Topic 18: Aspergillosis

Aspergillosis
An opportunistic mycosis that comprises a variety of syndromes involving a form-species of the form-genus *Aspergillus*.

Main agents:
1. *Aspergillus fumigatus* (80%)
2. *A. flavus**
3. *A. niger***
4. *A. terreus*** 18-19%
5. *A. ochraceus*
6. *A. nidulans*
7. *A. clavatus*
8. Other species ~ 1-2%

-Cause about 5000+ hospitalizations/yr in US with > 300 deaths/yr;** autopsy data* 1978 - 1982 indicated 0.5% multiorgan cases; 1980 - 1992 14-fold increase; 1993-to-date, some increase in AIDS-related cases***

*large form-genus* with phialidic anamorphs; when teleomorphs/holomorphs known are Plectomycetes, Eurotiales. Incidence of infection 4-38%; of fungal infection deaths, 85%.

** next most common
*** extremely conservative estimate
+ some suggest over 600 form-species (probably only about 100 "good" species)
History - very old

1815 - possibly first valid description from bird infection (most early descriptions too)

1847 - 1st human case possibly Sluyter** (or Bennett***, 1842)

1850 - Fresenius* coined aspergillosis for infection due to *Aspergillus* in a buzzard (*Aspergillus*, Micheli, 1729, after aspergillum)

1856 - Virchow - 4 cases → best early descriptions of bronchial & pulmonary forms – isolated *A. fumigatus*

* named many species, including *A. fumigatus*
** named Pityriasis versicolor
*** worked with Berg on thrush in newborns

1897 - Renon - occupational hazard association-
1. pigeon handlers
2. handlers of moldy grain
3. wig cleaners
4. farmers working with moldy hay (Farmers' lung)

*often chronic

1924 - Cleland - association with debilitation (opportunistic disease)

1952 until today - Opportunistic forms most important*
1. high % of deaths among leukemia patients/neutropenic
2. significant complications in organ transplant situations (e.g. BM transplants)
3. many outbreaks in hospital environments
4. AIDS

Clinical Syndromes Aspergillosis
Broad Classification

1. Toxicity - due to ingestion of moldy food (e.g. aflatoxicosis) (*Aspergillus* mycotoxicosis)
2. Allergy & sequelae to the presence of conidia or transient hyphal growth in body orifices (e.g. nasal & lung)
3. Colonization without invasion into preformed cavities or debilitated tissue
4.* Chronic invasive, inflammatory, granulomatous, necrotizing disease of lungs & other tissue
5.* Systemic and fatal dissemination disease

*True pathogenesis (ubiquitous & opportunistic)

<table>
<thead>
<tr>
<th>Main Predisposing Factor</th>
<th>Neutropenia: normally PMNs</th>
<th>white cell count:</th>
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<tr>
<td>oxidative micro-biological killers</td>
<td><em>neutrophils</em> = 40-60%</td>
<td>eosinophils = 1 to 3%</td>
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<tr>
<td>no, H₂O₂, O, etc</td>
<td>basophils = 0.5 to 1%</td>
<td>lymphocytes = 20 to 40% T&amp;B cells</td>
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<td>monocytes = 4 to 8%</td>
<td>MΦ</td>
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Laboratory Identification

Traditionally by morphological characteristics of anamorphs

1. Colony morphology
   color (most often because of spore color)
2. Conidiophore & phialide
   morphology (uniserate or biserate)
3. Conidium morphology
   with \textit{A. fumagatus}
   \begin{itemize}
   \item thermotolerance (45\degree C)
   \item other species 37-40\degree C
   \end{itemize}

Teleomorphs* (homothallic &/or heterothallic)
   cleistothecial structure - pseudoparenchymatous**
   \textbf{Eurotiales}
   \textbf{Eurotiaceae}

*unknown for four most common pathogens
**vs proenchantous of Onygenales

Clinical Categories of "Infectous" Aspergillosis

\textbf{Asthma}
\textbf{Allergic Alveolitis}
\textbf{Allergic broncho-pulmonary}

A. Pulmonary
   1) allergic
   2) colonizing (Aspergilloma) usually
   3) invasive* primary

B. Disseminated*
C. CNS usually
D. Cutaneous secondary
E. Nasal
F. Iatrogenic (any adverse** condition due to medical intervention)
G. Otomycosis

*1) due to lowered resistance caused by disease or drugs, neutropenic; granulocytopenia; (GCSF therapy)*
**2) barrier breaks - e.g., surgery, 3) disruption of normal flora due to antibiotics or steroids, 4) etc.
[ lots of cases initiated in operating room setting; started to show up in 1970's (or be documented)]
*Granulocyte Colony Stimulating Factor
Pulmonary Forms of Aspergillosis

1. Allergic
   a. asthma - the least serious & a response to conidia; conidia seldom germinate.
      symptoms- cough, wheezing, chills, aches, pains, rare fever; no skin test reaction of
      arthus type (immediate*); but DTH**+ detected by skin test
   b. allergic alveolitis- usually found in individuals having repeated exposure to large #s of conidia &
      hyphal fragments (usually occupational: farmer's lung disease)
      symptoms- cough, fever, chills
      - occur within 6 hrs
      - X-ray infiltration common
      - Arthus-type skin test***
      - Repeated exposures ➔ granulomatous disease
   c. allergic bronchopulmonary (more serious extension of allergic Alveolitis)
      1) bronchoscopy may show fungus patches (rare) in bronchi
      2) conidiophores and conidia often observed in lungs
      3) sputum has fungus and conidia
      4) positive sputum throughout disease course
      5) Arthus type skin test**
      6) sputum may become bloody
      7) often restricted to upper lung lobes
   *IgE-mediated or immunocomplex type
   **CMI-mediated or immunocomplex type
   ***2 - 4 hrs., & mediated by ppt antibodies (see notes p24)

2. Colonizing aspergillosis (aspergilloma)
   a. development of large fungus balls* throughout lungs or cavities caused by other disease
   b. symptoms as above - but more severe
   * can inhibit exhalation/often associated with TB

3. Invasive pulmonary aspergillosis
   - rare form - fungus wide-spread
   - usually opportunistic
   - pneumonia, fever, cough, pain
   - extensive X-ray
   - often in cancer patients with leukemia and lymphomas
   - may be chronic or sometimes fulminate

4. Disseminated
   - symptoms of acutely ill patient
   - lung> brain> kidney >heart>etc.
   - lung origin
   - hyphae in tissue dichotomously branched and nonsporulating

5. CNS mostly from iatrogenic invasion (drug addicts)
   - acute meningitis
   - rapidly fatal disease

6. & 7. Cutaneous & nasal (rare)

8. Iatrogenic - very common & often symptoms as with disseminated

9. Otomyosis = colonization of ear drum external surface (swimmer's ear), bacterial overgrowth common ➔
   much discomfort.
   - antibacterial treatment only gets rid of bacteria; fungal origin still there.: Can be treated with
topical antifungals.
Aspergillosis - Prognosis & Therapy

Allergic - essentially benign; needs little attention or antiallergy treatments (steroids, desensitivation, Allegra™, etc.)

Colonizing
- colonizing may or may not require intensive antifungal therapy if in otherwise healthy patient
- need to minimize bronchial plugging (aspiration; lavage)
- surgical resectioning

Invasive:
- Amphotericin B; various azoles in use or in trial, itraconazole most promising
- Granulocyte Colony Stimulating Factor (G-CSF) therapy

Serology
- CF, CIE, ID*

Factors for Successful Treatment of Aspergillosis*

1. Early recognition of disease
2. Prompt, aggressive therapy with Fungizone® (amphotericin B/Squibb)**
3. Supportive measures continued until granulocyte recovery

**Some patients included in this study also received flucytosine