspergillosis* (Pal, 2007; Dave., *et al.* 2015). Surgical intervention is imperative for the management of aspergilloma (Pal, 2007).

### Prevention and Control

Currently, no commercial vaccine is available to immunize the humans and animals. It is suggested that immune compromised patients should must avoid dusty environment and use face mask to prevent exposure to *Aspergillus*. It is suggested that potted plants should not be kept in patient's room. HEPA filters should be installed in the room of hospital where high risk patients are admitted. The pregnant animals should not be fed with mouldy fodder. Strict biosecurity measures are needed at poultry farms (Pal, 2007).

### Conclusion

*Aspergillosis*, principally caused by *Aspergillus fumigatus*, is one of the most frequently occurring opportunistic mycosis of global significance. Disease affects both sexes, all age groups and all races, and is found in immune compromised as well as immune competent hosts. The prolonged neutropenia predisposes the humans and animals to *Aspergillus* infection. Therefore, invasive aspergillosis has become a leading cause of death in neutropenic patients. Further studies on ecology, pathogenesis, molecular epidemiology, and vaccinology should be undertaken. Attempts should be made to develop potent, safe and low cost drugs, which can be easily afforded by poor resource nations for better management of aspergillosis both in humans and animals.

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