Nosocomial and iatrogenic fungal infections (health care associated fungal infections)

A real increase??

• More candidates:
  – More aggressive treatment of hematological pathologies and solid tumors
  – Increase in all kinds of transplantations
  – Use of immunomodulatory agents
  – Invasive devices
  – ICU stay

• More awareness

• More diagnostic tools

• More techniques to prove causality between infection and (environmental) contamination

I. Surmont
Nosocomial and iatrogenic fungal infections

• **Candidiasis: “medical” risk factors:**
  – Relatively minimal immunosuppression is required
  – Broad spectrum antibacterial agents
  – Surgery
  – Hemodialysis
  – TPN
  – Immunosuppression and chemotherapy
  – Transplants
  – Invasive devices
  – Hand hygiene (33% of surgical ICU and 29% of neonatal ICU HCWs with *Candida* spp. on their hands*)
  – *Candida parapsilosis* is the most common yeast isolated from the hands of HCWs

Nosocomial and iatrogenic fungal infections

• Other yeasts:
  – *Malassezia* fungemia in low-birth-weight neonates and in immunocompromised adults:
    • role of intravascular catheters and parenteral lipid formulations
    • colonization of the hands and pet dogs of HCWs (*Malassezia pachydermatis*)
  – *Saccharomyces cerevisiae* fungemia and Enterol® (*Saccharomyces boulardii*)


Nosocomial and iatrogenic fungal infections

- **Aspergillosis**: pulmonary form
  - Most cases are sporadic and in patients with intermediate to severe immunosuppression
  - Outbreaks of environmental airborne infections within hospital settings have been reported: construction and renovation works in and around hospitals, improperly functioning ventilation systems and air filters, contaminated false ceilings and insulation material, water leaks, food, ornamental plants
  - But there is no uniform definition of what constitutes nosocomial aspergillosis. Reasons: unknown incubation period of invasive aspergillosis and frequent admissions and discharges of high-risk patients
  - Air sampling is almost always too late and is unreliable due to irregular release of spores
  - Molecular techniques reveal different strains in the environment and even in the patient (poor correlation of the spp. from the environment and species isolated from the patients)
Nosocomial and iatrogenic fungal infections

- **Aspergillosis:** cutaneous form
  - In burn units (use of dressings contaminated with *Aspergillus* spores)
  - At intravenous insertion sites because of contaminated dressings on arm boards providing support to IV lines (children) or after inserting a CVC in non-optimal conditions

- **Postoperative aspergillosis:** due to failing air handling systems

Nosocomial and iatrogenic fungal infections

• **Mucormycosis:**
  - Desferrioxamine therapy
  - Cutaneous infections associated with Elastoplast adhesive dressings
  - Airborne transmission due to contaminated ventilation systems
  - Contaminated wooden tongue depressors (gastric mucormycosis)
  - Non-sterile karaya (plant-derived adhesive) for securing ostomy bags
Nosocomial and iatrogenic fungal infections

- **Fusarium infections:**
  - Contamination of lens solutions
  - Contamination of the water system
  - Contamination of implantations??


Nosocomial and iatrogenic fungal infections

- *Pneumocystis jirovecii* (PCP)
  - Person-to-person airborne transmission
  - Isolation measures, also in ambulatory care???


Nosocomial and iatrogenic fungal infections

- Recent “scandal”: 2012 - 2013
Nosocomial and iatrogenic fungal infections

“patients who received epidural or paraspinal glucocorticoid injections of preservative-free methylprednisolone acetate prepared by a single compounding pharmacy”
not a generic drug!

• *Exserohilum rostratum*
Nosocomial and iatrogenic fungal infections

- More than 13,400 patients could have been exposed
- Some 750 patients have been affected
- Peak incubation period +/- 28 days (2.3% more than 40 days)
- Attack rate: from 3% to 35% depending on the lot, the delay between production and injection, and the number of injections per patient
- Clinical forms: meningitis, epidural abscesses, discitis, osteomyelitis, arthritis, bursitis
- Case fatality rate (for CNS cases): 8.9% depending on (lack of) treatment
Figure 1. Number of Epidural and Paraspinal Glucocorticoid Injections and Attack Rate.
Shown are the number of epidural and paraspinal glucocorticoid injection procedures performed in case patients, as well as the attack rates among persons who received methylprednisolone acetate from the implicated lots during these procedures. Data are shown according to 5-day time periods.

## Cases and Deaths with Fungal Infections Linked to Steroid Injections

<table>
<thead>
<tr>
<th>State</th>
<th>Total Case Count</th>
<th>Meningitis Only</th>
<th>Meningitis + Paraspinal/Spinal Infection</th>
<th>Stroke w/out Lumbar Puncture Only</th>
<th>Paraspinal/Spinal Infection only</th>
<th>Peripheral Joint Infection Only</th>
<th>Paraspinal/Spinal Infection + Peripheral Joint Infection</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida (FL)</td>
<td>25</td>
<td>22</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Georgia (GA)</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Idaho (ID)</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Illinois (IL)</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Indiana (IN)</td>
<td>92</td>
<td>30</td>
<td>17</td>
<td>1</td>
<td>44</td>
<td>0</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Maryland (MD)</td>
<td>26</td>
<td>23</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Michigan (MI)</td>
<td>264</td>
<td>23</td>
<td>46</td>
<td>2</td>
<td>166</td>
<td>25</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>Minnesota (MN)</td>
<td>12</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>North Carolina (NC)</td>
<td>18</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>New Hampshire (NH)</td>
<td>14</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>New Jersey (NJ)</td>
<td>51</td>
<td>30</td>
<td>11</td>
<td>0</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>New York (NY)</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ohio (OH)</td>
<td>20</td>
<td>12</td>
<td>3</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Pennsylvania (PA)</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Rhode Island (RI)</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>South Carolina (SC)</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tennessee (TN)</td>
<td>153</td>
<td>22</td>
<td>57</td>
<td>3</td>
<td>69</td>
<td>2</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Texas (TX)</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Virginia (VA)</td>
<td>54</td>
<td>41</td>
<td>9</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>West Virginia (WV)</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>750</strong></td>
<td><strong>233</strong></td>
<td><strong>151</strong></td>
<td><strong>7</strong></td>
<td><strong>324</strong></td>
<td><strong>33</strong></td>
<td><strong>2</strong></td>
<td><strong>64</strong></td>
</tr>
</tbody>
</table>

[http://www.cdc.gov/hai/outbreaks/meningitis-map-large.html](http://www.cdc.gov/hai/outbreaks/meningitis-map-large.html)
Figure 1. Distribution of Disease Types in the Clinical Cohort.
Shown are data for 328 patients, according to the total number of diagnoses. Patients with multiple diagnoses were included in more than one category.