Zygomycosis

Presentation Developed By: Jacob Rose, Tom Mariani, Shalyn Russell, and Terra Runyon

Also known as Mucormycosis and Phycomycosis

Rare invasive fungal disease
- First human case depicted in 1885

Often attacks the eyes, sinuses, lungs and brain

Caused by zygomycetes
- Murocales
- Entomophthorales
- Mortierellales

Source: http://www.healthyclippings.com/mucormycosis.html

Zygomycosis Structure

- Filamentous
- Root like rhizoids
- Hyphae have no septa
- Unbranched sporangiophores with sporangium for a "head"
- Sporangium is thick walled
- Cell walls contain chitin, chitosan, and polyglucuronic acid.

Zygomycosis: Taxonomy

- Kingdom: Fungi
- Phylum: Zygomycota
- Class: Zygomycetes
- Order: Mucorales
- Family: Mucoraceae
- Genus: Rhizopus, Mucor, Rhizomucor

Zygomycosis Geographic Distribution

- Worldwide occurrence
- Widespread in tropical and subtropical regions of Africa and Southeast Asia
- Zygomycetes common to environment in bread mold, soil, manure, decaying fruit and vegetables
- Commonly found colonizing oral mucosa, nose, paranasal sinuses and throat (immense spore formation)

Etiological Agents

- Rhizopus arrhizus
- R. microsporus – rarely isolated from lesions
- R. azygosporus
- Mucor spp.
- Apophysomyces elegans
- A. corymbifera- rarely recorded in literature
- Rhizomucor pusillus
- Cunninghamhamella bertholletiae
- Absidia spp.
Zygomycosis Life Cycle

- Hyaline filamentous fungi
- Invades blood vessels
  - Thrombosis (clot) and necrosis (death) of infected tissue
- Asexual reproduction:
  - Formation of sporangiophores produced in sporangia
  - Genetically identical spores
- Sexual Reproduction:
  - Fusion of gametangia from + and - strains (if the species is heterothallic)
  - Forming a diploid zygote
  - Thick wall formed: structure called zygosporangium (zygospore)

Zygomycosis

- Epidemiology:
  - Usually limited to individuals with predisposed conditions
    - Diabetes mellitus (approx. 70%)
    - Major trauma (organ transplant)
    - Immunocompromised (HIV, leukemia)
    - Iron overload (deferoxamine)
    - Illicit intravenous drug use
  - Prevalent in third world countries; those with untreated underlying factors
- Pathogenesis:
  - Opportunistic
  - Spores inhaled and may deposit on nasal turbinates and/or pass into alveolar spaces.
  - Spores make contact with open wounds of skin and penetrate the flesh with hyphae.

Types of Infections

- Rhinocerebral Zygomycosis
  - Most common
  - Inhalation of sporangiophores
  - Clinical manifestations:
    - Necrosis in orbit, palate, face, nose, brain, starts in paranasal sinus
    - Diagnosis: collect nasal discharges, scrapings and aspirates from sinus

Types of Infections

- Pulmonary Zygomycosis
  - Inhalation of sporangiophores
  - Clinical manifestations:
    - Bronchioles and alveoli -- leads to pulmonary infarction and necrosis with cavitations
    - Diagnosis: sputum and needle biopsies from lesions

Types of Infections

- Gastrointestinal Zygomycosis
  - Ingestion of fungal elements
  - Clinical manifestations:
    - Necrotic ulcers
    - Diagnosis: biopsy tissue

Types of Infections

- Cutaneous Zygomycosis
  - Local implantation of fungal elements through skin
  - Clinical manifestations:
    - Necrosis of skin, plaques, ulcerations, abscesses, pustules
    - For diagnosis: skin scrapings
- CNS
  - Intravenous drug abuse
  - Leads to brain abscess

Case Study

- 37 yr old woman from People’s Republic of China
- 10 year history of enlarging plaque and nodules on face
- Lesion formed dark red plaque
- Microscopic examination revealed hyaline, broad, ribbon-like, sparsely septate, right-angled branching hyphae

© 2009 by the Infectious Diseases Society of America
Case Study con’t

- A fungal Cx of the lesion was obtained
- Microscopic examination revealed long, wide hyaline hyphae stolons, not fully developed
- Sperical sporangia, 100um diameter, easily rupturing membranes, spherical columella, and obvious collarettes
- Isolate identified as Rhizomucor variabilis confirmed by internal transcribed spacer region nucleotide sequencing
- Isolate susceptible to amphotericin B, resistant to other antifungal drugs; fluconazole, intraconazole, voriconazole, and caspofungin

© 2009 by the Infectious Diseases Society of America

Research Study

- 59 neonatal zygomycosis cases reported as of 2007
- 157 pediatric cases were published up to 2004
- 30 additional pediatric cases reported from 2004-2008
- Most common:
  - Gastrointestinal zygomycosis (54%)  
  - Cutaneous zygomycosis (36%)
- Adults have higher rates of sinopulmonary and rhinocerebral zygomycosis

Research study (Treatment)

- 73% of the 81 pediatric Pt’s who received antifungal therapy, received Amb formulation only.
- Remaining pt’s received mostly Amb combined with other antifungal agents, 92 (59%) endured surgery
- Antifungal therapy and surgery, significantly improved outcome of children with zygomycosis
- Reducing the risk of death by 92%
Antifungal therapy with Amb combined with surgical removal of infected tissue holds the greatest possibility for cure for adults.

Neonatal Zygomycosis has a high mortality rate, and a strong propensity to disseminate; therefore, early dx and Amb formulations with surgery can drastically improve an otherwise unfortunate outcome.

References

- Nichols L, Ocques RZ, and Daly Y. 2011. "Zygomycosis Associated with HIV Infection and Liver Transplantation." Pathology Research International; Article ID 545981 4 pg.

Questions and Answers

- What is the best treatment for zygomycosis?
  - Antifungal agents and surgery
  - Amphotericin B and surgery
  - Intraconazole and surgery
  - Amb

- What is the most common underlying condition causing zygomycosis?
  - HIV
  - Organ transplant
  - Diabetes mellitus
  - Iron overload

- What species of zygomycosis is rarely isolated from lesions?
  - Rhizopus microsporus
  - Rhizopus arrhizus
  - Apophysomyces elegans

- What causes a zygomycosis infection?
  - Mucur
  - Absidia
  - Rhizomucor
  - Rhizopus

- What is the most common type of zygomycete infection?
  - Pulmonary
  - Rhinocerebral
  - Mucormycosis
  - Rhizopus