Black Mold and ECMO: Everything You Never Wanted To Know; A Case Report

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Patient Presents to ED

- 18 YO Female-60 Kg
- Persistent Chest Pain
- Coughing up Blood

Hx
- Recurrent INVASIVE Aspergillus and Pulmonary Embolism
- Being medically managed at home with anti-fungals and PIC line
- SP long standing medical management with thoracotomy excision of fungal mass with partial lung removal
- Social and economic issues where patient still lives in home full of Black Mold!
- Prior to that was living in car with parents...

Not Black Gold/Texas Tea
Four Letter Word Presentation

- MOLD
- ECMO
- #$%^$
- &^&^*

DPH: Mycology Basics

Fungi = yeasts and mold

**Yeast**
- Unicellular
- Round, globose
- Most reproduce by budding

**Mold**
- Multicellular, filamentous
- Filaments - hyphae
- Reproduce from fruiting body via conidia (spores) which can become airborne
Fast Facts About Fungi

- Lack Chlorophyll
- Depend on external food sources
- Must have water to grow
- Thousands of fungal species
- Ubiquitous in nearly all environments

Infective Facts About Fungi

- Fungal spore size: 1-50 um
- Humidity can affect size
- Spores less than 10 um can be deposited in alveoli
- Lower airway deposits in newborns can be more than 6 times higher than in adults
- Spores in some species contain low molecular weight chemicals that are cytotoxic

Medically Important Fungi

- Most belong to phylum Deuteromycota, or Fungi Imperfecti
- Disease Ranges
  - Superficial mycoses with no pathology
  - Invasive
  - Lethal

Indoor Fungi = Opportunistic

- Almost exclusively affect debilitated patients
- Allergy in patients with underlying respiratory conditions:
  - Asthma
  - Cystic Fibrosis
  - Immunocompromised pts
- Enter on clothes, shoes, pets, doors, windows, HVAC
Mold Is In Every Home In The USA

Just because mold is found in a building, it doesn’t mean everyone will be exposed or become symptomatic. In order to be exposed, people must either:

• Inhale airborne spores or fungal byproducts
• Skin contact
• Eat it

Allergic

• 10% of population has antibodies to fungal antigens
• 5% expected to show clinical illness
  • allergic asthma
  • Allergic rhinitis (“hay fever”)
• Hypersensitivity pneumonitis
  • more serious but rare
• Outdoor molds more abundant

Infectious

• Benign tinea
  • ...pedis, cruris, corporus, onychomycosis

• Pathogenic
  • Blastomyces
  • Coccidioides
  • Cryptococcus
  • Histoplasma

Toxic

• Secondary metabolites (mycotoxins)
  • not required for survival of fungus

• Clinical use
  • PCN, CSA

• Inhalation
  • Blamed for numerous non-specific symptoms
Symptoms

- Bloody cough
- Abdominal pain and irritation
- Dyspnea
- Airflow obstruction (otherwise healthy)
- Mucous membrane irritation syndrome
- Chronic obstructive pulmonary disease
- Inhalational fevers (non-occupational)

Health Outcomes vs Mold

- Lower respiratory illness (healthy adults)
- Rheumatologic / other immune disease
- Acute idiopathic pulmonary hemorrhage
- Skin symptoms
- Asthma development
- Gastrointestinal tract problems
- Fatigue
- Neuropsychiatric symptoms
- Cancer
- Reproductive effects - impotence and sterility

“Toxic Mold”

DPH Message – If it looks like, smells like...
DPH Recommendations

- Find the water source and stop the leaking
- Discard water-damaged porous materials
- Clean non-porous surfaces with 10% bleach (1 part bleach + 9 parts water) – allow it to dry naturally
- Ventilate – open windows/doors, and/or turn on air handling systems
- Keep relative humidity below 60% at all times
- Use a dehumidifier
- Measure relative humidity to be sure dehumidifier is doing it’s job

Statistics

- WHO - Estimated 6.5 million deaths annually (11.6% of all global deaths) are associated with indoor and outdoor air pollution together.
- WHO - This study estimated the cost of indoor and outdoor pollution of 53 countries in the European Region at $1.6 trillion.
- EPA - One third to one half of all structures have damp conditions that may encourage development of pollutants such as molds and bacteria
- EPA - Of the 21.8 million people reported to have asthma in the U.S., approximately 4.6 million cases are estimated to be attributable to dampness and mold exposure in the home.
- EPA - The national annual cost of asthma that is attributable to dampness and mold exposure in the home is $3.5 billion
- EPA - The cause of most chronic sinus infections -- an immune system response to fungus.

Perfusion Presentation

How might one guess perfusion is made aware of this patient?

Urgent Case Added for Redo Thoracotomy with Perfusion Stand-By

WTH why and what is the purpose….

In case the patient needs ECMO Don’t You Know
Surgery 1

- Patient Decompensates during Lung manipulation for mass excision
- Crash on Bypass
- Complete resection
- Attempt to come off multiple times, much bleeding, multiple transfusions…
- Fail…

Convert to 4 Letter Word…

- CentriMag – Abbott
- 3/8 x 3/8 AV Loop, In/Out
- Femoral Cannulation
- Maquet QuadroxID
- Terumo CDI 500
- Sat/HCT with Shunt sensor
- CentriMag Pre and Post mmHg

ECMO Course…Very Eventful…Very Busy

- 5 Days
- 2 blood Banks of Blood
- Multiple Returns to OR for Bleeding and Chest Tubes and cannulas
  - Distal Perfusion Cannula with 10 Fr Biomed ECMO Cannula
- Additional Chest Tube

Day One…..

- Just clamp off the chest tube and we will fill the void and tamponade and stop all the bleeding….
- Oh yes, that works (insert eye roll here)
Day 2...

• Back to OR...
• Insert 2nd chest tube
• Clean out
• Try to stop some bleeding

Day 3-5

• Bleeding, Bleeding, Bleeding
• Multiple returns for evacuation, debridement, hemorrhaging
• PTSD

Lets Give Nova 7!... Again...

• Gave 30 mcg/kg (rounded up to 2000 mcg) both trips to OR
• In the ICU day 5 – 1 hour later clotted off oxygenator
• Patient asystole…. Heroic measures stopped.

![Graph showing Heparin and ACT levels](image-url)
Moral (s) of the Story....

• Don't Do IT!!
• Nova 7 Sucks
• There is nothing you can do about a mold infestation!!!