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Mucormycosis: Maiming COVID Patient in India

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Abstract:

Mycosis caused by fungi of the genus Mucor usually primarily involving the lungs and invading other tissues by means of metastatic lesions.

Mucormycosis (sometimes called zygomycosis) is a serious but rare fungal infection caused by a group of molds called mucormycetes. These fungi live throughout the environment, particularly in soil and in decaying organic matter, such as leaves, compost piles, or rotten wood. Diagnosis is by biopsy and culture, with medical imaging to help determine the extent of disease. It may appear similar to aspergillosis. Treatment is generally with amphotericin B and surgical debridementPreventive measures include wearing a face mask in dusty areas, avoiding contact with water-damaged buildings, and protecting the skin from exposure to soil such as when gardening or certain outdoor work. It tends to progress rapidly and is fatal in about half of sinus cases and almost all cases of the widespread type.

We discuss the disease, its current management, diagnostics and potential new modalities of treatment.

Keywords: History, Mucormycosis classification, Root cause, Symptoms, Mechanism, Complications, Treatment, Prevention.

1. Introduction:

Mucormycosis is a type of fungal infection. It's relatively rare, but also very serious.Formally known as zygomycosis, this infection tends to occur most often if you have weakened immunity from an illness or health condition.It's important to get treatment. If left untreated, mucormycosis can be fatal

Mucormycosis, also known as black fungus, is a serious fungal infection, usually in people with reduced ability to fight infections.Symptoms depend on where in the body the infection occurs. It most commonly infects the nose, sinuses, eye and brain resulting in a runny nose, one sided facial swelling and pain, headache, fever, blurred vision, swollen and bulging eye, and tissue death.Other forms of disease may infect the lungs, stomach and intestines, and skin.

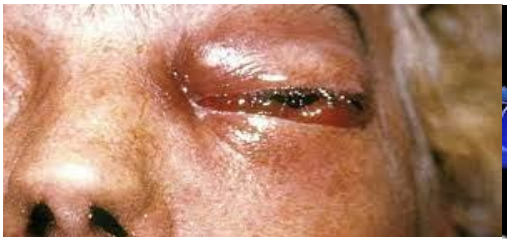
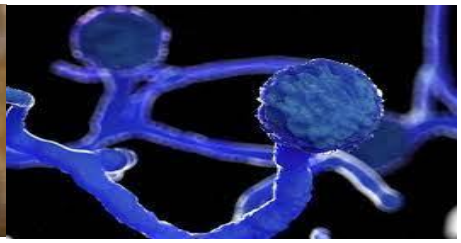
It is spread by spores of molds of the order Mucorales, most often through inhalation, contaminated food, or contamination of open wounds. These fungi are common in soils, decomposing organic matter (such as rotting fruit and vegetables), and animal manure, but usually do not affect people. It is not transmitted between people. Risk factors include diabetes with persistently high blood sugar levels or diabetic ketoacidosis, low white cells, cancer, organ transplant, iron overload, kidney problems, long-term steroids or immunosuppressant use, and to a lesser extent in HIV/AIDS.

Mucormycosis is usually rare, affecting fewer than 2 people per million people each year in San Francisco, but is now ~80 times more common in India. People of any age may be affected, including premature infants. The first known case of mucormycosis was possibly one described by Friedrich Küchenmeister in 1855. The disease has been reported in natural disasters; 2004 Indian Ocean tsunami and the 2011 Missouri tornado. During the COVID-19 pandemic 2020/21, an association between mucormycosis and COVID-19 has been reported. This association is thought to relate to reduced immune function during the course of the illness and may also be related to glucocorticoid therapy for COVID-19. A rise in cases was particularly noted in India.

What is Mucormycosis?

Mucormycosis is a very rare infection. It is caused by exposure to mucor mould which is commonly found in soil, plants, manure, and decaying fruits and vegetables. "It is ubiquitous and found in soil and air and even in the nose and mucus of healthy people," says Dr Nair.

It affects the sinuses, the brain and the lungs and can be life-threatening in diabetic or severely immunocompromised individuals, such as cancer patients or people with HIV/AIDS.

History:

The first case of mucormycosis was possibly one described by Friedrich Küchenmeister in 1855. Fürbringer first described the disease in the lungs in 1876. In 1884, Lichtheim established the development of the disease in rabbits and described two species; Mucor corymbifera and Mucor rhizopodiformis, later known as Lichtheimia and Rhizopus, respectively. In 1943, its association with poorly controlled diabetes was reported in three cases with severe sinus, brain and eye involvement.

In 1953, Saksenaea vasiformis, found to cause several cases, was isolated from Indian forest soil, and in 1979, P. C. Misra examined soil from an Indian mango orchard, from where they isolated Apophysomyces, later found to be a major cause of mucormycosis. Several species of mucorales have since been described. When cases were reported in the United States in the mid-1950s, the author thought it to be a new disease resulting from the use of antibiotics, ACTH and steroids. Until the latter half of the 20th century, the only available treatment was potassium iodide. In a review of cases involving the lungs diagnosed following flexible bronchoscopy between 1970 and 2000, survival was found to be better in those who received combined surgery and medical treatment, mostly with amphotericin B.

Arnold Paltauf coined the term "Mycosis Mucorina" in 1885, after describing a case with systemic symptoms involving the sinus, brain and gastrointestinal tract, following which the term "mucormycosis" became popular. "Mucormycosis" is often used interchangeably with "zygomycosis", a term made obsolete following changes in classification of the kingdom Fungi. The former phylum Zygomycota included Mucorales, Entomophthorales, and others. Mucormycosis describes infections caused by fungi of the order Mucorales.

Classification:

Generally, mucormycosis is classified into five main types according to the part of the body affected A sixth type has been described as mucormycosis of the kidney, or miscellaneous, that is mucormycosis at other sites, although less commonly affected.

- Sinuses and brain (rhinocerebral); most common in people with poorly controlled diabetes and in people who have had a kidney transplant
- Lungs (pulmonary); the most common type of mucormycosis in people with cancer and in people who have had an organ transplant or a stem cell transplant
- Stomach and intestine (gastrointestinal); more common among young premature and low birth weight infants, who have had antibiotics, surgery, or medications that lower the body's ability to fight infection.
- Skin (cutaneous); after a burn, or other skin injury, in people with leukaemia, poorly controlled diabetes, graft-versus-host disease, HIV and intravenous drug use.
- Widespread (disseminated); when the infection spreads to other organs via the blood.

Cause of Mucormycisis:

Mucormycosis is a fungal infection caused by fungi in the order Mucorales.In most cases it is due to an invasion of the genera Rhizopus and Mucor, common bread molds. Most fatal infections are caused by Rhizopus oryzae.[16] It is less likely due to Lichtheimia, and rarely due to Apophysomyces.Others include Cunninghamella, Mortierella, and Saksenaea.

The fungal spores are in the environment, can be found on for instance moldy bread and fruit and are breathed in frequently, but cause disease only in some people. addition to being breathed in to be deposited in the nose, sinuses and lungs, the spores can also enter the skin via blood or directly through a cut or open wound, or grow in the intestine if eaten. Once deposited, the fungus grows branch-like filaments which invade blood vessels, causing clots to form and surrounding tissues to die. Other reported causes include contaminated wound dressings. Mucormycosis has been reported following the use of elastoplast and the use of tongue depressors for holding in place intravenous cathetersOutbreaks have also been linked to hospital bed sheets, negative-pressure rooms, water leaks, poor ventilation, contaminated medical equipment, and building works.

Moldy bread

Dung

Mold on wet soil

Mucormycosis is caused by exposure to mucormyete molds. These organisms occur in:

- leaves
- piles of compost
- soil
- rotting wood

You can contract mucormycosis by breathing in affected mold spores in the air. This is referred to as a sinus (pulmonary) exposure. In turn, you may develop the infection in your:

- central nervous system (rarer)
- eyes
- face
- lungs
- sinuses

The fungus can also infect your skin via a cut or burn (cutaneous exposure). In such cases, the wound or burn ends up becoming the area of infection. While these types of molds can naturally occur in the environment, not everyone exposed will get the fungal infection. You may be at an increased risk of contracting this type of infection if you have a weakened immune system. Conditions that may increase your risk include:

1) burns
2) cuts and scrapes
3) cancer
4) recent organ transplant
5) HIV or AIDS
6) diabetes (especially if it's not being treated properly)
7) surgery

What are the Symptoms of Mucormycosis?

These include pain and redness around eyes and/or nose, fever, headache, coughing, shortness of breath, bloody vomits, and altered mental status. Warning signs can include toothache, loosening of teeth, blurred or double vision with pain.

Mucormycosis presents itself as either a respiratory or a skin infection. Signs of a related sinus or respiratory infection may include:

- cough
- fever
- headache
- nasal congestion
- sinus pain

With a skin infection, mucormycosis can develop within any part of your body. It may initially occur at the site of skin trauma, but it can quickly spread to another area. Be on the lookout for symptoms such as:

- blackened skin tissue
- blisters
- fever
- redness
- swelling
- tenderness
- ulcers

Mechanism of Mucormycosis:

Most people are frequently exposed to Mucorales without developing the disease. Mucormycosis is generally spread by breathing in, eating food contaminated by, or getting spores of molds of the Mucorales type in an open wound. It is not transmitted between people.

The precise mechanism by which diabetics become susceptible is unclear. In vivo, a high sugar alone does not permit the growth of the fungus, but acidosis alone does. People with high sugars frequently have higher iron levels, also known to be a risk factor for developing mucormycosisIn people on deferoxamine, the iron removed is captured by siderophores on Rhizopus species, which uses the iron to grow.

How is Mucormycosis Diagnosed?

It depends on the location of the suspected infection. A sample of fluid from your respiratory system may be collected for testing in the lab; otherwise a tissue biopsy or a CT scan of your lungs, sinuses etc may be conducted.
People who have mucormycosis often don't know they have it. You may get diagnosed with the condition upon going to the doctor for a lung, sinus, or skin infection. You should see your doctor for any type of suspected infection.Mucormycosis is diagnosed by looking at a tissue sample in the lab. Your doctor may collect a sample of phlegm or nasal discharge if you have a suspected sinus infection. In the case of a skin infection, your doctor may also clean the wounded area in question

What are Complications of Mucormycosis?

1) The complications of mucormycosis are serious and are related to the body area initially infected but also can occur in other body regions because the fungi often spread to the organs or tissues that physically contact or are near the originally infected area.
2) In addition, because surgical debridement is almost uniformly needed, some normal tissue may be destroyed because the surgeon must remove all tissue that is dead or dying.
3) Unfortunately, that means the surgeon may have to remove some normal tissue to insure all of the fungi are removed.
4) An example is infection of the eye orbit; often the whole eye must be removed.
5) Consequently, serious complications may occur, such as
    - blindness,
    - meningitis,
    - brain abscesses,
    - osteomyelitis,
    - pulmonary hemorrhages,
    - gastrointestinal hemorrhages,
    - cavitary lesions in organs and eventually secondary bacterial infections, sepsis, and death.

Is it possible to prevent Mucormycosis?

- Avoiding predicted disasters (hurricanes) and taking safety measures if possible (getting to safe shelters if warning of a tsunami, tornado, or earthquake) are probably the best ways to avoid mucormycosis.
- Patients with debilitating disease can increase their likelihood of avoiding the infection by good control (treatment) of their health problem with diabetes as the classic example.
- Some clinicians suggest that if a patient is exposed to circumstances that are favorable for mucormycosis to develop, if they are taking prednisone (Deltasone, Orasone, Prednicen-M, Liquid Pred) or deferoxamine (Desferal), they should cease these medications (consult your doctor or emergency center if possible before modifiying medications).
- Finally, if a person thinks they may have mucormycosis, they should consult their doctor or an emergency center immediately.
- There is no vaccine available for mucormycosis.
- Patients may need additional surgeries and usually need antifungal therapy for an extended time period (weeks to months) depending on the severity of the disease.

Consultation with an infectious-disease expert is advised

How is Mucormycosis Treated?

Mucormycosis needs to be treated with prescription antifungal medicine. In some cases, it can require surgery; it can lead to eventual loss of the upper jaw and sometimes even an eye.

- Treatments for mucormycosis need to be fast and aggressive. The need for speed is because by the time even the presumptive diagnosis is made, often the patient has suffered significant tissue damage that cannot be reversed.
- Most patients will require both surgical and medical treatments.
- Most infectious-disease experts say that without aggressive surgical debridement of the infected area, the patient is likely to die.

- Medications play an important role. Two main goals are sought at the same time: antifungal medications to slow or halt fungal spread and medications to treat any debilitating underlying diseases.
    - Amphotericin B (initially intravenous) is the usual drug of choice for antifungal treatment.
    - In addition, posaconazole or isavuconazole may treat mucormycosis.
- Patients with underlying diseases like diabetes need their diabetes optimally controlled.
- Patients normally on steroids or undergoing treatment with deferoxamine (Desferal; used to remove excess iron in the body) are likely to have these medications stopped because they can increase the survival of fungi in the body.

Life after Surgery for Mucormycosis

Mucormycosis can lead to loss of the upper jaw and sometimes even the eye. “Patients would need to come to terms with loss of function due to a missing jaw — difficulty with chewing, swallowing, facial aesthetics and loss of self-esteem, doctors say. Be it the eye or upper jaw, these can be replaced with appropriate artificial substitutes or prostheses. While prosthetic replacement of the missing facial structures can commence once the patient stabilises after surgery, doctors it is important to reassure him about the availability of such interventions instead of leaving him to panic with the sudden unforeseen loss, augmenting a post-Covid stress disorder which is already a reality,” said Dr B Srinivasan, a maxillofacial prosthodontist. “Prosthetic reconstruction can be effected after surgery, but interim solutions should be planned even before surgery of the jaws for better long-term outcomes. Prosthetic reconstruction can ensure that the cure is not more dreadful than the disease itself,” he said.

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