A visit to the dentist

CLINID conference
Hunter Ratliff
03/20/2025

Ages, dates, and other identifying information may have been changed
I have no conflict of interest in relation to this presentation

Case #1

Case 1: HPI

A **27 y/o M** with PMH including poorly controlled DM p/w **chronic groin wound drainage** & **productive cough**

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- Tenderness with purulent drainage from wounds
- High blood sugar
- Right sided chest tightness & productive cough
- Ongoing for “months”

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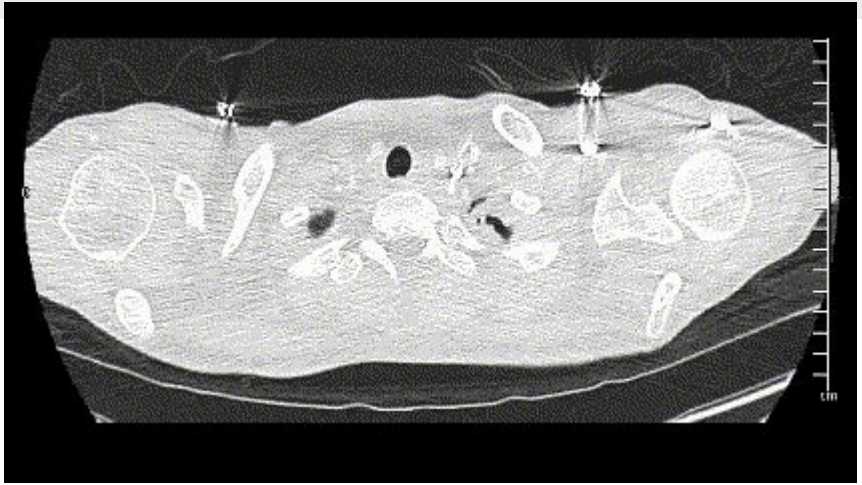
- High blood sugar
- Right sided chest tightness & productive cough
- Ongoing for “months”

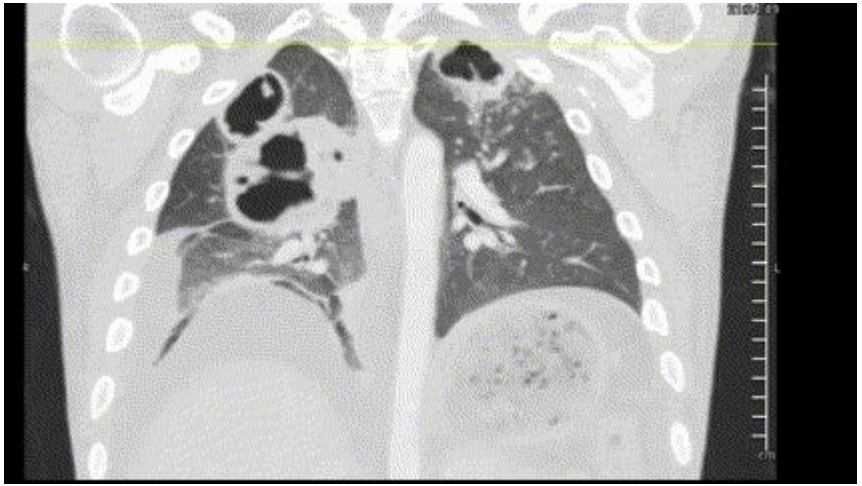
ROS

- No fevers, chills, night sweats
- DOE, but no dyspnea at rest
- Chronic diarrhea

Case 1: HPI

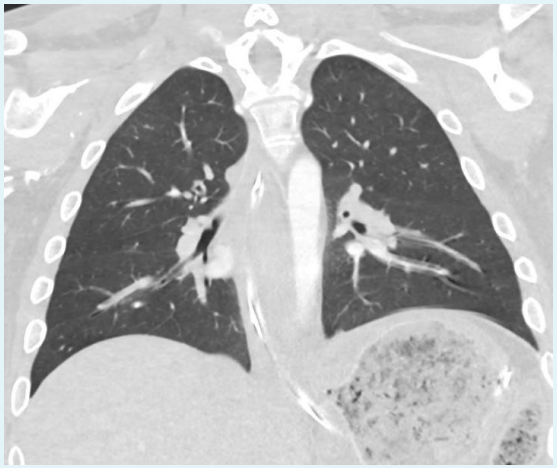
A **27 y/o M** with PMH including poorly controlled DM p/w **chronic groin wound drainage** & **productive cough**

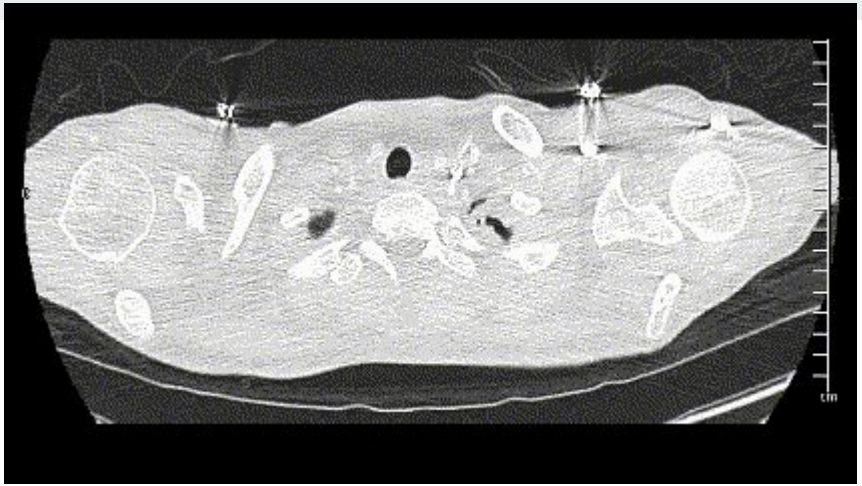


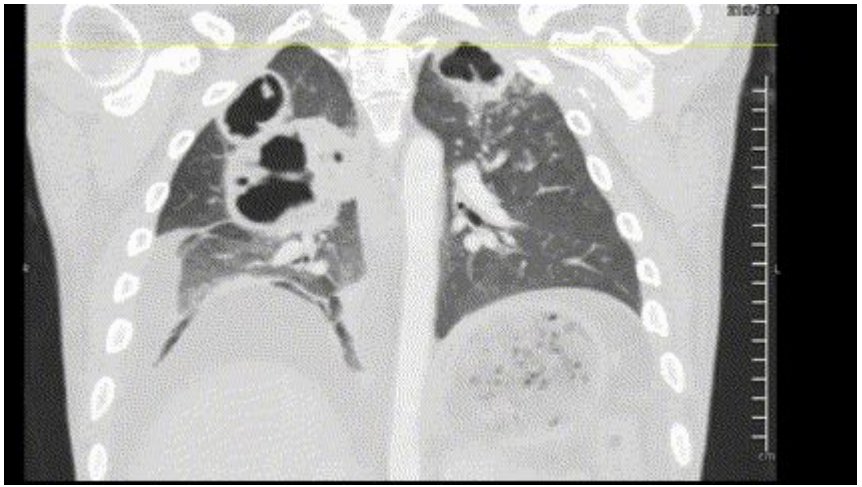


Case 1: HPI

Prior CT (5 months ago)







Case 1: Social & Exposure History

Geographic & Travel	• The patient lives in **Ohio** with parents • He denies recent foreign or domestic travel
Occupational	• Not working; no hobbies; doesn't do outdoor activities
Substance & needles	• Denies EtOH (prior ID notes state "alcohol abuse" in problem list) • **Vapes tobacco** • **Smokes weed**, no other drugs; never IVDU • Remote hx of **unprofessional tattoos**
Animals	• No animals (including birds, bats), aside from **pet cat**
Exposures	• No TB risk factors • No exposures to soil; no dead/decaying wood or vegetation • No water exposures (e.g. hot tubs, humidifiers)

Case 1: Physical exam

Vitals: BP 102/61 (**on levophed**) | **Pulse 102** | Temp 36.6 °C | SpO2 94% | BMI 25.13 kg/m^2

Gen: alert and oriented, NAD

Head/Neck: NCAT; trachea appears midline, no gross LAD

ENT: EOMI grossly, anicteric sclerae; **good detention**

Resp: normal respiratory effort, CTAB

CV: RRR; extremities perfused

GI: non-distended; no TTP

Neuro/MSK: moves extremities, CN exam normal

Psych: normal mood; appropriate affect

Case 1: Chart review

Multiple admissions for DKA
- A1c >15

3 months ago**: NSTI groin & scrotum**
- Done at OSH, so no micro records
- Completed abx while inpatient

2.5 months ago: **Wheeling for wounds**
- No surgical procedures done
- ID saw him there, was on Vanc/Unasyn for 4 days
- Pt declined OPAT
- Sent home on doxy/Augmentin

Micro: Lots of negative blood cultures in recent months

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Micro: Lots of negative blood cultures in recent months

Hospital course (thus far)

- Admitted to MICU w/ septic shock
- Groin I&D with general surgery
  - Left groin abscess at the site that was spontaneously draining
  - A moderate amount of pus was expressed from abscess
  - No true NSTI (per note)
  - Gram stain: GPC, yeast
- Pulm does bronch in OR
- ID consult on hospital day 2

Case 1: Summary

A **27 y/o M** with PMH including poorly controlled DM, recent NSTI of groin p/w chronic groin **wound drainage** & **productive cough** and found to have **numerous cavitary lesions**

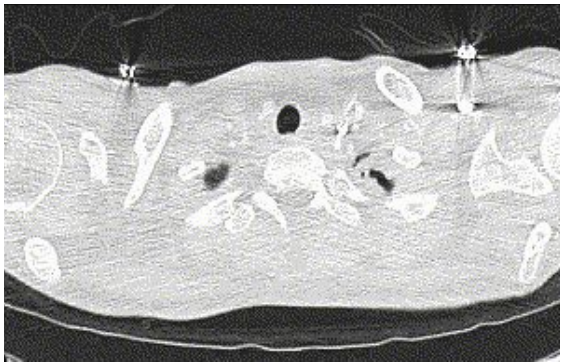
- **DDx?**
- **Workup?**

-5 months — **Normal CT chest**

-3 mo — **Groin NSTI (OSH)**

Debridement, unknow what Cx or abx he got
Ongoing wounds since then

Now — **This admission**



Let's place some bets

Mycobacterial
- Mycobacterium tuberculosis
- NTM: M kansasii, M abscessus, MAC

Endemic mycoses
- Histo
- Blasto
- Cocci

Other fungal
- Crypto
- Aspergillus
- Mucor

Necrotizing bacteria
- Staph aureus
- Enterobacterales: Kleb, E cloacae
- Nonfermenters: Pseudomonas, Steno

Oral & anaerobes
- Streptococcus anginosus group
- Bacteroides, fusobacterium, prevotella

Filamentous gram positive rods
- Nocardia
- Actinomyces

Case 1: Workup

BAL	Result
Asp GM	
Asp PCR	
MTB PCR	
PJP PCR	

Serum / Urine	Result
Histo Ag	
Blasto Ag	
Crypto Ag	
Fungitell	
Asp GM	
uStrep Ag	

Micro	Result
Blood	
Urine	
OR (groin)	GPC Yeast
BAL (routine)	
BAL (AFB)	
BAL (fungal)	

Case 1: Workup

BAL	Result
Asp GM	Neg
Asp PCR	Neg
MTB PCR	Neg
PJP PCR	Neg

Serum / Urine	Result
Histo Ag	
Blasto Ag	
Crypto Ag	
Fungitell	
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Asp GM	Neg
Asp PCR	Neg
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Serum / Urine	Result
Histo Ag	Neg
Blasto Ag	Neg
Crypto Ag	---
Fungitell	34
Asp GM	Neg
uStrep Ag	Neg

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Blood	
Urine	
OR (groin)	GPC Yeast
BAL (routine)	
BAL (AFB)	
BAL (fungal)	

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Asp GM	Neg
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Crypto Ag	---
Fungitell	34
Asp GM	Neg
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Micro	Result
Blood	Neg
Urine	Neg
OR (groin)	GPC Yeast
BAL (routine)	**GNR**
BAL (AFB)	
BAL (fungal)	

Case 1: Workup

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Asp GM	Neg
Asp PCR	Neg
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PJP PCR	Neg

Serum / Urine	Result
Histo Ag	Neg
Blasto Ag	Neg
Crypto Ag	---
Fungitell	34
Asp GM	Neg
uStrep Ag	Neg

Micro	Result
Blood	Neg
Urine	Neg
OR (groin)	4+ **Mixed GP & GN** 4+ **Strep Anginosus** 3+ **CONS** 2+ **C albicans** 1+ **Proteus mirabilis**
BAL (routine)	**GNR** (gram stain)
BAL (AFB)	
BAL (fungal)	

Case 1: Workup

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Asp GM	Neg
Asp PCR	Neg
MTB PCR	Neg
PJP PCR	Neg

Serum / Urine	Result
Histo Ag	Neg
Blasto Ag	Neg
Crypto Ag	**1:1280**
Fungitell	34
Asp GM	Neg
uStrep Ag	Neg

Micro	Result
Blood	Neg
Urine	Neg
OR (groin)	4+ Mixed GP & GN organisms 4+ **Strep Anginosus** 3+ **CONS** 2+ **C albicans** 1+ **Proteus mirabilis**
BAL (routine)	>100k cfu **Kleb pneumo** **Mucoid kleb** in the lab
BAL (AFB)	Neg
BAL (fungal)	Neg

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Date of CrAG	Titer
Day 2	**1 : 1280**
Day 3	**1 : 320**

4 fold decrease

HIV: negative
CD4: 780 (56%, ratio 2.0)

Case 1: Workup

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Date of CrAG	Titer
Day 2	**1 : 1280**
Day 3	**1 : 320**

LP	Result
Opening Pr (cm H2O)	13
WBC (Neut, lymph)	**50** (56%, 40%)
RBC	**875**
Pro / Glu	40 / 131
Biofire	Neg
Cx (routine/AFB/fungal)	Neg
India ink	Neg
Crypto Ag	Neg

Case 1: Next steps

A **27 y/o M** with PMH including **poorly controlled DM**, recent NSTI of groin p/w chronic groin **wound drainage** & productive cough and found to have **numerous cavitary lesions** that have grown mucoid **kleb pneumo**, but **serum CrAG** was also strongly positive

- Is this **kleb** or **crypto** (or **both**)?
- What do you do for **treatment**?

Micro	Result
Blood	Neg
OR (groin)	4+ Mixed GP & GN organisms 4+ **Strep Anginosus** 3+ **CONS** 2+ **C albicans** 1+ **Proteus mirabilis**
BAL (routine)	>100k cfu **Kleb pneumo** **Mucoid kleb** in the lab
BAL (fungal)	Neg

Date of CrAG	Titer
Day 2	**1 : 1280**
Day 3	**1 : 320**

W/O treatment

Case 1: Hospital course

- Asked for **TTE** (normal), **CD4** (780, 56%, ratio 2.0)
- Initially on **Zyvox + Zosyn** (for NSTI) → **Unasyn**
- After LP was done, added **fluconazole 400**
- Signed off:
  - **Unasyn** → **Augmentin** x6 weeks (w/ repeat imaging)
  - **Fluconazole** (for 6 months?)

Case 1: Hospital course

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- Initially on **Zyvox + Zosyn** (for NSTI) → **Unasyn**
- After LP was done, added **fluconazole 400**
- Signed off:
  - **Unasyn** → **Augmentin** x6 weeks (w/ repeat imaging)
  - **Fluconazole** (for 6 months?)
- Worsening **pleural effusion**, got chest tube
  - Pleural fluid also grew **kleb pneumo** again
- Started heading towards **neutropenia on Unasyn**
  - Switched to **ceftriaxone + Flagyl** → **cefpodoxime + Flagyl**
  - Still on **fluconazole**

Discussion

Links to articles discussed here

Hypermucoviscous Klebsiella pneumoniae (HmKp)

- Define HmKp and **distinguish it from classical *Klebsiella pneumoniae*** based on genetic & virulence factors
- Analyze the **geographic distribution of HmKp** highlighting its emergence as a global pathogen
- Recognize the **unique clinical manifestations of HmKp infections** and differences in disease severity compared to classical *Klebsiella pneumoniae* infections

HmKp: What is it? [1.1]

Hypermucoviscous Klebsiella pneumoniae (HmKp) is a phenotype of *K pneumoniae* that produces a thick, mucoid capsule

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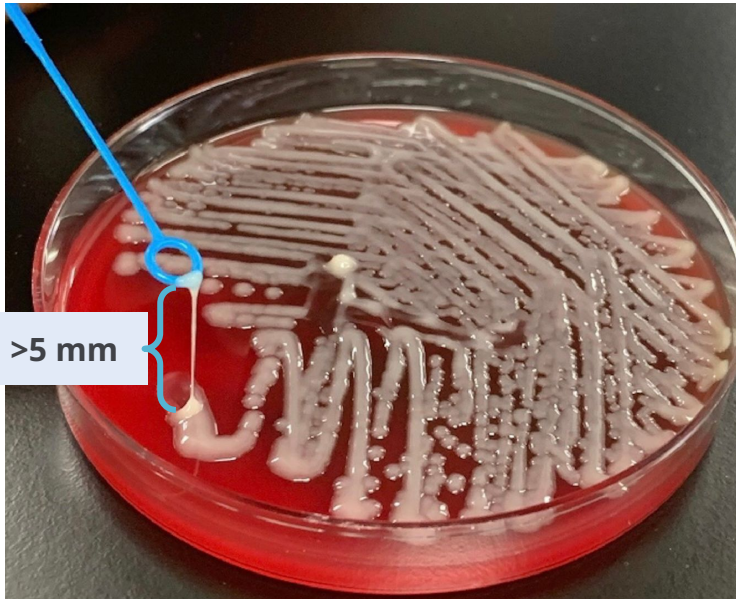
Hypermucoviscous Klebsiella pneumoniae (HmKp) is a phenotype of *K pneumoniae* that produces a thick, mucoid capsule

- Identified with the **string test**
  - Stretches over 5mm with an inoculation loop



HmKp: What is it? [1.1]

Virulence genes on plasmids (rmpA & rmpA2)

↓

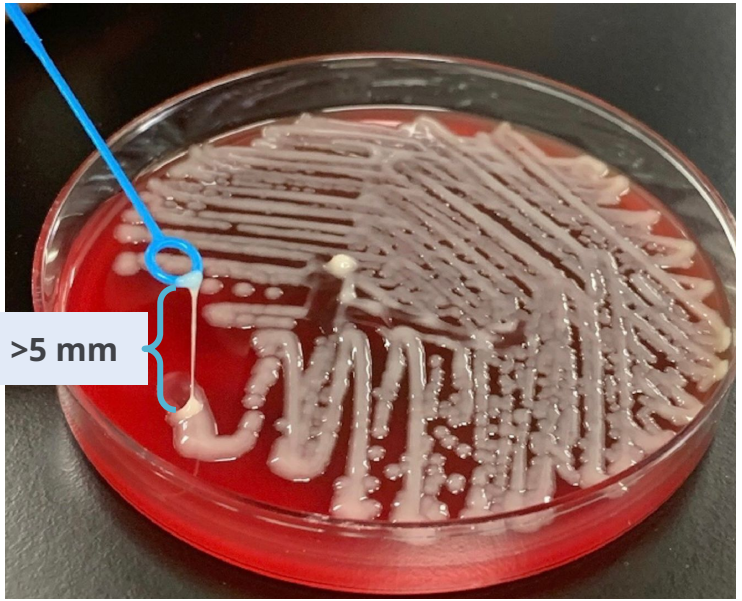
Overproduction of **capsular polysaccharides**

↓

Reduced **complement deposition** & **phagocytosis**

↓

Evades immune defenses



HmKp: Who gets it? [1.1][1.2]

- Initial identified in **East/Southeast Asia**, but **spreading world wide**
- More often **community acquired** (as opposed to other strains of *K pneumo*)
    - Often younger, healthier folks
    - Immunosuppression isn't major risk factor, with the **exception of diabetes**

HmKp: Who gets it? [1.3]

May be associated with **extensive antimicrobial resistance**, especially **internationally**

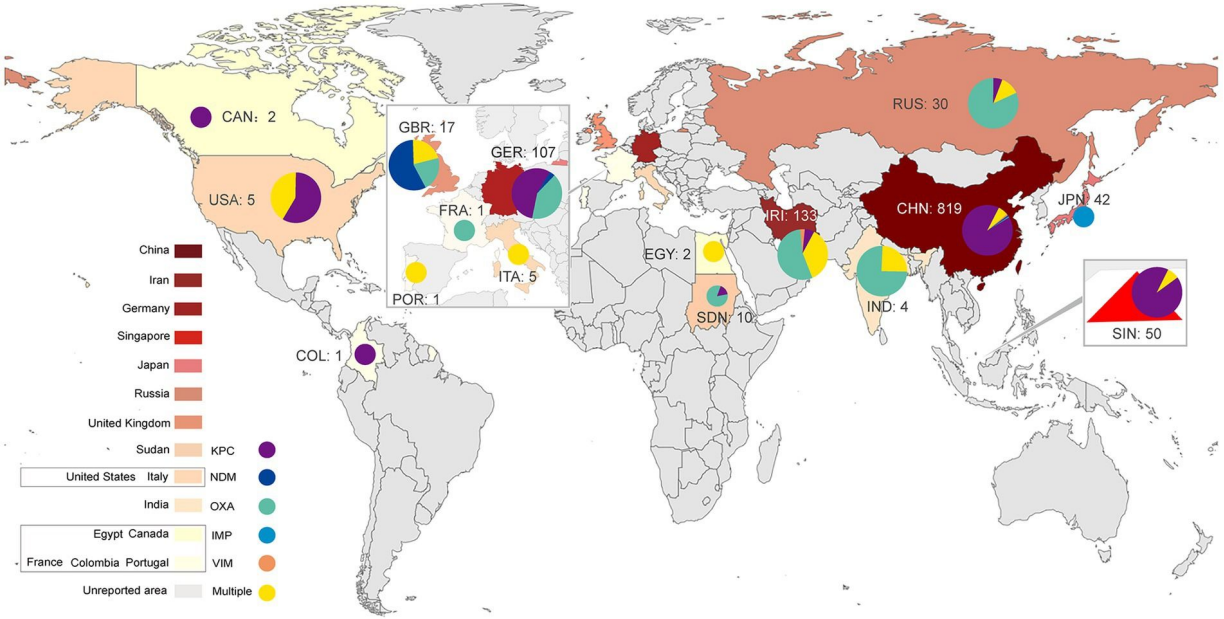


Figure 1 [1.3]:
Global distribution of CR-hvKP (2015–2022)

HmKp: Clinical manifestations [1.1][1.4]

- High risk for **metastatic spread** (12-28%)
- Classically: **liver abscess in healthy adults**
- Most common sides
  - Meningitis
  - Pleural empyema
  - Endophthalmitis
- Many reports with NSTIs (as was maybe our case)
- Has been reported to seed almost anywhere

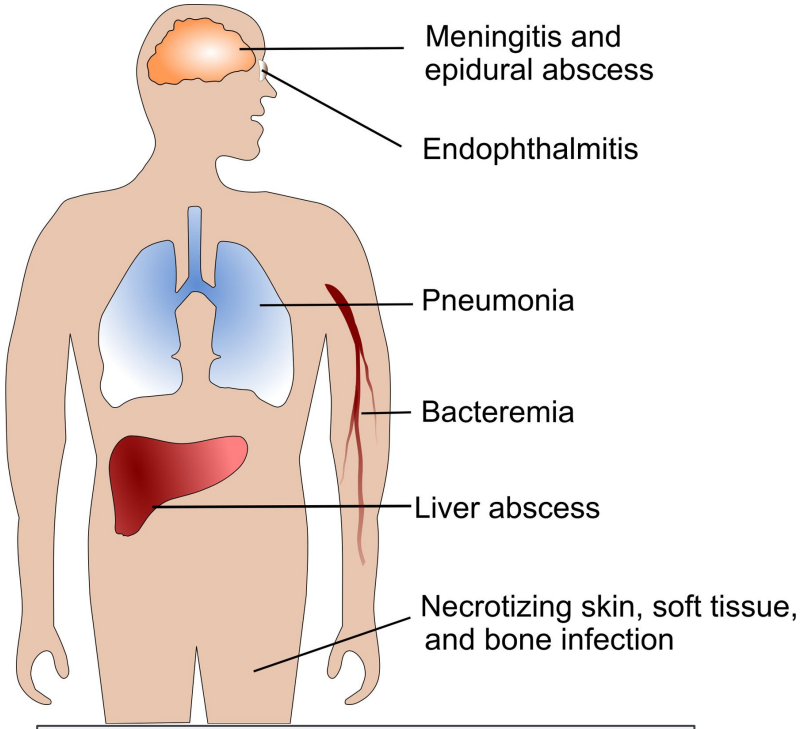


Figure 1 [1.4]: Common sites of primary and metastatic infections caused by hvKp

Evidence Bayes'ed medicine

$$P(H \mid E) = \frac{P(E \mid H)\, P(H)}{P(E)}$$

- Review **Bayes' theorem and it's applications** (without talking too much about math)
- Highlight the key relationship between **pre-test probability and testing characteristics** (sensitivity, specificity)

Bayes theorem

- Named after Thomas Bayes
- Law of conditional probability

Bayes Theorem

$$P(A \mid B) = \frac{P(B \mid A)\, P(A)}{P(B)}$$

Bayes theorem

- **Posterior**: Probability the “hypothesis” being true, given observed “evidence”

Bayes Theorem

$$P(H|E) = \frac{P(E|H)\,P(H)}{P(E)}$$

H = hypothesis
E = evidence
A|B = means “A given B”

Bayes theorem

- **Posterior**: Probability the “hypothesis” being true, given observed “evidence”
- **Likelihood**: Probability that “evidence” occurs if “hypothesis” is true

Bayes Theorem

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Bayes theorem

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Bayes Theorem

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Bayes theorem

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- **Likelihood**: Probability that “evidence” occurs if “hypothesis” is true
- **Prior**: The pre-test probability the “hypothesis” is true
- **Evidence**: The probability of the “evidence” occurring (regardless of “hypothesis”)

Bayes Theorem

$$P(H \mid E) = \frac{P(E \mid H)\, P(H)}{P(E)}$$

H = hypothesis
E = evidence
A|B = means “A given B”

The good news

You don’t need to do the math!

The important takeaway is that the **chance our hypothesis is right, given the evidence** is *equally* influenced by of **BOTH**

- The **quality of the test** (e.g. sensitivity, specificity)
- The pre-test probability (e.g. the base rate)

Bayes Theorem

$$P(H \mid E) = \frac{P(E \mid H)\, P(H)}{P(E)}$$

Posterior: Probability the “hypothesis” being true, given observed “evidence”

Likelihood: Probability that “evidence” occurs if “hypothesis” is true

Prior: The pre-test probability the “hypothesis” is true

Evidence: The probability of the “evidence” occurring

What the pre-test probability?

How often would you expect this to be caused by cryptococcus?

- One in 10?
- One in 20?
- One in 50?
- One in 100?
- One in 1000?

A **27 y/o M** with PMH including **poorly controlled DM**, recent NSTI of groin was found to have **numerous cavitary lesions**

- BAL: **Kleb pneumo**
- No risk factors for Cryptococcus
- No fungal growth or yeast on slides

Serum cryptococcal antigen

Serum		CrAg EIA	
		Positive	Negative
CrAg LFA	Positive	96	7
	Negative	0	94

Sensitivity = 96 / (96 + 0) = **100%**

Specificity = 94 / (94 + 7) = **93.1%**

		Disease	
		Positive	Negative
Test	Positive	True Pos	False Pos
	Negative	False Neg	True Neg

Sensitivity = TP / (TP + FN)

Specificity = TN / (TN + FP)

Source: https://www.immy.com/package_inserts/cr2003/CR2003%20IFU%20(Int'l)%20-%20English.pdf

Serum cryptococcal antigen

Serum		CrAg EIA	
		Positive	Negative
CrAg LFA	Positive	96	7
	Negative	0	94

Likelihood ratio

LR+ = sensitivity / (1 - specificity)

LR+ = Pr(T+ | D+) / Pr(T+ | D-)

LR+ = 1 / (1 - .931) = **14.5**

Sensitivity = 96 / (96 + 0) = 100%

Specificity = 94 / (94 + 7) = **93.1%**

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Post-test probability

How often would you expect this to be caused by cryptococcus?

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- One in 50?
- One in 100?
- One in 1000?

Among 44 cryptococcosis patients with DM2 as the only identifiable risk factor for disease, the annual incidence of cryptococcosis was 0.001% (**1 in a thousand**), with a prevalence of 0.002%. [1.5]

PPV & Bayes | Graphical representation | Likelihood ratios | Sens & Spec | Derivation

Sensitivity:

0 % — 100 %

0 10 20 30 40 50 60 70 80 90 100

Specificity:

0 % — 93 %

0 10 20 30 40 50 60 70 80 90 100

Set Prevalence

Disease prevalence: 1 per 1,000 (0%)

Numerator

1 affected — 100 affected

0 10 20 30 40 50 60 70 80 90 100

Denominator

Per 1,000

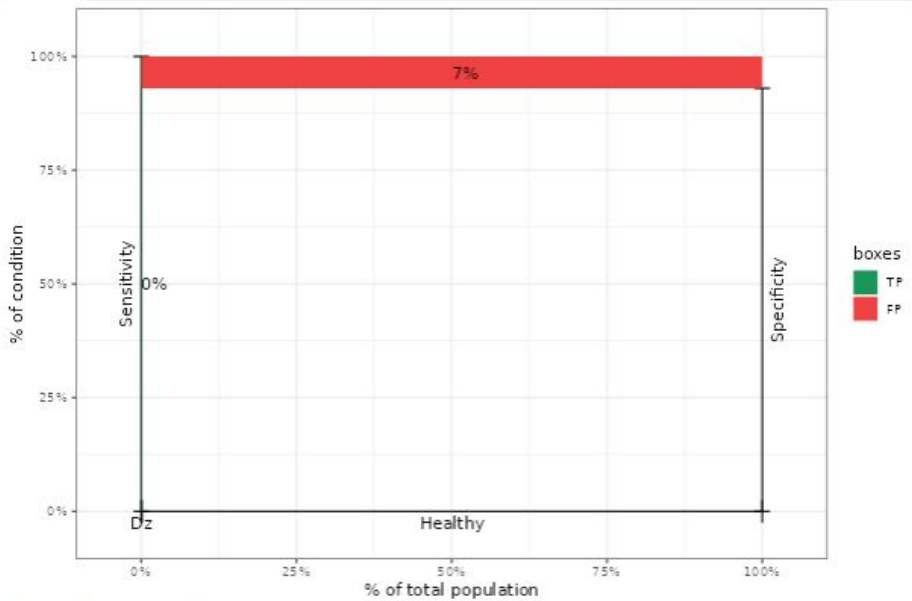
2 x 2 table

	Has Disease	No Disease
Test (+)	TP: 0%	FP: 7%
Test (-)	FN: 0%	TN: 93%

Positive Predictive Value

Among those who test positive, 1% will actually have the disease

Plot | Math



Show which cases?

○ Both ◉ Test positive ○ Test negative

https://hunterratliff1.shinyapps.io/BayesPPV/

PPV & Bayes | Graphical representation | Likelihood ratios | Sens & Spec | Derivation

Sensitivity: 0 % — 100 %

0 10 20 30 40 50 60 70 80 90 100

Specificity: 0 % — 93 %

0 10 20 30 40 50 60 70 80 90 100

Set Prevalence

Disease prevalence: 10 per 100 (10%)

Numerator

10 affected — 100 affected

0 10 20 30 40 50 60 70 80 90 100

Denominator

Per 100 population

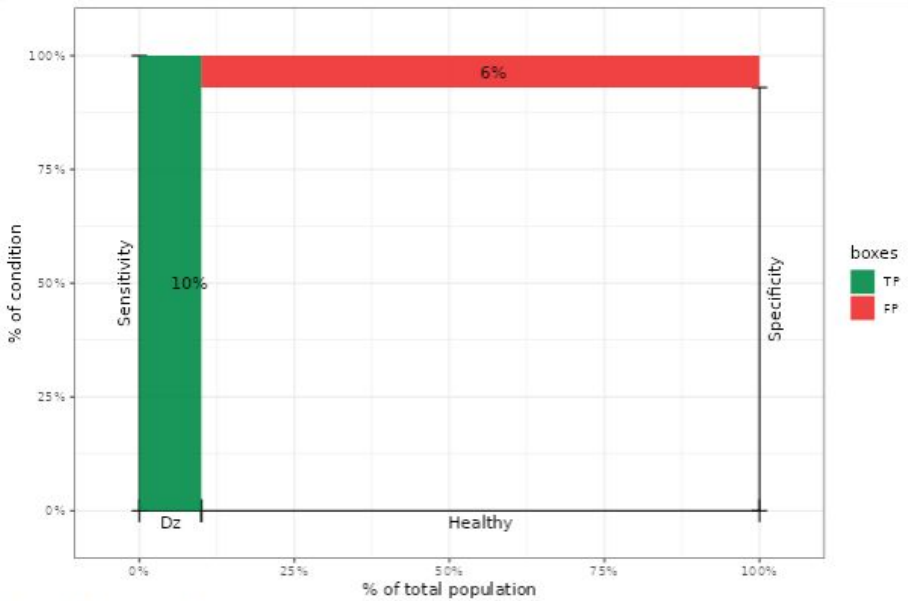
2 x 2 table

	Has Disease	No Disease
Test (+)	TP: 10%	FP: 6%
Test (-)	FN: 0%	TN: 84%

Positive Predictive Value

Among those who test positive, 61% will actually have the disease

Plot | Math



Show which cases?

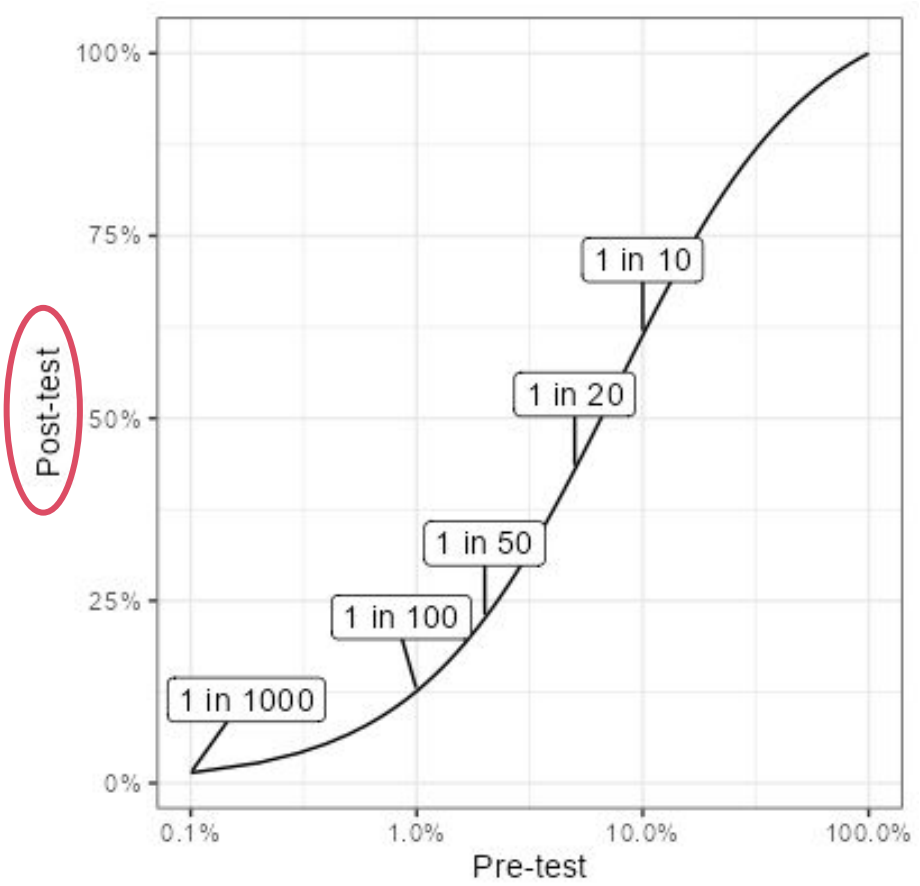
○ Both ◉ Test positive ○ Test negative

https://hunterratliff1.shinyapps.io/BayesPPV/

Post-test probability

How often would you expect this to be caused by cryptococcus?

- One in 10? **Pr(post) = 61.7%**
- One in 20? **Pr(post) = 43.2%**
- One in 50? **Pr(post) = 22.8%**
- One in 100? **Pr(post) = 12.8%**
- One in 1000? **Pr(post) = 1.4%**



Case #2

Case 2: HPI

A **22 y/o M** with no PMH who p/w **subacute cough**

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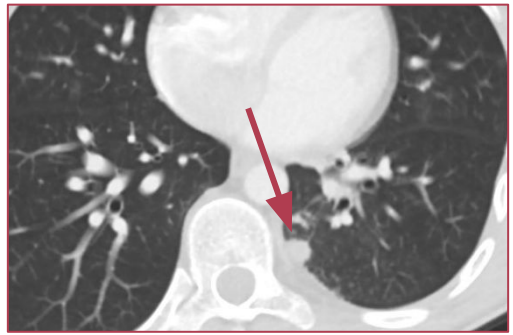
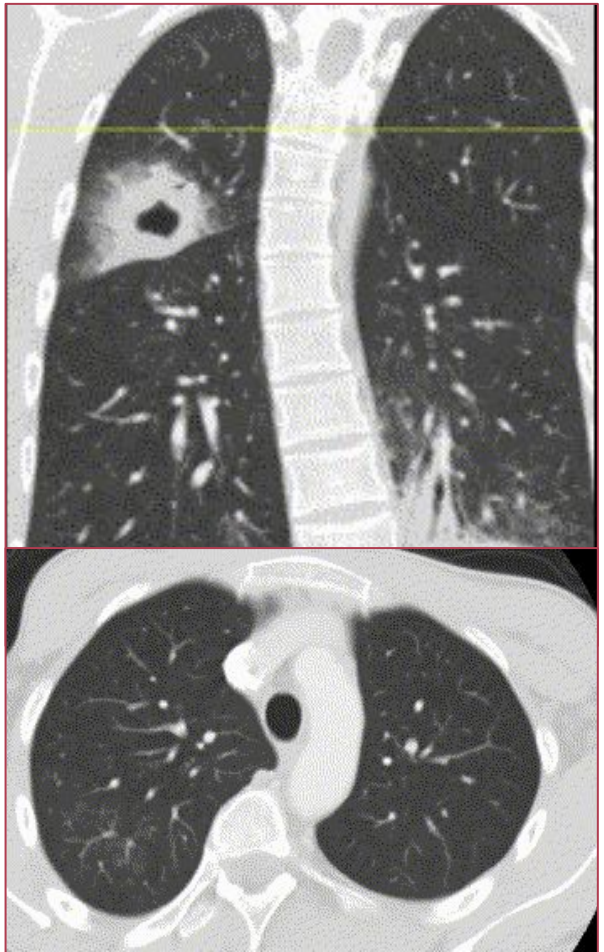
A **22 y/o M** with no PMH who p/w **subacute cough**

CT chest impression

- Ill-defined **4 cm** thick-walled cavitary mass **posterior RUL**
- **10 mm** round subpleural nodule **posterior medial LLL**

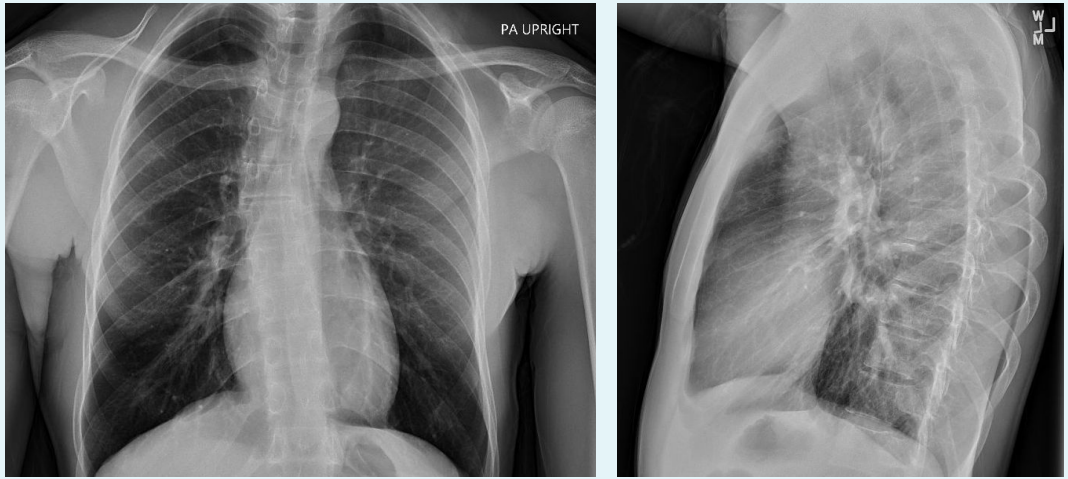


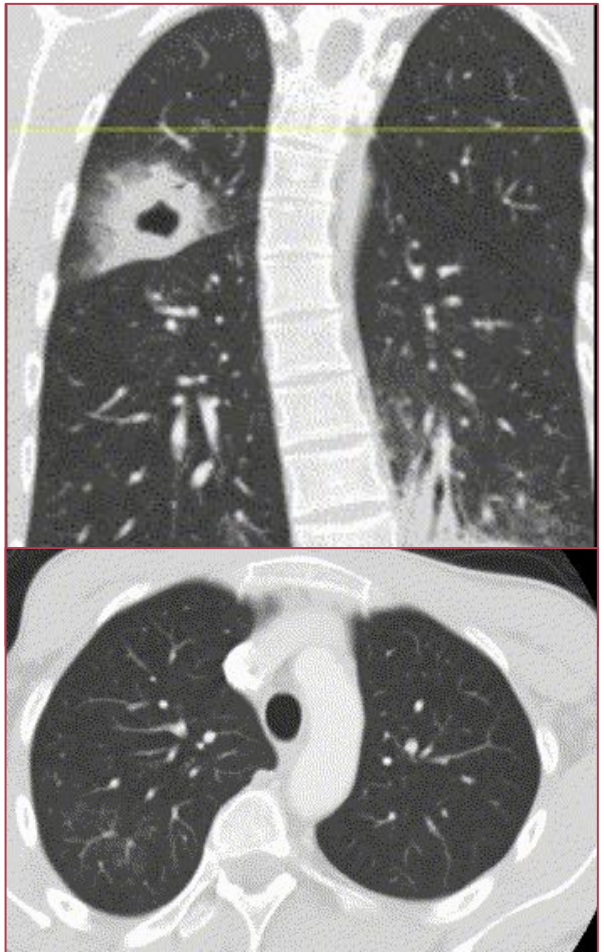


Case 2: HPI

A **22 y/o M** with no PMH who p/w **subacute cough**

Prior XR (14 months ago)

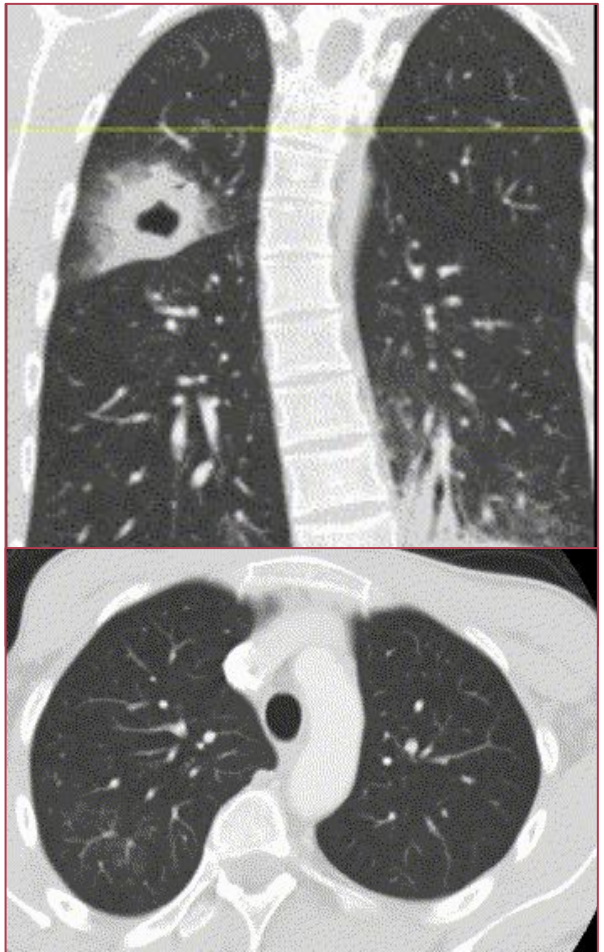




Case 2: HPI

A **22 y/o M** with no PMH who p/w **subacute cough**

- **4 weeks ago**: **sore throat** → **fevers**, **cough**, anorexia
- After 7-10 days, still having **productive cough**
  - But **all other symptoms resolved**
  - Never took antibiotics
- Went to urgent care due to cough
  - Obtained CXR → Sent to ED



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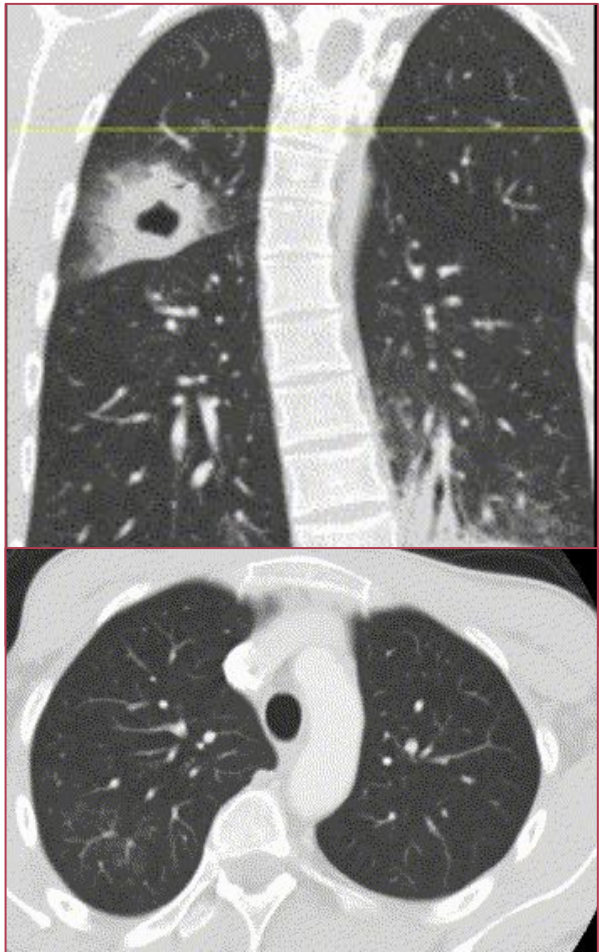
- **Cracked a tooth 4 years ago**, but no new symptoms
- Had routine dental cleaning (**2 weeks ago**)
  - This was well after onset of fever & cough
  - Says **exam & X-rays** were normal



Case 2: Social & Exposure History

Geographic & Travel	• The patient lives in **Tennessee** (between Nashville & Memphis) for **past year** ○ Before that, lived in **Washington state** for **a few years** • Visits parents in **Morgantown** frequently • A **few months ago**, some time in **northern California** for a family reunion • Has driven through the **Southwest states** (Arizona, Texas), but did not spend much time there • Only ***international travel*** has been to **Canada** (Alberta/BC area)

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No caves, landscaping, wood, or dust/dirt/soil exposure
Helping parents with their house renovations</td><td>Occupational

Substance & needles

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<tr><td>Animals</td><td colspan="3">Rodent exposure (cleaned mouse feces) w/o appropriate PPE
While working as delivery driver, he pet a cat on the street (unclear if feral)
Otherwise, no other animal exposures (including birds, bats, pets)</td></tr>
</table>

Case 2: Exam & initial labs

Vitals: BP 100/57| Pulse 62 | Temp 37.1 °C | SpO2 98% | BMI 18 kg/m^2

Gen: alert and oriented, NAD, physically fit

ENT: EOMI grossly, anicteric sclerae, MMM; **good detention**

Resp: normal respiratory effort, CTAB

CV: RRR

GI: no TTP

Neuro/MSK: moves extremities

CBC w/ diff: Normal

BMP: Normal

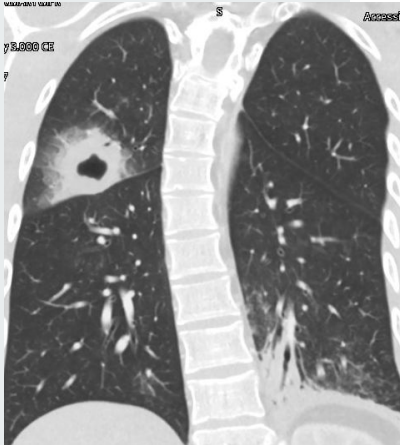
LFTs: Not available

HIV: Negative

Case 2: Summary

A **22 y/o M** with no PMH who p/w **subacute cough** x 1 month

- New 4cm RUL cavity, 1cm LLL nodule (vs XR 14 mo ago)
- Lots of fun travel & exposures
- Some dental issues?
- HIV negative



-3 years — **Living in Washington State**
- Lived in a house with “mold”
- International travel to British Columbia

-1 year — **Moved to Tennessee**
- Normal CXR around this time
- Travel to northern California
- Did cross country trips too
- House renovations (in WV)

-1 month — **Fever, cough, sore throat**
Self resolved after 7-10 days

-3 weeks — **Symptoms gone aside from cough**
Did go to the dentist

Now — **Admission**

Let's place some bets

Mycobacterial
- Mycobacterium tuberculosis
- NTM: M kansasii, M abscessus, MAC

Endemic mycoses
- Histo
- Blasto
- Cocci

Other fungal
- Crypto
- Aspergillus
- Mucor

Necrotizing bacteria
- Staph aureus
- Klebsiella pneumoniae
- Pseudomonas, E cloacae, Steno

Oral & anaerobes
- Streptococcus anginosus group
- Bacteroides, fusobacterium, prevotella

Filamentous gram positive rods
- Nocardia
- Actinomyces

Case 2: Workup

Serum / Urine	Result
Histo Ag	
Blasto Ag	
Crypto Ag	
Fungitell	
Asp GM	
Strep Ag	
Legionella Ag	
QuantGOLD	

BAL	Result
Asp GM	
Asp PCR	
MTB PCR	
PJP PCR	
Legionella DNA	

Micro	Result
Blood	
BAL (routine)	
BAL (AFB)	
BAL (fungal)	

Case 2: Workup

Serum / Urine	Result
Histo Ag	Neg
Blasto Ag	Neg
Crypto Ag	Neg
Fungitell	<31
Asp GM	Neg
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QuantGOLD	Neg

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Asp GM	Neg
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Legionella DNA	Neg

Micro	Result
Blood	NG
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Any other tests?

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Serum / Urine	Result
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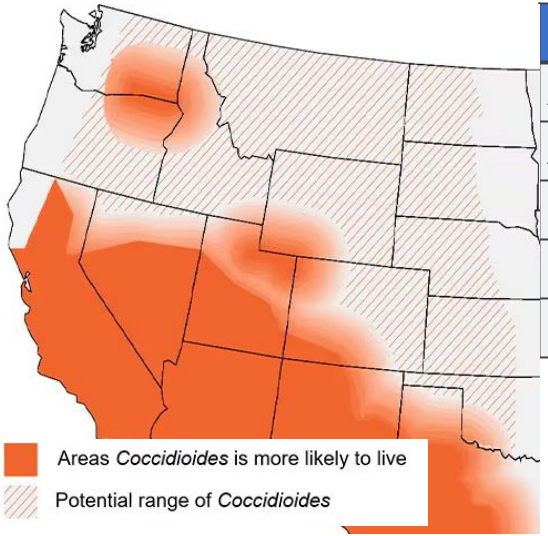
KARIUS ?

Any other tests?

Case 2: Workup



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Coccidioides antibody, serum

Complement fixation	Immunodiffusion
Antibody detected (**1:2**)	Antibody not detected

-3 years

Living in Washington State

- Lived in a house with "mold"
- International travel to British Columbia

Case 2: Workup

Complement fixation
Antibody detected (**1:2**)

All serum titers ≥ 1:2 should be **considered evidence indicative of coccidioidomycosis**, although **titers of 1:2 and 1:4 should be confirmed by immunodiffusion testing** . Titers exceeding 1:16 usually reflect disseminated disease. In general, higher titers are correlated with disease severity, and changes in serial titers are of prognostic value.

A **negative CF test does not**, however, **rule out diagnosis**. Only 70% of patients with cavitary diseases are positive, and only 30% of patients with nodular disease are positive.

Immunodiffusion
Antibody not detected

The immunodiffusion (ID) procedure correlates both in sensitivity and clinical utility with the CF test. The ID test, which **detects IgG** directed to the "F" antigen, becomes positive within 4 weeks after infection and remains positive throughout clinically active disease. **It is most useful in confirming the specificity of low CF titers**, where lines of identity are formed with reference antisera. Positive ID reactions are diagnostic for coccidioidomycosis and usually indicate active or recent disease and remain detectable for up to 1 year thereafter.

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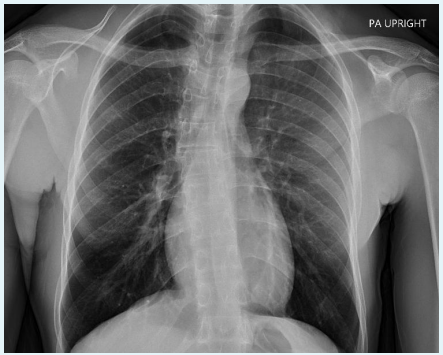
A **negat ule out diagnos** tary diseases tients with noc

Prior XR (14 months ago)



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Coccidioides

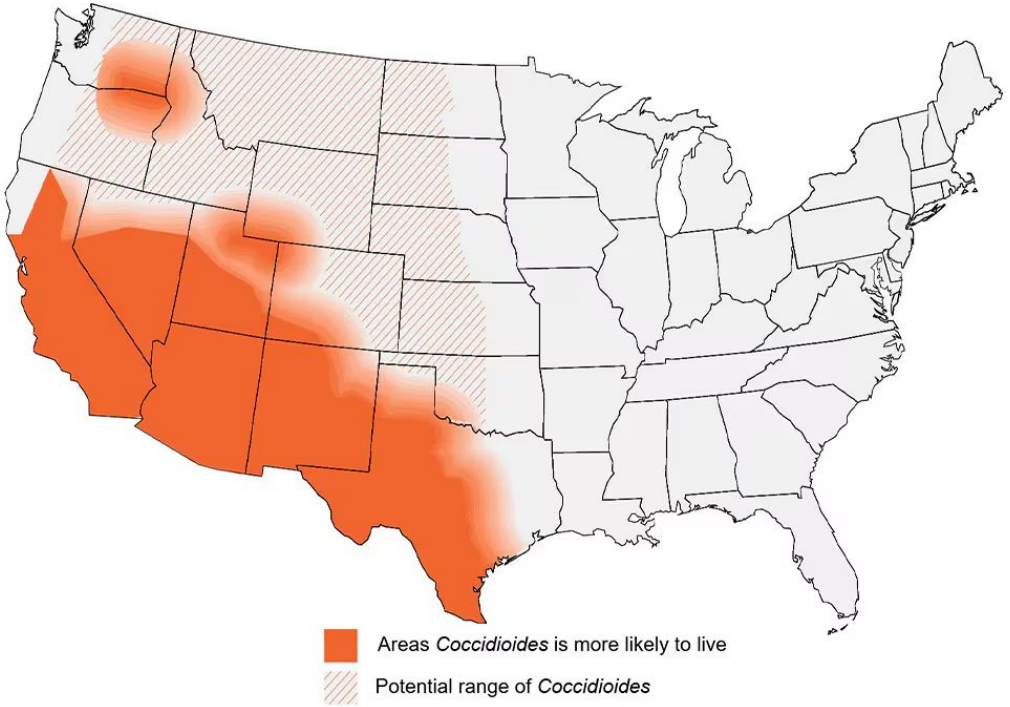
Links to articles discussed here

Coccidioides

- Describe the **epidemiology** **of Coccidioides**, including geographic distribution & seasonal patterns
- Explain the modes of transmission and **key risk factors** **for Coccidioides infection**
- Discuss the **diagnostic approaches** **for coccidioidomycosis**, including serologic testing, culture, and molecular methods
- Characterize the **spectrum of disease** **caused by Coccidioides**

Coccidioides (Valley fever)

- California, AZ, Washington
  - *Coccidioides immitis* more common in California
  - *C posadasii* elsewhere
  - No clinical difference



https://www.cdc.gov/valley-fever/areas/index.html

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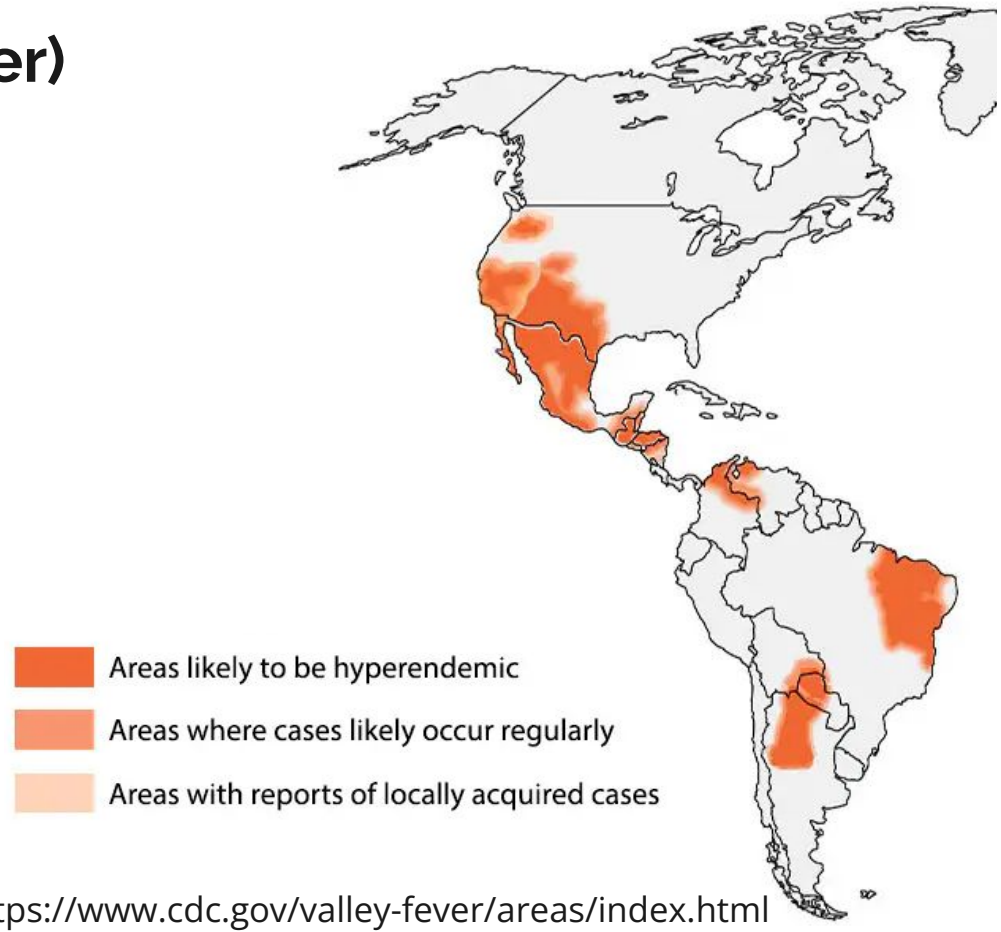
- California, AZ, Washington
  - *Coccidioides immitis* more common in California
  - *C posadasii* elsewhere
  - No clinical difference
- Also seen in Mexico, Central America, and some areas of South America



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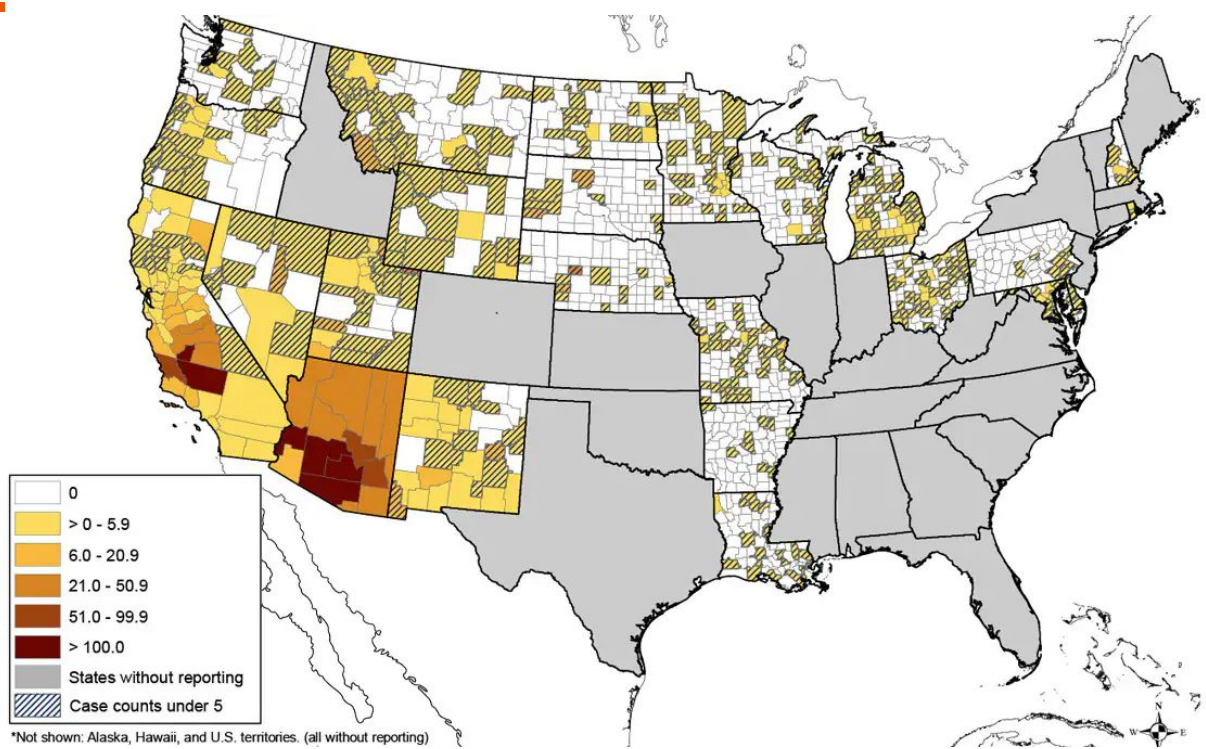


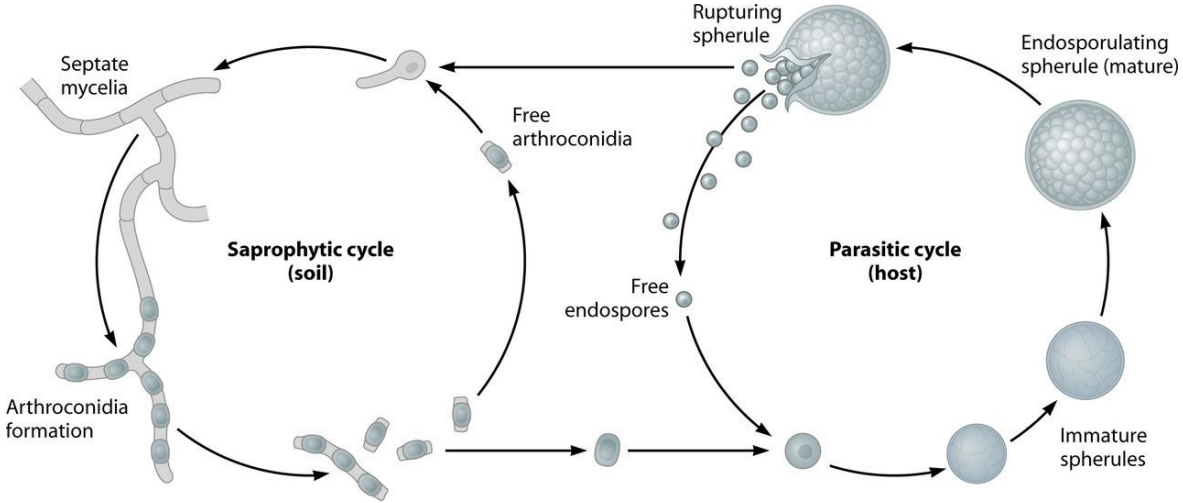
County incidence (per 100,000) from 2011 - 2017 https://www.cdc.gov/valley-fever/areas/index.html

Coccidioides: Transmission [2.1]

Inhalation of **arthroconidia** from contaminated soil

- Dust storms
- Construction
- Earthquakes

More common in the dry season



Coccidioides: Diagnosis [2.2]

Most common: EIA (screen) → immunodiffusion (confirmation)

- May have false negative early in the disease (re-test 1-3 weeks later)
- EIA is prone to false positives
- If immunodiffusion is positive → quantification should be done (either QID or CF)

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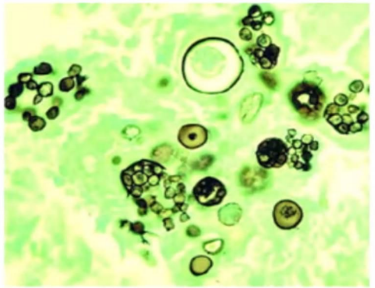
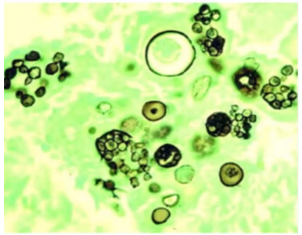
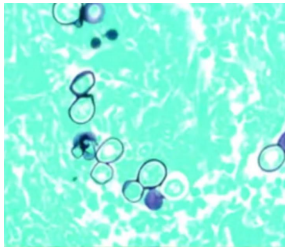
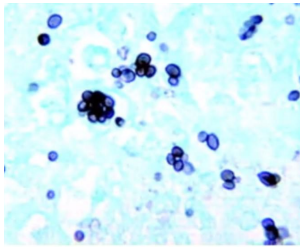
Culture: Coccidioides grows on most media

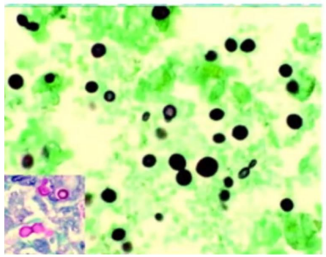
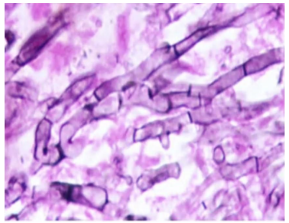
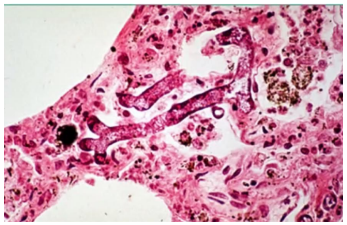
- Growth usually evident within a week



Spherules with multiple endospores - coccidioidomycosis

Adapted from @TheIDTrivia, @GeraldMD, & Febrile podcast #69

	Coccidioidomycosis	Blastomycosis	Histoplasmosis
BAL	Spherules with multiple endospores 	Broad based, single-budding 	Small yeast, narrow based budding. May be in macrophages 

	Cryptococcus	Aspergillosis	Mucor and Rhizopus
BAL	Narrow budding yeast with mucicarmine (+) capsules 	Septate hyphae Acute angle branching Forms conidial heads 	Ribbon-like hyphae Right angle branching Rare septations 

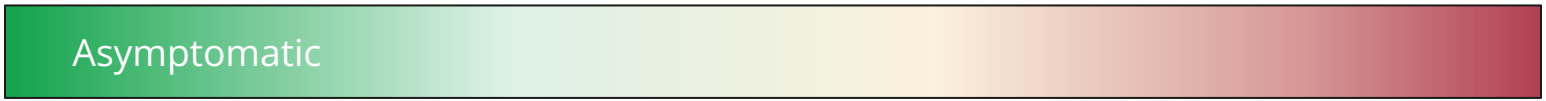
Adapted from @TheIDTrivia, @GeraldMD, & Febrile podcast #69

	Coccidioidomycosis	Blastomycosis	Histoplasmosis
Risk factors	Working in dusty areas	Working, playing, or hunting in wooded areas	Chickens, barns, caves, or any bird droppings
B-D glucan	+/-	No	+/-
Galacto-mannan	No	+/-	+/-

	Cryptococcus	Aspergillosis	Mucorales
Risk factors	Steroids, AIDs, sarcoid, liver dz	Steroids, neutropenia, transplant, viral infections	DM, DKA, steroids, burns, transplant
B-D glucan	No	Yes	No
Galacto-mannan	+/-	Yes	No

Coccidioides: Spectrum of disease [2.1]

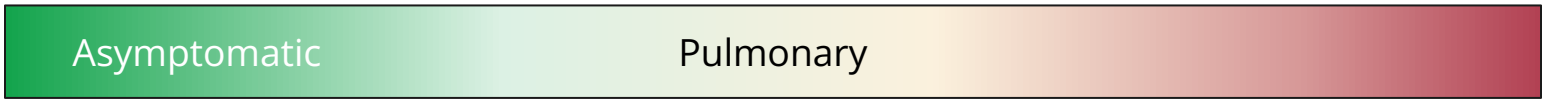
- Majority of patients (2/3) are asymptomatic



Coccidioides: Spectrum of disease [2.1]

Primary pulmonary disease

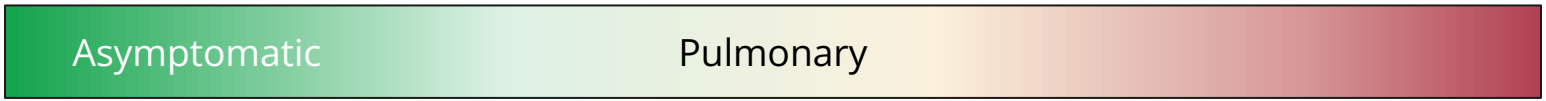
- In endemic areas, can account for 1 in 4 cases of CAP
- Often self limiting, some will have “multiple visits for unimproved symptoms (despite abx)”



Coccidioides: Spectrum of disease [2.1]

Primary pulmonary disease

- In endemic areas, can account for 1 in 4 cases of CAP
- Often self limiting, some will have “multiple visits for unimproved symptoms (despite abx)”
- **Systemic symptoms**: Fevers, night sweats
- **Immunologic**: **arthralgias** (“desert rheumatism”), erythema nodosum, erythema multiforme
- **Labs**: One in four have **peripheral eosinophilia**



Coccidioides: Spectrum of disease [2.1]

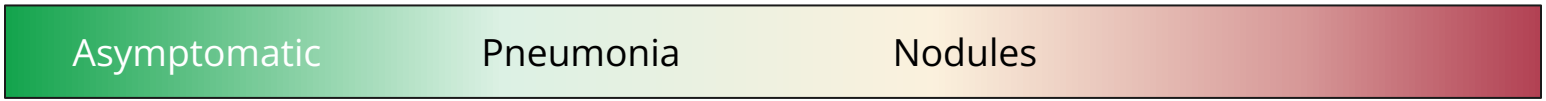
Primary pulmonary disease

- Systemic symptoms: Fevers, night sweats
- Immunologic: arthralgias, erythema nodosum, erythema multiforme
- Labs: Eosinophilia

These do not mean they have disseminated disease!

Radiographically

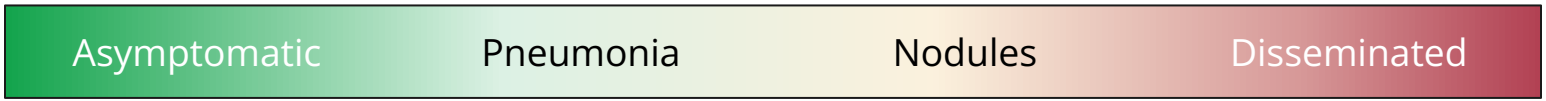
- Unilateral (upper > lower) infiltrate
- Associated hilar LAD
- Nodules &/or cavities (4-8%)



Coccidioides: Spectrum of disease [2.1]

Disseminated disease is rare

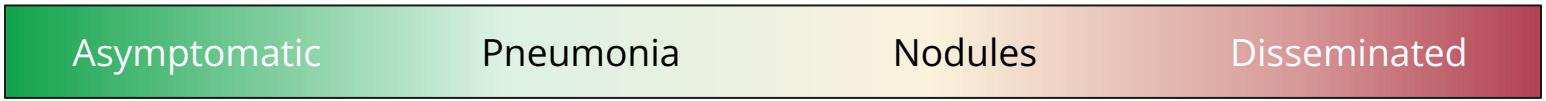
- **Skin and soft tissue**: Granulomatous infections (*not the immunologic phenomena*)
- **Bone & joint**: May progress to osteomyelitis
- **Others**: GU, peritoneum, eyes, pericardium



Coccidioides: Spectrum of disease [2.1]

Disseminated disease is rare

- Skin and soft tissue
- Bone & joint
- Others
- Most feared is **CNS**
  - Most common symptom: headache
  - 95% mortality if untreated
  - High rates of relapse



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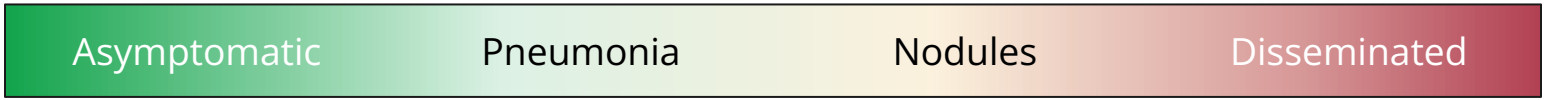
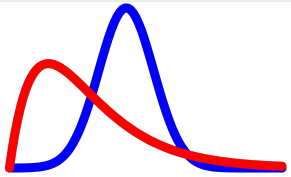
CSF studies
- Common to have eosinophilia
- Uncommon to grow on Cx



Learning points & take aways

Learning points & take aways



- Hypermucoviscous Klebsiella pneumoniae (HmKp) is a **thick, mucoid** phenotype of *K pneumoniae* (**string test**),
  - Predisposition to cause **more severe infections** in **immunocompetent hosts**
  - Likes to **metastasize**: Liver, CNS, lungs, brain
  - Can have **extensive antimicrobial resistance**, especially internationally
- Coccidioides is most often **asymptomatic or mild pulmonary infections**, but can be severe in immunocompromise
  - Risk factors: Travel to the **Western US** + **dry dirt/soil exposure**
  - Testing for coccidioides is multi-step, and subject to **false positives & false negatives**
- Interpreting the test results depends on both the nature of the test itself and the **pre-test probability**
  - You don't need to know Bayes Theorem itself, but online calculators can help improve our numeracy

Slides available on hunterratliff1.com/talk/; Citations available via QR code or via the "citations" button on the website