Systemic overview of Ayurvedic and Allopathic of Mucormycosis

Bamb Y, Bamb P, Sirvi I

ABSTRACT: Mucormycosis upshot from a variation of black fungi that may be typically harmless environment fungi and in essence affect immune compromised patients. Infection spot by five types and caused by group of moulds as mucormycetes. Because of the increased prevalence of diabetes mellitus, cancer, leads blindness, death and organ transplantation the more number of patients at risk for this viral infection in increasing. Regardless of forceful treatment, which incorporates distorting careful debridement and habitually adjunctive harmful antifungal treatment, the general death rate is high. Since patients with raised serum levels of accessible iron are exceptionally vulnerable to mucormycosis and these diseases are profoundly angioinvasive, accentuation is set on the capacity of the life form to secure iron from the host and on its collaborations with endothelial cells lining veins. A few promising remedial techniques in preclinical stages are recognized. The pathogenesis of mucormycosis and the host response to invading hyphae ultimately will provide target for novel mechanism. Comparisons of Ayurvedic and allopathic mechanism of action strategies were carried out in the present time. Depending upon the patients condition and symptoms. Ayurveda is the treatment long lasting. Allopathic treatments inhibit viral infection and quick relief. Researchers & scientists may face a challenge of a drugs that cure a mucormycosis in preclinical stages of black fungi. Symptom may include headache, loss of smell, fever, runny nose & area of death tissue will be seen as black color due to tissue death. When infection occurs in face & lungs may have a high risk of blurred vision and breathing, respectively. Missing of jaw, difficulty in chewing,swallowing problems can be face after surgery of mucormycosis The infection seen in 5 types such as rhino cerebellar, pulmonary, disseminated, cutaneous and gastrointestinal.

INTRODUCTION: Mucormycosis is an infectious disease mainly affect to immunocompromised and diabetes mellitus patients [1][2]. It is also known as black fungus or zygomycosis, belonging to the family of mucorales have ubiquitous in nature[2]. After covid-19 it can be caused due to reduction of immune function & glucocorticoid therapy and affecting at any age of people including premature infants. Mucormycetes spores mainly found in soil, decomposing organic matter and enters through inhalation, injuries, contaminated food, etc. in human body[1][3]. Symptom may include headache, loss of smell, fever, runny nose & area of infection appear as black color due to tissue death. When infection occurs in face & lungs may have a high risk of blurred vision and blood in cough, difficulty in breathing, respectively. Missing of jaw, difficulty in chewing,swallowing problems can be face after surgery of mucormycosis The infection seen in 5 types such as rhino cerebellar, pulmonary, disseminated, cutaneous and gastrointestinal[4].

HISTORY: Mucormycosis firstly identify in lab with the help of a tissue sample like phlegm or nasal discharge .In 1855 First time observed the symptoms of mucormycosis coined by Friedrich kuchenmeister[5]. In 1876 Furbringer first time detected disease in lungs[6]. In 1884 lithhein finding out newer stage of disease in rabbits and describing two species like mucorcorymbifer and mucourrhizapadiiforms . Scientists said that it’s a group member of fungii that causes mucormycosis also known as fungal disease . mucormycosis directly connected with environment like air, soil, decomposing organic matter such leaves, animal, dung etc[7].

PATHOPHYSIOLOGY: Mucormycosis is caused by a group of molds called as mucormycetes, in which mucorales are the ubiquitous fungus present in the soil and decaying matter. Mucormycosis mainly affect that people who have less immunity to fight against germs, viruses, etc. The main route of infection has through inhalation & other by injuries, ingestions, traumatic inoculations, in which spores can enter in blood vessels[8]. This spore can rapidly grow in blood vessels and decreases the blood volume. Due to less supply of blood in tissues, they can’t work properly hence, nutrition & oxygen supply also decreases & forms an ischemic condition. Due to ischemic condition, tissue necrosis occurs & area of death tissue will be seen as black color[9].
AYURVEDIC MEDICINE MECHANISM:

(A) Sanjivaniavati: It's also known as SanjeevaniGutika[10].


Ingredients: -1) Vaividang (False black paper) - Embelia ribes 2) Sonth(Ginger Rhizome) - Zingiber officinale 3) Pippali (Long Pepper) - Piper longum 4) Harad(Chebulic Myrist) - Terminalia chebula 5) Bibhitaki(Baera) - Terminalia bellirica 6) Amla(India Gooseberry) - Phyllanthus emblica 7) Vacation (Sweet Flag) - Scotia Calamus 8) Giloy (Guduchi) - Tinospora cordifolia 9) Shuddha Vatsanabha - Aconitum ferox 10) Cow's Urine [11][12].

How to react: - In these ayurvedic(anti-toxic) medicine orally passed through the our body then attack to the our upper side respiratory tract and fight the viral infection and also bacterial infection and reduce the symptoms of viral infected body[13].

Dose formation: - Children: 2 mg (Per kg body weight)
Adults: 125 to 375 mg (1 to 3 tablet per day)
Geriatric dosage: 125 mg (1 tab)
Maximum possible dose: 750 me per day

Uses: - It is used for removal of viral infection of our upper side respiratory tract (primary symptoms)[14].

(B) Mahasudarshanghanavati: - It's a antiviral ayurvedic formulation and booster immunity herbal tablet[15].

Category: - Antiviral[15][16].

Ingredients: - Pohkar (Inularacemosa) Mulethi (Glycyrhrizaglabra) Kuda (Holarrhenaantidisenterica) Ajwain(Trachyspermumammi)[17] Indrajav (Holarrhenaantidisenterica) Bharangi (Clerodendrumserratum) Sahajan (Moringaetygosperma) ShudhaPhitakari (Alum(Pure) Vach (Acoruscalamus) Dalchini (Cinnamomumzeylanicum) Padamkhar (Prunus puddenm) Khas (Vetiveriazizanioides) Chandanshvet (Santalum album) Atis (Aconitum heterophyllum) Khareti (Sidacordifolia) Shalparni (Desmodiumgangeticum) Prishinparni (Uraiapicta) Viavidang (Embeliaribes) Tagar (Valerianawallichii) Chitrak (Plumbagozeylanica) Devdaru (Cedrusdeodara) Chava (Piper chaba) Patolpatra (Trichosanthesdioica) Buheda (Terminaliabellerica) Amla (Emblica officinalis) Haldi(Curcuma longa) Daruhaldi (Berberisaristata)[18].
How to react :- Take a mahasudarshngavanatiayurvedic medicine per prescribe physian. It orally pass through the body then attack to the viral symptoms like that swinflu, fever cough etc and cures a viral infection and releives cough and cold

Dose formulation :-4 tablet per day after meal[18].

Uses:-1) It use to be cures to viral symptoms of our body  2) It is a powerful medicine for viral infection purpose[19].

(c) DivyaKayakalpvati: DivyaKayakalpvati is an Ayurvedic medicine in which kaya means body and kalpa means transformation [21]. It is used in the treatment of yeast infections, ringworms,eczema,psoriasis,wrinkles pimples, dark circles,skin infection,etc. It can give a natural glow to the affected part of the body.DivyaKayakalpvati can detoxified the blood [22].

Category:- Antiacne. Antipyretic, Anti-inflammatory, Antiviral, Antifungal, Anriaging[21][23].
Ingredients:- panvad Boej, turmeric, Darhaldi,Kadira or catechu, karanja, Neem, Amla, Manjistha, Giloy, chirayata, kutki, Dronapushpi, satyanashi, katha, Rasmanikya[20][23]

How to react:
•How causes a skin infection:- The toxins such as bacteria, fungi can affect the skin and makes an impure blood with immune inflammatory reaction and cause a skin infection[23]. Due to blood impurities skin turn to dark and glow less and producing acne, rashes, and pimples[23].
•After take a dose of DivyaKayakalpvati:- It can betaken by oral route. Due to antifungal property of a kayakalpvatit can fight with fungus and kill the fungi and controlled the infection and helps to cure the skin infection, remove black marks and burning sensation.

Dose formation: For adult:- 2 tablets with warm water, before meal[24]. For geriatric:- 2 tablets with lukewarm water, after meal.

Precautions to be taken before and after take a dose:- 1) Avoid rubbing the skin[21].
2) Avoid milk before 1 hr and after 1 hr when take a dose.
3) Avoid spicy and fried food.

(D) GandhakDruti: ‘Druti’ is derived from plant of the root “GandhakDruti means that Drutatva [liquefaction]. It is necessary process of Rasashastra in which metal or minerals are converted into properly stable liquefaction state[25]. Druti where the sulfur is converted into stable liquid state with the help of different herb, mineral and heat. It is indicated for various ailment such as kasa ,pandu , kshudra and also to enhance health[25][26].

Category: - Antiviral and all skin infection types.

Ingredient:
Drug of quantity:- Shuddhagandhaka- 1 part, Shunthi- 1/16 part, Pippali-1/16 part, Maricha- 1/16 part, Tila Taila- Quantity sufficient[26].
Drug material:- Impure Gandhaka, Cow milk, Earthen vessel, Sarava, Cotton cloth, Multanimitti for sundhbandhana, Uplas.

How to react:-
(A) External :- It is medicinal oil which is an application in each and every skin ailment. In these antiviral and a skin infection medicine externally apply the disease part of a skin and after some time symptoms have of diseases reduced.
(B) Internal :- It can be given in the dose of 1-2 drops to 5 -7 the ml or as per the disease of the treatment and a condition. Antiviral medicine has orally passed through our body then attack the infected part of or an organ and an internal skin and fight the infected part . Slowly - slowly fight and reduce the symptoms[26].

Dosage from :- 1) For Adults:- 1-3 grams in divided doses per day.
2) For child up to 5 years: - 250 mg per day
3 ) For children of 5-12 years of age: - 250 mg -1 gram per day in equal doses[25][26].

Uses :-1. It is useful of all types of skin disease like that eczema, lichenusplanus , lichen simplex , worm infection[26].
2. In external can be used to dress the open cuts, burned skin etc.
3. Prevent recurrence.
4. Alleviates severe itching attack immediately with massage.
**Siddhamrut Kadha:** Its improve the immune system internally and protect the body from infected part. Its is present powder from 10 - 15 medicine plant of part are made siddhamrutkadha. This kadha boost immunity to fight against fungi, bacteria, virus.

**Category:** Antioxidant, Antiviral, Antifungal

**Ingredient:** - Glycyrrhiza Glabra, Desmodium gangeticum, Acacia catechu, Tinospora cordifolia, emblica officinalis, Stereospermum suaveolens, Azadirachta indica, Andrographis paniculata, Carum carvi, Alsonia scholaris, Syzigium aromaticum, Tulsi, Kalimirchi, Saunth, Dalchini and pincon of turmeric.

**Process of drug taken:**
1. Divide the powder into three parallel parts.
2. Boil one part powder in a glass of water in a steel vessel on medium heat till it becomes half a glass and then filter it.
3. In the filtered decoction, mix one teaspoon ginger juice, one teaspoon lemon juice and one teaspoon honey in place of patient honey, take half teaspoon turmeric and mix it well in the morning on an empty stomach (within 30 minutes after making the decoction).
4. Similarly, the decoction has to be consumed for 3 days.
5. After this, after 3 days in the morning on an empty stomach, after roasting 4 garlic cloves well on the pan (without oil), chew and eat and drink 1 glass of lukewarm water.
6. After this, do not eat or drink anything for 1 hour. Children of 5 years have to eat 2 cloves of garlic.

**How to react:** Siddhamrutkadha is fall of antioxidant and vitamins that are very essential to enhance your immune system and symptoms of body part. This kadha helps to reduce internal infection and external infection by destroying free radicles. It is directly spread in blood so that blood purification with reduce the symptoms of infected part like that fungi. Some of the best siddhamrutkadha to boost the immunity are elderberry, enchinacea and ginger.

**Dose formation:** it is generally advised to consume 30 to 60 ml of the kadha after meals two or three a day. It is best to consume it with one glass of water.

**Uses:**
1. Reduce fever
2. stimulates digestion
3. Increase immunity
4. reduce infected part
5. Detoxifies body.

**ALLOPATHIC MEDICINE MECHANISM:**

**1. POSACONAZOLE:** Posaconazole is an antifungal drug that is used to treat of micromyosidiseases. The brand names of noxafil and posanol. It was approved for medical use in the united states in September 2006. It kills and stop the growth of the fungi and destroying its cell membrane.

**Mechanisms of action:**
1. In the cell membrane is a lipid bilayer with protein, calcium, K+ embedded in it. Its differs by presence of furan ring and substitution of chlorine with fluorine. In side chain of posaconazole and traconazole add with the azole target CYP51. Furgus trawl is the major sterile synthesized by 14 alpha demethylase enzyme that provide stability to the membrane.
2. Glucans synthase complex located in the cell membrane is responsible for synthesis of beta 1-3 glucan chains. Elongation and cross-linking of the glue can change with chitin imparts toughness to the cell wall.
3. The easels have broad spectrum antifungal activity they impair our gastrual synthesis by inhibiting the fungal cytochrome p450 medicated enzyme 14 alpha demethylase inhibiting demethylation of one ester all and accumulation of methyl sterols lack of ergosterol leads to disruption of fungal cell membrane. The many multiple hydrophobic result from and the interaction of the extended side chain within a channel of CYP51. protein and small molecules pass in extracellular membrane so that fungal cell membrane destroying and new cell from.
2. Amphotericin B: Amphotericin B is a macrocyclic polycyclic antibiotic with 7 conjugated double bonds. It is derived from Streptomyces nodosus & effective in first line therapy or as treatment for invasive fungal infection. It is an fungicidal and has a stimulatory effects which can attacks on phagocytic cell and stops to grow fungal infection. Amphotericin B administered by intravenously and metabolized in kidney and 40% excrete out by urine [32][33].

Mechanism of action: Amphotericin B acts by two different ways:
1. By inducing oxidative damage: Amphotericin B causing an oxidative stress inside the fungal cell and remains unclear when extent of oxidative damage and contribute with drug effectiveness. When addition of free radicals antioxidants or scavengers, it can increase membrane permeability. Amphotericin B can resist to species like scedosporium prolificans without affecting the cell wall [33].

2. By binding with ergosterol at cell membrane and induce pore formation and ergosterol sequestration: Amphotericin B has a higher affinity towards ergosterol and forms bimolecular complex which can nurture the pores and stabilized by Vanderwaal interactions. Formation of pores in cell membrane which leads to inhibit the fungal glycolysis and quick release of potassium, magnesium & small molecules present inside the fungal cell & results the death of fungal cell [32].
Isavuconazole: is also known as creseba. The drug FDA department approved in March 2015 for the treatment of mucormycosis. Isavuconazonium sulphate is a prodrug and also active agent. It is a sulphate fastly metabolized by serum butylcholinesterase to the active form isvuconazole (ISZ). As an important fungal infection isavuconazole is second generation triazole (Tri+zole) with a wide brod spectrum. The drug available in market is IV, Intrachangeble, and oral form approved by USA and EU for the treatment of mucormycosis and it’s a water soluble prodrug [34][35].

**Mechanism of action** :-
1. Isavuconazole family of drug specifically targets the fungal cell membrane [35].
2. The cell membrane of fungi is similar to that of other eukaryotic cell and is composed of a lipid bilayer with protein embedded within it. A major component of the fungal cell membrane is the presence of sterols which are virtually absent from all prokaryotes including bacteria [36].
3. One of the essential sterols in the fungal cell membrane is orga sterile in most fungi it replaces the cholesterol component found in higher eukaryotic cell membranes [35][36].
4. Ergo sterile provides stability and flexibility to the fungal cell membrane lanosterol serves as the precursor for the formation of ergo sterile although many enzymes are involved in the formation of ergosterol the 14 alpha demethylase enzyme is responsible for the C14 alpha methylation of lanister all it is essential enzyme that serves as target for anti fungal agent [36][37].
5. Although some a souls have an immediate effect of damaging the fungal cell membrane directly.
6. The major mechanism of action is by binding the cytochrome p450 mediated 14 alpha demethylase are enzyme thus inhibition the diminution of lanister all and blocking the synthesis of ergosterol in turn this result in an accumulation of 14 alpha methyl sterile and a depletion of argost all in the cell membrane.
7. The lack of ergosterol in the fungal cell membrane makes it very unstable eventually cell membrane begins to break down and the fungal organism dies [37].

![Figure 4. Isavuconazole mechanism of action](image-url)
## COMPARISON OF ALLOPATHIC DRUG AND AYURVEDIC DRUG[38][39][40][41]

<table>
<thead>
<tr>
<th>POINTS</th>
<th>AYURVEDA</th>
<th>ALLOPATHY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origin</td>
<td>The naturally available plants and herbs.</td>
<td>The chemical and synthetic things alone.</td>
</tr>
<tr>
<td>Approach</td>
<td>Holistic</td>
<td>Non – holistic</td>
</tr>
<tr>
<td>Healing Time</td>
<td>Natural but take more time.</td>
<td>Quick process with spontaneous relief.</td>
</tr>
<tr>
<td>Side Effect</td>
<td>Ordinary natural.</td>
<td>This is concomitant no side effects.</td>
</tr>
<tr>
<td>Testing</td>
<td>It is tested on animals. The process may lead to in efficiency and irreversible side effects both on the humans and animals.</td>
<td>It is not tested on animal for its effect and action. It is not bring more amounts of harm to the human body.</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Done by use of five sense or guns.</td>
<td>Done by laboratory equipments and investigations.</td>
</tr>
<tr>
<td>Therapeutic level</td>
<td>This considers cure of a disease as the only way to go for the treatments. there cannot be down than the a medical science.</td>
<td>Science seen to be confused for most of time. These talk about the treatments and managements.</td>
</tr>
<tr>
<td>Aim</td>
<td>The wellness is a complete packaging not a scattered tissue.</td>
<td>Believe to changes of the organ.</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Not developed enough for quick healing.</td>
<td>Surgical treatments are more advanced.</td>
</tr>
<tr>
<td>Evidence</td>
<td>The nature it directly means that it is following some natural wisdom and a universal truth, which need not to be launch and withdraw.</td>
<td>The system of medicine but not that true the physicians launches and withdraws medicines it never seems to be evidence based system of medicine.</td>
</tr>
<tr>
<td>Wholesomeness</td>
<td>The wellness is a complete package not a scattered issue.</td>
<td>Believe to change of the organs.</td>
</tr>
<tr>
<td>Natural</td>
<td>To follows the nature is the only way to achieve the complete wellness.</td>
<td>They believe in chemical and synthetic things alone.</td>
</tr>
<tr>
<td>Root cause</td>
<td>The important role the root cause first and then applies the same understanding to root out the diseases form the body.</td>
<td>Medical science understands this things and they keep on suppressing the sign and symptoms alone not concerned with the root cause of a disease.</td>
</tr>
<tr>
<td>Diet</td>
<td>Brings permanent cure for the suffering by penetrating deep into the cells.</td>
<td>Brings spontaneous relief.</td>
</tr>
</tbody>
</table>

**CONCLUSION :-** The outbreak of the fungus can affects the public & medical financial infrastructure. Allopathic treatments can take short time with severe side effects but ayurvedic treatments take long time to recover. Due to emergency conditions, peoples & doctors can go towards allopathic treatments for rapid action but they can face various side effects. Mucoral spores requires less immunity of human to attack & people have a high risk of blindness or death. To avoid blindness, death we can build a strong immune system by eating healthy foods. The potential advantages of intercessions that would supplement existing treatments would be significant for patients with mucormycosis.
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