### Blastomycosis

#### Source: pharmacy-and-drugs.com

**Blastomycosis**
- A rare infection caused by inhalation of *Blastomyces dermatitidis*
- 0.3-1.5/100,000 cases in endemic areas
- *Blastomyces dermatitidis* only known species

#### History
- Founded by Gilchrist in Baltimore (1890s)
- Thought to be a skin infection caused by a protozoan and titled Gilchrist’s disease
- Gilchrist was wrong
  - Disease not endemic to Baltimore
  - Is a fungus not a protozoan
  - Skin is secondary infection

#### History Cont’d
- Has 3 clinical forms:
  - Pulmonary (most common)
  - Cutaneous
  - Systemic
- Pulmonary infection discovered by Witorsch and Utz in 1968

#### Blastomycosis dermatitidis

**Dimorphic fungus:**
- Conidia inhaled
- Transformed to yeast in lungs (37°C)

**Chronic disease affecting:**
- Lungs
- Skin
- Bones
- GI tract
- Other organs

#### Blastomycosis

- Asymptomatic – 50%
- Acute Pulmonary – Very similar to pneumonia, and hard to distinguish
- Chronic Pulmonary – Can develop lobar infiltrates leading to carcinoma
- Skin – Ulcers, verrucous lesions, or subcutaneous lesions
- Bones – Ribs and vertebrae (osteolytic)
- GI – 10-30% mainly attacks prostate and epididymis
**SYMPTOMS**
- Chest pain
- Cough
- Fatigue
- Fever
- Stiffness
- Rash
- Shortness of breath
- Weight loss

**TAXONOMY**
- Taxonomic Classification
  - Kingdom: Fungi
  - Phylum: Ascomycota
  - Class: Euascomycetes
  - Order: Onygenales
  - Family: Onygenaceae
  - Genus: Blastomyces
  - Species: dermatitidis

**ETIOLOGY**
- *Blastomyces dermatitidis*
  - Thermal dimorphic fungus
    - Exists as a mycelial form in nature and a yeast form in tissue
    - Grows as a broad-based budding yeast at 37°C. At 25°C, produces mycelia and can produce conidia.

**BASIC BIOLOGY**
- Macroscopic Features
  - At 25°C
    - Growth rate: slow to moderately rapid.
    - Colony diameter: 0.5 to 3 cm following incubation for 7 days on potato glucose agar.
    - Texture: appears granular to verrucose on the surface.
    - Color of the colony: white to beige.

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- Microscopic Features
  - At 25°C
    - Septate hyaline hyphae and unbranched short conidiophores are observed.
    - Conidiophores arise. The conidia are hyaline and unicellular.
At 37°C
- Fungus appears as budding yeast cells.
- The yeast cells (8-12 µm in diameter) typically have double-contoured refractile walls and a broad base attaching the bud to the parent cell.
- These blastoconidia are globose in appearance.

Probable saprobe of the soil.
- Inhibits decaying wood material.
- Proximal to large bodies of water.
- Isolation is likely when sample contains soil and rich organic material.
  - Animal feces
  - Plant fragments
  - Insect remains
  - Dust

It is one of the endemic mycoses in the U.S.
- Endemic areas include:
  - North America
    - Mississippi river valley
    - Ohio river valley
    - Missouri river valley
    - Midwestern and Canadian providences bordering Great Lakes
  - Africa
    - Within these endemic regions are hyperendemic regions—high rates of blastomycosis
      - Lincoln Country, Wisconsin—outbreak from January to April 2006
        - 27 confirmed cases compared to typical 8
      - Source—Pine needle pine

- Presentation is pneumonia with radiography revealing an alveolar or mass-like infiltrate.

- Chronic pneumonia
  - Weight loss, night sweats, fever, cough, and chest pain.

- Acute pneumonia
  - Fever, chills, and productive purulent cough
CUTANEOUS

- Skin lesions with or without pulmonary lesions.
  - Either verrucous or ulcerative
  - Verrucous – has an irregular and raised border often with crust and exude above the abscess in the subcutaneous tissue.
  - Ulcerative – occurs when subcutaneous abscess spontaneously drains. Borders are raised and distinct.

GENITOURINARY

- Often present at the same time as infection in lung.
- Men are more likely to have extrapulmonary blastomycosis.
  - Prostatitis and epididymoorchitis are common.
- Female genital tract less frequently diagnosed
  - Endometrial infection and tubo-ovarian abscess

OSTEOARTICULAR

- The vertebrae, pelvis, sacrum, skull, ribs or long bones are most frequent site of infection.
- Debridement may be required for cure.
  - Most resolve with antifungal therapy.
- Articular blastomycosis less common than osseous.
  - Most patients have concurrent disease of skin and lungs.
### CNS

- Least common area to be affected.
- Meningitis, cerebral abscesses, or blastomycomas are usual manifestations.
- Difficult to identify organism
  - Radiographic imagining—to biopsy the cranial abscesses or blastomycoma

### CNS (cont.)

### IMMUNOSUPPRESSED PATIENTS

Fluid or tissue from infected region are obtained and placed in 10% KOH

A mould form to yeast form conversion is required to pinpoint *B. dermatitidis*

- Required because yeast of *B. dermatitidis* can be similar to other species of *Coccidioides* and *Cryptococcus*

### IDENTIFYING *Blastomycosis dermatitidis*

From here, the conversion can be made by placing cells on a Kelley’s agar or blood agar supplemented with glutamine

**INCUBATE at 37°C**

DNA can be examined to verify *B. dermatitidis*
### Epidemiology Cont’d
- Disease is very sporadic
- One endemic region may have few outbreaks, while another has many (no consistency)
- Have been as many as 42 cases per 100,000 people
- More reported cases in males than females by 4-15 fold
- More prevalent in adults than children

### Pathogenicity
- Inhalation of conidia
  - Organism transforms into yeast in the alveoli
  - Induces inflammatory response – forms granuloma
  - Relatively resistant to phagocytosis
  - Growth occurs in the lungs
  - Can also spread via bloodstream
- Direct inoculation of the fungus into the skin
- Virulence factor – BAD1

### Diagnosis
- Cytology (sputum/biopsy of the lesion)
- Histopathology (biopsy of the lesion)
- Culture (sputum)
- Antigen (urine and serum)
- KOH

- Relatively easy to identify in tissue or exudates

### Diagnosis (cont.)
- Common specimens
  - Sputum
  - Bronchoalveolar lavage
  - Transtracheal aspirate
  - Lung biopsy

- Examine directly with KOH, calcofluor white, or both
- Primary isolation media should contain antibiotics and cycloheximide to inhibit saprophytic fungi
- All cultures should be incubated for 4-8 weeks

### Prevention
- Due to sporadic nature, there is no specific prevention
- No specific risk factors identified
- No vaccine, but getting close
  - Vaccine with the antigen WI-1 being tested
  - Prevents organism from binding to cells
- Maintain immune system
  - AIDS, transplant recipients, and other immune compromised patients at high risk

### Treatment
- Itraconazole and Amphotericin B are most common
- Fluconazole and Ketoconazole also used
- Antifungals may be used together and for prolonged periods of time (6 months or more)
- Serious cases = high doses of Amphotericin B
- Minor cases = Itraconazole and other antifungals
CASE REPORT

- Case #1 - 15 year old African American female
  - Multiple skin nodules
  - Swelling of the right ring finger
  - 2 months prior – small, nontender lesion was noticed
    - Increased in mass and became tender
    - Was incised and drained
    - Given oral Cephalexin

CASE REPORT (cont.)

- 1 month later
  - Multiple subcutaneous nodules
    - Right upper eyelid, upper arms, and right side of chest
  - Developed productive cough
  - Occasional haemoptysis
  - Progressive fatigue
  - Fever
  - Night sweats
  - Weight loss

CASE REPORT (cont.)

- Chest Radiography
  - Large posterior infiltrate
- Radiograph of right ring finger
  - Lytic cortical defect of proximal phalanx
- Computed Tomograph of the head
  - Several small lytic areas in brain stem
- Wounds were irrigated and closed
- Bronchoscopy
- Bronchoalveolar lavage

CASE REPORT (cont.)

- Silver stain
  - Numerous thick-walled, broad-based yeast forms
  - Allow for diagnosis of Blastomycosis

CASE REPORT (cont.)

- Did not tolerate Amphotericin B
- Abelcet – lipid soluble form of the drug
- Discharged in 10 days
- Outpatient treatment 3 times a week for 6 weeks
- Fluconazole orally for one year

CASE REPORT (cont.)

- Case #2 - 43 year old white male
  - Developed prostatitis
    - Only partial responsive to oral Ciprofloxacin
  - 1 month later – onset of cutaneous lesions
    - Dysuria, daily fevers, lost 5 kg in weight
    - Multiple verrucous and ulcerative lesions
      - Face, hands, trunk, legs
      - Mild bibasilar rales on auscultation of the chest
      - Swollen right ankle
      - Obvious effusion
      - Ulcerative lesion of the right lateral foot
CASE REPORT (cont.)

- Urine Analysis
  - Haematuria and proteinuria

- Chest Radiography
  - Right foot – luency of dome of talus, consistent with osteomyelitis
  - Left hand – cortical lytic lesion of middle phalanx of middle finger

- KOH prep
  - Yeast forms consistent with Blastomycosis

Treated with Amphotericin B
  - Continued for 9 days

Abcesses were incised and drained

Daily whirlpool bath treatments

Itraconazole orally for 6-12 months

CITATION

- http://www.health.state.mn.us/divs/idepc/diseases/blastomycosis/basics.html
- Atlas of fungal infections. 2nd ed. / editor, Carol A. Kauffmann ; editor-in-chief, Gerald L. Mandell ; with 26 contributors.
- http://www.doctorfungus.org/thefungi/Blastomyces.htm

QUESTION 1

Serious infections of Blastomycosis are treated with?

A) Itraconazole
B) Ketoconazole
C) Voriconazole
D) Amphotericin B
QUESTION 2
What is the virulence factor for \textit{B. dermatitidis}?

A) BAD1  
B) TGF-ß  
C) TNF-α  
D) BALB

Question 3

\textit{B. dermatitidis} is endemic to which continent?

A) South America  
B) North America  
C) Asia  
D) Europe

Question 4

Where is the prominent location of dissemination?

A) Bloodstream  
B) Lungs  
C) Cutaneous surfaces  
D) Liver

Question 5

Inside the body \textit{B. dermatitidis} is in the form of?

A) Conidia  
B) Yeast  
C) Mold  
D) Hyphae