

Aspergillosis

What is Aspergillosis?

Aspergillosis is not a single disease but several. It includes pulmonary aspergillosis, invasive aspergillosis and aspergilloma.

It is caused by the inhalation of fungal spores belonging to the fungal genus— aspergillus.

Pulmonary aspergillosis is the most common of the three. It occurs when the aspergillus fungi colonise the bronchi (**Fig 1**). The fungal spores trigger an asthma-like allergic reaction, reducing the efficiency of the air passages in the lungs and causes coughing, wheezing and shortness of breath.

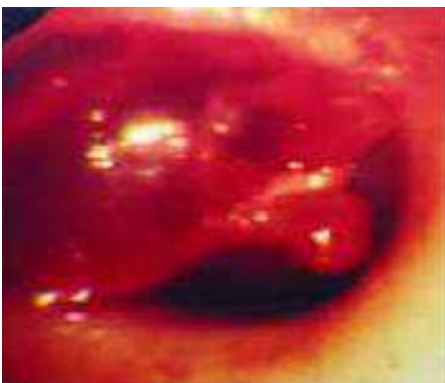


Fig 1. Inflammatory granulomatous lesion

Aspergilloma is the growth of the fungus in a pre-existing lung cavity (**Fig 2**) that has been caused by a lung disease such as tuberculosis, abscess, or sarcoidosis.

Invasive aspergillosis (IA) is a serious lung infection that affects people who have a weakened immune system. It causes a pneumonia-like infection that, as well as affecting the lungs, can spread to other areas of the body such as the eyes, heart, kidneys and brain; In fact, almost any

organ or system in the human body may be involved.

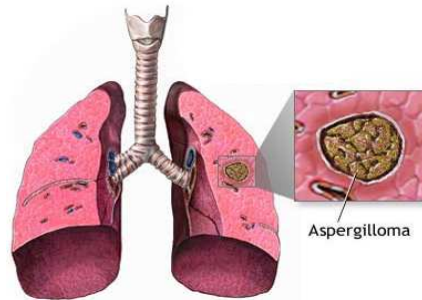


Fig 2. Growth of fungus in a pre-existing lung cavity

The genus *Aspergillus* includes over 185 species. Around 20 species have so far been reported as causative agents of opportunistic infections in man.

Among these, *Aspergillus fumigatus* is the most commonly isolated species, followed by *Aspergillus flavus* and *Aspergillus niger*. These 3 make up 95% of all aspergillosis infections.



Fig 3. Typical colonial growth of *Aspergillus fumigatus*.

Aspergillus fumigatus may be regarded as the most important airborne saprophytic fungus. It is largely found growing on soil, plant debris and rotting vegetation but can also be found inside buildings, especially in air conditioning systems and

hospitals. Numerous conidia (spores) are released into the air which we inhale, and in the healthy host, these are eliminated by innate mechanisms, (the mucous layer and the ciliary action of the respiratory tract, macrophages and neutrophils of the lungs) and do not cause illness.

However, an individual with a weakened immune status may be susceptible to infection. Examples include patients with leukaemia, chemotherapy patients or those on high dose steroid therapy, transplant patients, cystic fibrosis (CF), HIV AIDS sufferers, chronic obstructive pulmonary disease (COPD), chronic granulomatous disease (CGD) sufferers, severe asthma with fungal sensitivity (SAFS) and many others. Both adults and children can be affected.

Diagnosis

It can be very difficult to make an accurate diagnosis of aspergillosis, especially in a person who already suffers from respiratory problems, such as asthma or CF.



Fig 4. X-ray showing wedge-shaped lesion of the left lung caused by *Aspergillus*

Aspergillosis

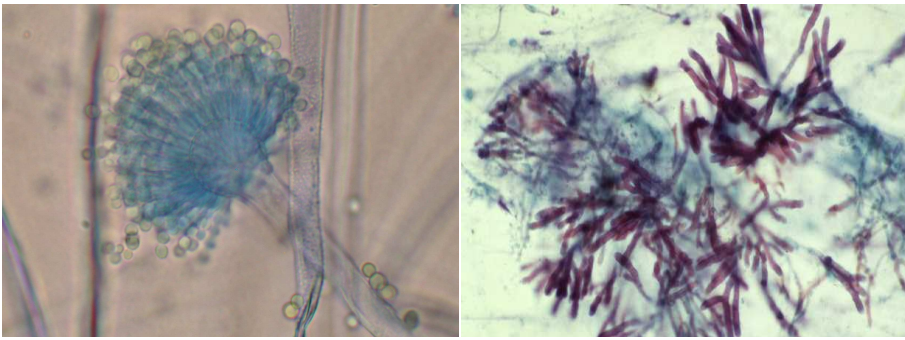


Fig 6. Left: KOH preparation showing a typical *Aspergillus* conidiophore. Right: *Aspergillus* hyphae as seen in a sputum Gram Stain.

Early identification is of course favourable to a better outcome.

Diagnosis is usually made based on symptoms, clinical history and radiographic imaging (Fig 4) with confirmation by culture (Fig 3).

When observed under the microscope in a sputum gram stain (Fig 6), *Aspergillus* are typically septate hyphae, that branch dichotomously at acute (45°) angles with no or very slight constriction at the septa.

In a potassium hydroxide (KOH) preparation (where a drop of specimen is added to a drop of KOH), *Aspergillus* hyphae are clear and septate. Each conidiophore (Fig 6) has a swollen vesicle from which the conidia (spores) are generated.

The problem is that because *aspergillus* spores are found everywhere, culture, particularly from sputum samples, has a low sensitivity and specificity (see below) and must be repeatedly isolated in order to be confirmed as a true infection. By the time this has been achieved (sometimes up to 4 weeks), the prognosis for the patient is poor.

An average of 5.5 days elapses between onset of symptoms and first radiographic signs, and 4.5 days before the detection of

“Halo” regions by CT imaging (Fig 5).

It has been suggested that galactomannan, a constituent of the fungal cell wall, can be detected by ELISA methods even earlier than this, while PCR techniques have the potential to reduce this further.

However, although the sensitivities of the latter two methods are much higher than that of culture, the variations in way in which they are performed means that their specificities differ too much to make them accurate enough to use for diagnosis alone. For now they remain just a tool.

Sensitivity

Is the accuracy with which a test can confirm the presence of an infection. Tests with high sensitivity show few false negatives.

Specificity

Is the accuracy with which a test can confirm the absence of an infection. Tests with high specificity show few false positives.

Prevention

The main way to prevent aspergillosis is by avoiding exposure to the *aspergillus* fungus. Those with asthma, a suppressed immune system, or a history of lung disease should avoid places where the *aspergillus* fungus is likely to be, such as marshlands and bogs, forests, compost heaps, grain stores, rotting vegetation and piles of dead leaves. Ensuring that there is adequate ventilation and dust control can reduce the harmful effects of the fungus in buildings. This is particularly important if hospital construction or renovation work is being carried out. Disinfection, temperature, humidity control and ensuring adequate air flow are all useful ways of preventing infection from occurring.

Conclusion

- There are several forms of the disease aspergillosis.
- Invasive Aspergillosis occurs almost exclusively in patients who are immunocompromised.
- Detection of *Aspergillus* by repeat culture is infrequently achieved and when it is, there is a poor prognosis for the patient.



Fig 5. CT image showing left lung “halo”