



Atrium Health
Levine Children's

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

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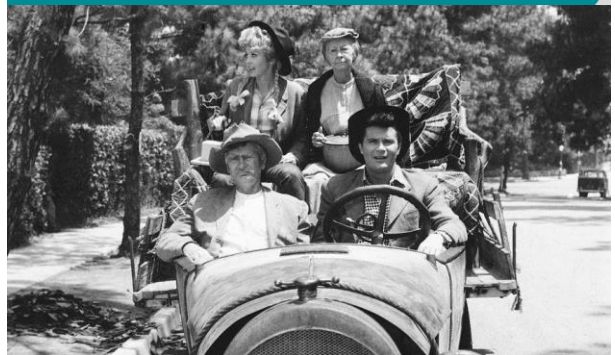


Hx

- 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 Back Mold!
- Prior to that was living in car with parents...



Not Black Gold/Texas Tea





Four Letter Word Presentation

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



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DPH: Mycology Basics

Fungi = yeasts and mold

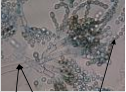
Yeasts

- Unicellular
- Round, globose
- Most reproduce by budding

Mold

- Multicellular, filamentous
- Filaments - hyphae
- Reproduce from fruiting body via conidia (spores) which can become airborne



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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



Penicillium sp.



Stachybotris spores



Cladosporium spores



Alternaria spores



Medically Important Fungi

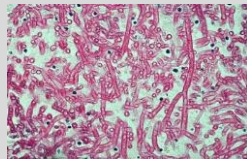
- Most belong to phylum Deuteromycota, or Fungi Imperfecti
- Disease Ranges
 - Superficial mycoses with no pathology
 - Invasive
 - Lethal



Aspergillus fumigatus

Lung Tissue:
Fungal
Pneumonia-
*Aspergillus
fumigatus*

Note septate
hyphae,
dichotomous
branching



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, corporis, 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)

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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"



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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. ²²



Perfusion Presentation

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

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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

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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...

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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

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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)

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Day 2...

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

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Day 3-5

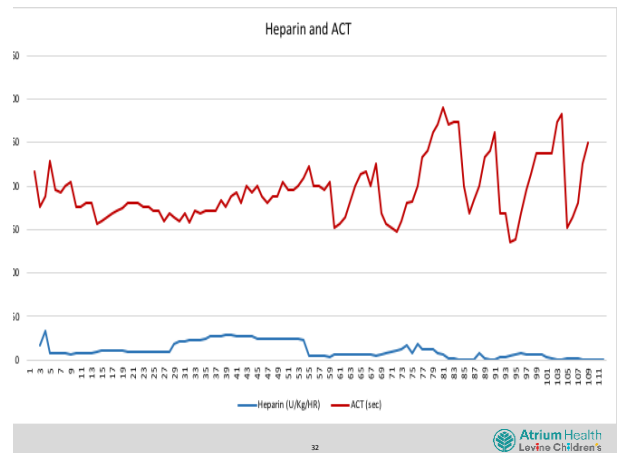
- Bleeding, Bleeding, Bleeding
- Multiple returns for evacuation, debridement, hemorrhaging
- PTSD

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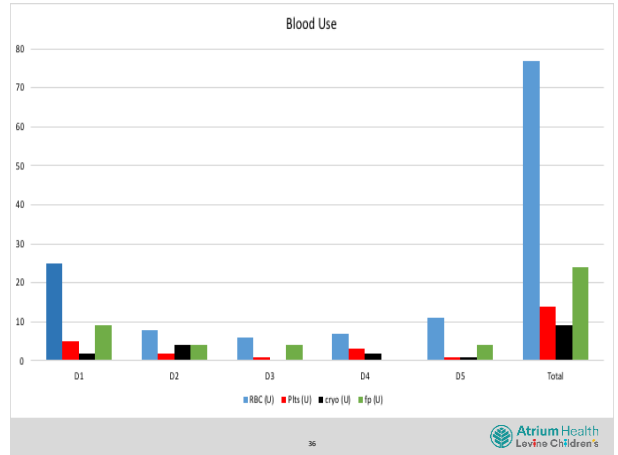
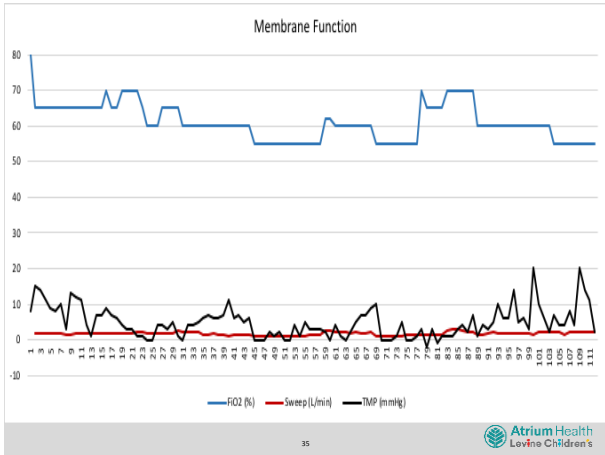
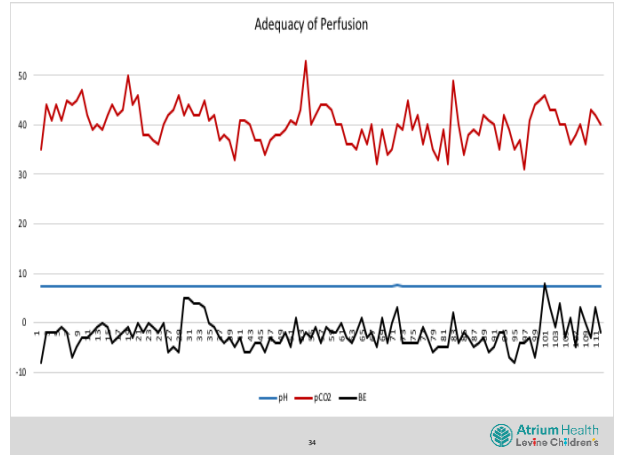
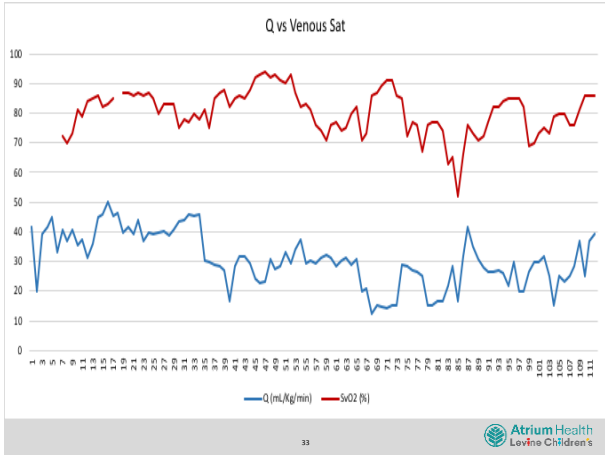
Lets Give Nova 7!... Again...

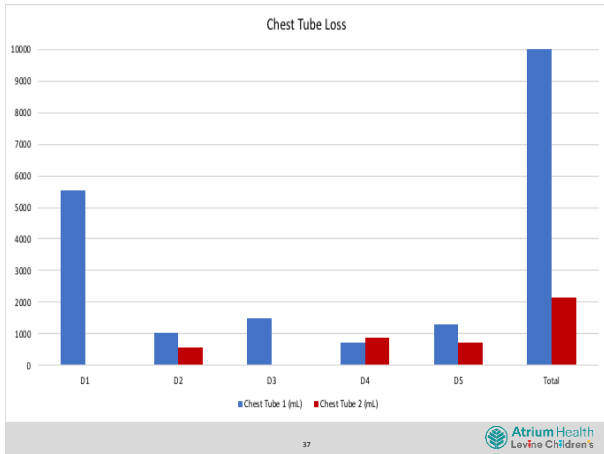
- Gave 30 mcg/kg (rounded up to 2000 mcg) both trips to OR
- In the ICU day 5 – 1 hour later clotted off oxygenator
- Patient asystole.... Heroic measures stopped.

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Moral (s) of the Story....

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

Questions?

We're the best so he can be **THE BEST**

BEST CHILDREN'S HOSPITALS
US News
RANKED IN 6 SPECIALTIES
2018-19

Emmett, 6