HIV-Associated Opportunistic Infections I

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Disclosures of Financial Relationships with Relevant Commercial Interests

- List of disclosures or "None"

Question #1

For which of the following infections would life long suppressive therapy be indicated for a patient with an initial CD4 count <50 cells and high viral load, regardless of subsequent success of ART regimen in terms of CD4 count and viral load?

A. Disseminated histoplasmosis
B. Cryptococcal meningitis
C. Coccidioides meningitis
D. Miliary tuberculosis
E. Disseminated Mycobacterium avium complex

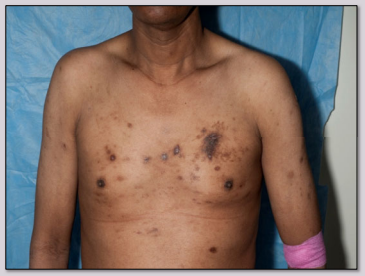
Question #2

A patient who was recently found to be HIV positive…

- **(CD4=10 cells/uL, VL=2 mil copies)**

….has noted the lesions shown on the following PowerPoint developing on his trunk, face and extremities over the past 8 months.

Otherwise, he feels fine.



Question #2

What virus would you expect to be causative agent for these lesions?

A. HHV-6
B. HHV-8
C. EBV
D. JC virus
E. BK virus

Question #3

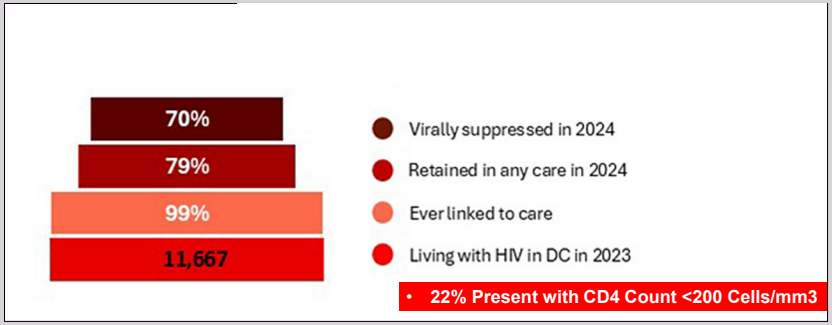
The patient whose photo was shown, for your differential diagnosis…

What would be the most likely non-viral infectious cause of these lesions and their associated fever?

A. Cryptococcus neoformans
B. Blastomyces hominis
C. Treponema pallidum
D. Mycobacterium genevense
E. Bartonella henselae

Why Does Anyone in US Develop an HIV Associated Opportunistic Infection in Current Era?

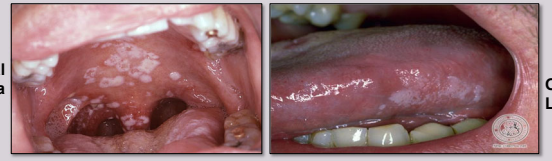
HIV Care Continuum in DC,2024



SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

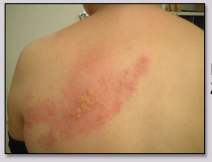
https://dchealth.dc.gov/service/hiv-reports-and-publications

Clinical Indicators of Immunosuppression



Mucosal Candida

Oral Hairy Leukoplakia (EBV)

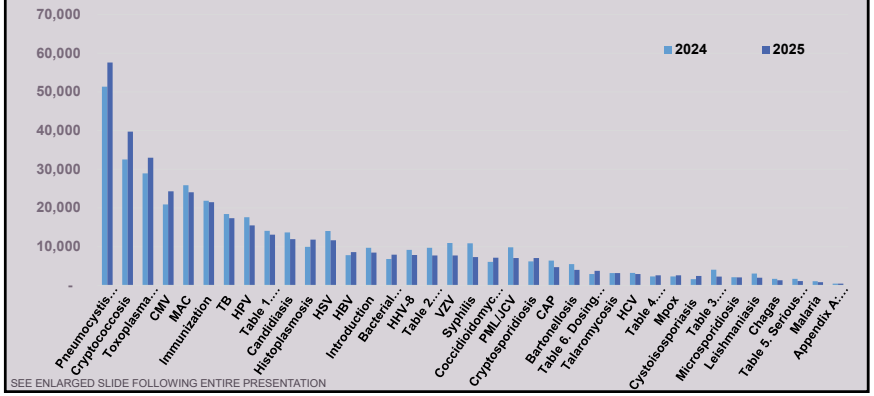


Dermatomal Zoster

Cardinal AIDS-Defining Illnesses

- Pneumocystis pneumonia
- Cryptococcus
- Toxoplasma encephalitis
- CMV Retinitis
- Disseminated Mycobacterium avium complex/Tuberculosis
- Chronic cryptosporidiosis/microsporidiosis
- Kaposi Sarcoma

NIH IDSA HIV Associated Opportunistic Infections Guideline
Which Pages Are Consulted Most By Users



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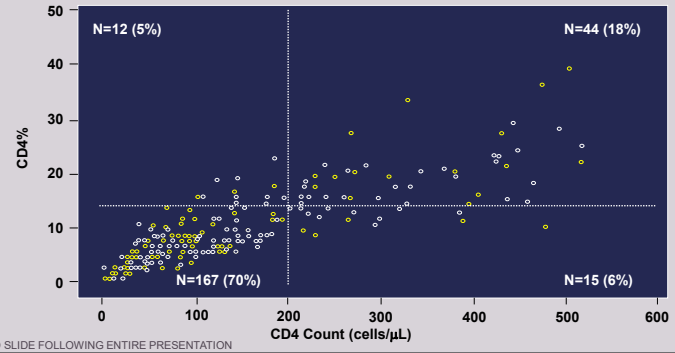
Susceptibility to Opportunistic Infections Patients with HIV

- CD4 Count
  - Current count is most important
  - Prior nadir count is much less important
- Viral Load
  - Independent risk factor for OIs

At What CD4 Counts Do Opportunistic Infections Occur?

Scatterplot of CD4 Number vs CD4 Percent Within 6 Months of HIV-Associated PCP



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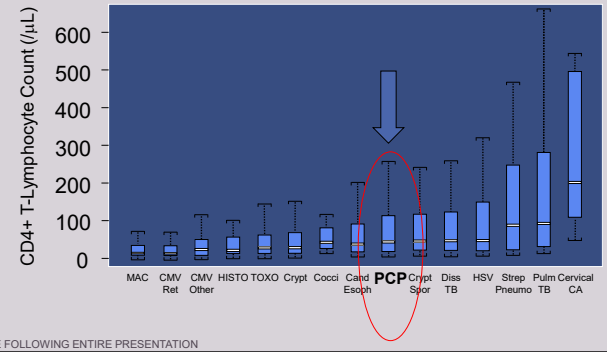
CD4+ Lymphocyte Counts Are Excellent Predictor of the Occurrence of Opportunistic Infections for HIV/AIDS



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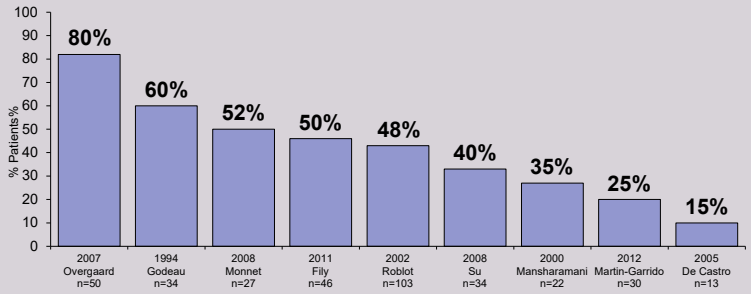
Warning for Utility of CD4 Counts in Non-HIV

- High CD4 Count (e.g., >200) NOT indicative of “low risk”
- Low CD4 Count (e.g., <200) probably indicates “high risk”

Non-HIV Patients Who Develop PCP When CD4>200



SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Messiaen. *Transpl Infect Dis.* 2017;19:e12651.

Non-HIV Patients Who Develop PCP When CD4>200

- Solid Organ Transplant Recipients
- Human Stem Cell Transplant Recipients
- Cancer Chemotherapy
- Immunosuppressive Biologics
- Congenital Immunodeficiencies
- New: Decompensated Cirrhosis

- Not on PCP Prophylaxis

Messiaen. *Transpl Infect Dis.* 2017;19:e12651.

What is the Most Effective Intervention to Prevent Opportunistic Infections and Neoplasms?

What is the Most Effective Intervention to Prevent Opportunistic Infections and Neoplasms for PWH?

Antiretroviral Therapy

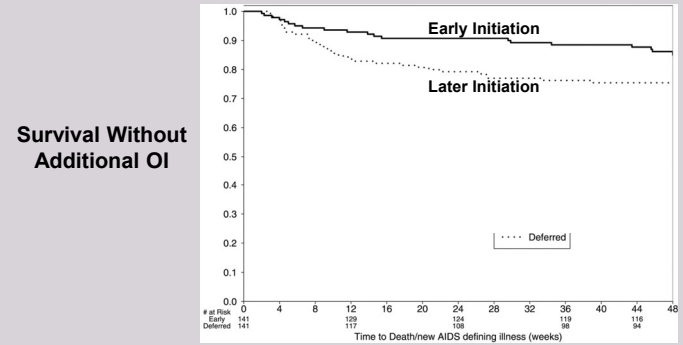
When to Start ART Following Opportunistic Infection

When to Start ART Following Opportunistic Infection

- Most OIs
  - **Within 2 weeks** of diagnosis

ART Initiation Following HIV Related Opportunistic Infections

Early Initiation (<2 weeks) Favors Survival



SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Zolopa PLoS One 2009;4:e5575

When to Start ART: Exceptions to Two Week "Rule"

- Tuberculosis: 2-8 weeks after initiation RX*
  - CD4<50 or Pregnant-within 2 weeks of diagnosis
  - CD4>50-within 8 weeks of diagnosis
- Cryptococcal Meningitis: 4-6 weeks after initiation of RX
  - Sooner if mild and if CD4<50
  - Later if severe
- "Untreatable" OIs, i.e., PML, Cryptosporidiosis
  - Start immediately

*For TB meningitis: potentially longer

Primary and Secondary OI Prophylaxis

These Are Guidelines But They Are Based on 1980-1990 ART

- **Primary Prophylaxis**
  - PCP (CD4 <200, oral candida, prior AIDS Defining)
  - Toxo (CD4 <100, old or new positive anti Toxo IgG)
  - Cocci (CD4<250, IgG or new positive cocci IgM
  - ~~MAC (CD4 < 50)~~ ---NIH/CDC/IDSA guideline has eliminated this except patients whose VL can't be suppressed and have CD4 less than 50
- **Secondary Prophylaxis/Chronic Suppression**
  - PCP
  - Toxo
  - MAC
  - CMV
  - Cryptococcus
  - Histoplasma
  - Coccidio

*Some experts would give Histo primary prophylaxis with itraconazole in high-risk situations if CD4<150/200 and would not use histo serology in decision (not reliable)

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Discontinue Prophylaxis/Chronic Maintenance

Board might consider this a "look up"

	CD4 Count Due to ART
• **Primary Prophylaxis**	
• PCP or Toxo	>200 x 3 months
• **PCP**	**(>100 and VL<50)**
• **Secondary Prophylaxis/Chronic Maintenance**	
• PCP	>200 x 3 months
• Toxo	>200 x 6 months
• Crypt	>200 x 6 months
• MAC	>100 x 6 months + 12 m Rx
• CMV	>100 x 3-6 months*

Discontinue Prophylaxis/Chronic Maintenance

Board might consider this a "look up"

- **Primar**
  - PCP
  - **PCP**
- **Secon**
  - PCP
  - Toxo
  - Cryp
  - MAC
  - CMV

Many of "Rules" About Primary and Secondary Prophylaxis Are Based on Studies from the 1980-2000 Time Period

- **For Exam: These Recommendations Are From Current Guideline**
- **Are they still relevant for patient who durably suppressed by ART?**

Primary Coccidiomycosis Prophylaxis 2026 OI Guideline

Serologic Testing in Endemic Areas

- Once or twice-yearly testing for seronegative patients

Primary Prophylaxis

- **Do not administer in endemic area if serology negative**
- **Do Administer in the endemic area if…..**
  - Positive IgG or IgM serology* and
  - CD4 count is <250 cells (BIII) and
  - No Active Disease
- **Regimen**
  - Fluconazole 400mg qd until CD4>250 and fully suppressed viral load

Immunizations for Persons with HIV

Immunization Schedule for Adults with HIV from NIH IDSA Guidelines 2026 (Minor Differences from ACIP)

Vaccine	All People With HIV	Where Varies by Age	Where Varies by Pregnancy Status	Where Varies by CD4 Cell Count (Cells/mm³)	
				<200	≥200
COVID-19	One dose annually			Consider an additional dose 6 months after the last dose.	
Hepatitis A (HepA, HepA-HepB)	Two to three doses (varies by formulation)		Two dose series recommended for pregnant women who have chronic HBV and who are nonimmune to HAV		
Hepatitis B (HepBCpG, HepB, HepA-HepB)	Two to three doses (varies by formulation and indication)				
Human Papillomavirus (HPV)		Three doses for ages 18–26 years Consider for ages 27–45 years with shared decision-making	Not recommended during pregnancy		
Influenza (Multiple Vaccines)	One dose annually				
Measles, Mumps, Rubella (MMR)			Not recommended during pregnancy	Contraindicated	Two doses if born after 1956 and no history of vaccination or positive antibody titer
Meningococcal A, C, W, Y Conjugate (MenACWY)	Two doses				
Meningococcal B (MenB)	Three doses		Not recommended during pregnancy		
Mpox (MVA-BN, Attenuated)	Two doses	Subcutaneous route preferred for people aged <18 years	Shared decision-making		
Pneumococcal Conjugate (PCV15, PCV20, PCV21)	One dose				
Pneumococcal Polysaccharide (PPSV23)	One dose (if conjugate vaccine was PCV15)				
Respiratory Syncytial Virus (RSV)		One dose for people aged ≥75 years One dose for people aged 50–74 years with a comorbid condition that increases risk for severe RSV disease	One dose between 32 and 36 weeks' gestation		
Tetanus, Diphtheria, Pertussis (Tdap/Td)	Tdap once, then Td or Tdap booster every 10 years		Recommend booster with each pregnancy		
Varicella (VAR)			Contraindicated	Contraindicated	Two doses
Zoster Recombinant (RZV)		Two doses for ages ≥18 years	Not recommended during pregnancy		

Recommended for all adults and adolescents with HIV who meet the age requirement or lack documentation of vaccination or evidence of past infection.

Recommended for adults and adolescents with HIV with another risk factor (medical, occupational, or other indication) or in select circumstances.

Contraindicated or Not Recommended

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION R-38

This is All Oversimplified, But for the Exam

- Avoid live vaccines at CD4 counts < 200 or Uncontrolled Viral Replication
  - MMR, Varicella, Yellow Fever, Oral typhoid, *Intranasal Influenza
  - But……Mpox Jynneos live vaccine is safe because it is non replicating
- Administer
  - HAV, HBV, Meningococcus ACWY, Pneumococcus, COVID and probably RSV
    - All higher incidence or more severe in HIV than non-HIV
  - RZV (Shingrix) age >18 years
  - Pneumococcus, when in doubt use PCV 20 or 21 –no follow up immunization needed
    - (or PCV 15 plus 23 valent polysaccharide)
- Administer Mpox if possibly exposed or likely to be exposed
- Assess post vaccine titers for HBV (and HAV if CD4<200)

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION https://clinicalinfo.hiv.gov/en/guidelines/adult-and-adolescent-opportunistic-infection

Who Should be Vaccinated for HBV

- People without chronic HBV infection and without immunity to HBV infection (anti-HBs <10 mIU/mL)
- Current Recommendation
  - Two dose regimen*
    - Conjugated vaccine: **Heplisav-B®** IM at 0 and 1 months
  - NIH/IDSA perspective re assessing post vaccine titers
    - 1-2 months post vaccine and then some experts would test annually
    - Boost responders when annual level <10mIU/ml

HBV Non-Responders

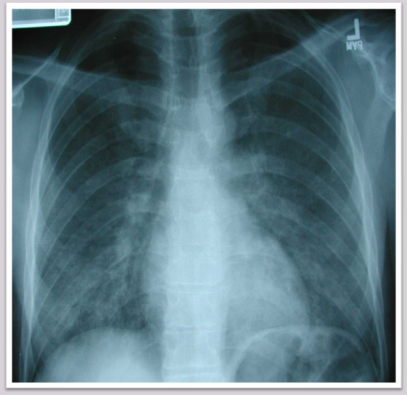
- **Definition**
  - Anti-HBs <10 international units/mL 1 month after vaccination series
- **Options: Not testable**
  - (Heplisav- if that was not the initial regimen)-3 doses
  - Switch to another HBV vaccine
  - Double dose of recombinant vaccine
  - Four dose recombinant regimen

*BEe-HIV Trial is too new for exam-HIV and prior non-response (JAMA 12/24 and 7/25))- i.e., Heplisav provides higher and more durable titers than prior HBV alum product

HBV Immunization for Persons with Isolated Anti HBc

- **Frequency: 7-20% Patients**
  - Either false positive, loss of prior HBsAb or latent infection
  - Serum DNA testing only recommended for pregnancy
- **Recommend one standard dose of HepB vaccine followed by checking anti-HBs level at 1–2 months**
  - If the titer is >100 mIU/mL, no further vaccination is needed (anamnestic response)
  - If the titer is <100 mIU/mL, a complete series of HepB vaccine should be completed, followed by anti-HBs testing
- **If the anti-HBs quantitative titer is not available**
  - Recommend complete HepB vaccine series

HIV Associated Pulmonary Disease



Respiratory Disease in Patients with HIV
Do Not Focus Only on OIs!

- **Non-Infectious**
  - Congestive Heart Failure — Age, cocaine, pulm hypertension
  - Pulmonary emboli — Increased risk
  - Drug toxicity — ~~Abacavir~~, Lactic acidosis, dapsone
  - Neoplastic — KS, Lymphoma, Lung CA

Respiratory Disease in Patients with HIV
Do Not Focus Only on OIs!

- **Non-Infectious**
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  - Pulmonary emboli — Increased risk
  - Drug toxicity — Abacavir, Lactic acidosis, dapsone
  - Neoplastic — Kaposi sarcoma, Lymphoma, Lung CA
- **Non-Opportunistic Infections**
  - Community acquired — (Influenza and MRSA)
  - Aspiration — (Opioid related, nosocomial)
  - Septic Emboli — (IV catheters, endocarditis)

Approach to Diagnosis and Therapy of Pneumonia in PWH

Parameter	Example
• **Rapidity of Onset**	> 3 days: PCP, TB, <3 days: Bacteria, viral
• **Temperature**	Afebrile: Neoplasm, PE, CHF
• **Sputum**	Scant: PCP, Virus, TB Purulent: Bacteria
• **Physical Exam**	Noral: PCP Consolidation: Bacteria
• **X-ray**	Suggestive But Never Diagnostic

Etiology of HIV Associated Pulmonary Disorders

Common	Less Common	Rare
Pneumococcus	Histo/Cocci	CMV
Pneumocystis	Toxoplasma	MAC
Tuberculosis	Lymphoma	HSV
	Kaposi Sarcoma	Asperg

Internal Medicine Question

Are There Strategies for Reducing Bacterial Pneumonias in Patients with HIV Infection?

Strategies to Reduce Incidence of Pneumonia for Patients with HIV

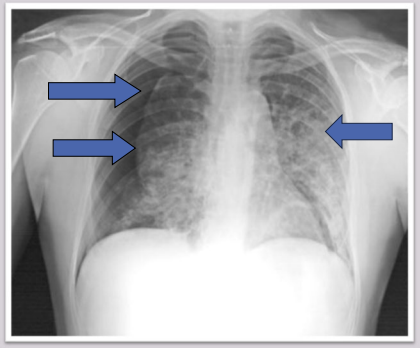
- **Patient Focused Strategies**
  - Antiretroviral Therapy
  - Pneumococcal vaccine
  - Influenza vaccine
  - Tobacco cessation
- **Environmental Strategies**
  - Immunize contacts and community (esp children)
    - Pneumococcal and Hemophilus vaccines
    - Influenza vaccine

HIV and COVID

- **Nothing testable that is HIV specific**
  - No increased susceptibility
  - Probably increased severity, especially with low CD4
    - May be primarily linked to other co-morbidities
  - Drug interactions-Paxlovid and Remdesivir
    - No major interaction with Integrase inhibitors or Cobicistat

Question #4

- A 28-year-old male with HIV (CD4 count = 10 cells) presents to the ER 4 weeks of malaise and mild cough and now has bilateral interstitial infiltrates and a right sided pneumothorax.
- The patient lives in Chicago, works in an office and has never left the Midwest and has no unusual exposures.



Question #4

A 28-year-old male with HIV (CD4 count = 10 cells) presents to the ER 4 weeks of malaise and mild cough and now has bilateral interstitial infiltrates and a right sided pneumothorax.

The patient lives in Chicago, works in an office and has never left the Midwest and no unusual exposures.

What is the most likely INFECTIOUS cause of this pneumothorax?

A. Mycobacterium avium complex
B. Blastomycosis
C. PCP
D. CMV
E. Aspergillosis

Pneumocystis Jirovecii (Formerly P. carinii) (PCP or PJP)

- Taxonomy
  - Fungus (no longer Protozoan)
- Epidemiology
  - Environmental source unknown
- Life Cycle
  - Unknown
- Transmission
  - Respiratory

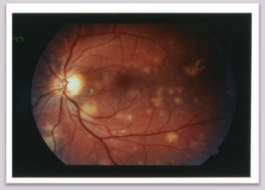
Host Susceptibility to PCP

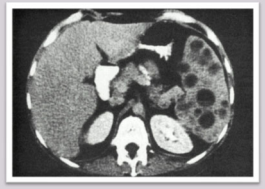
- **CD4 < 200 cells/μL --(90% of cases)**
- **CD4% <14**

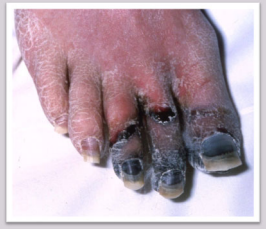
PCP is More Often Subacute in Persons With HIV Compared To Other Immunosuppressed Persons

Kovacs et al. Ann Intern Med 1984

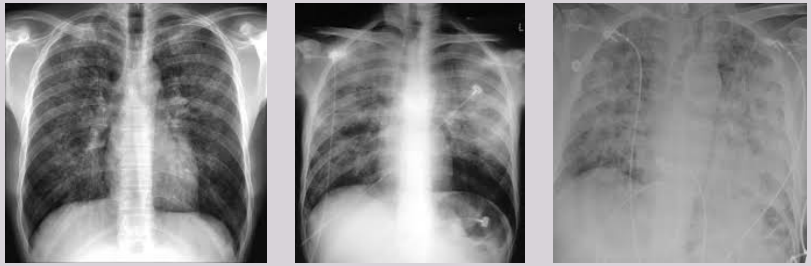
Uncommon Manifestations of PCP



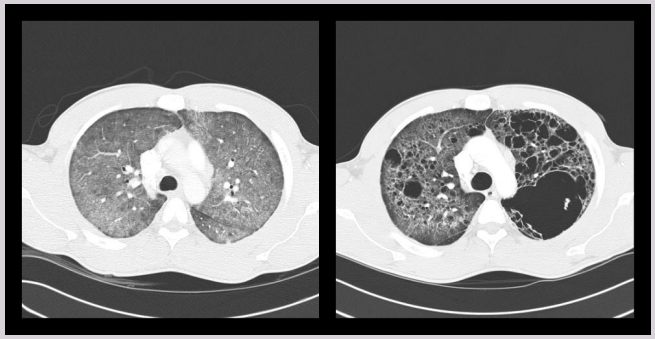




HIV Related PCP



Development of Pneumatocoeles



May 23 June 13

Radiologic Patterns Associated with Documented Pneumocystis Pneumonia

- **Most Frequent**
  - Diffuse symmetric interstitial infiltrates progressing to diffuse alveolar process
    - Butterfly pattern radiating from hilum

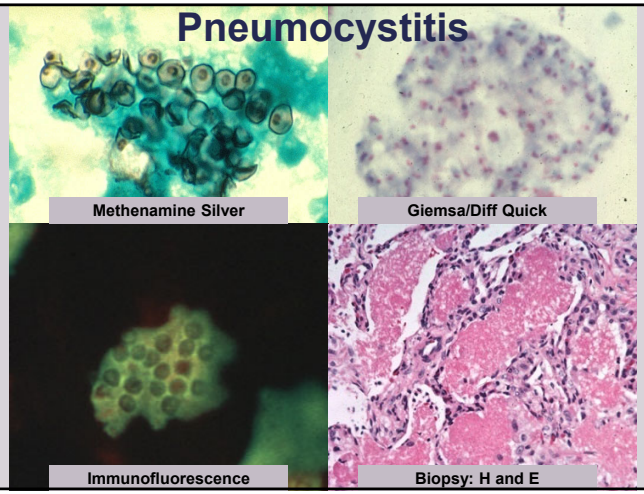
Radiologic Patterns Associated with Documented Pneumocystis Pneumonia

- **Other Patterns Recognized**
  - Normal
  - Lobar infiltrates
  - Upper lobe infiltrates
  - Pneumothorax
  - Solitary nodules
  - Cavitating lesions
  - Infiltrates with effusions
  - Asymmetric or unilateral processes

Diagnosis of Pneumocystis Pneumonia

Specimen Acquisition	1957	Organism Detection
Open lung biopsy		Methenamine silver
Transbronchial biopsy		Immunofluorescence
Bronchoalveolar lavage		Giemsa / Diff Quik
Induced sputum		PCR
	2026	

Pneumocystitis



PCR
Diagnosis of Pneumocystis

- **Highly sensitive in BAL**
  - Less sensitive induced sputum
  - Insensitive in blood/serum/plasma
- **High biologic specificity**
  - Positive = infection or disease
  - Cycle number (copy number) helpful but not definitive

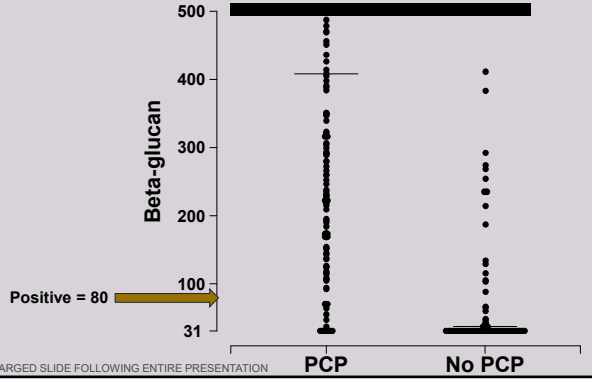
PCR
Diagnosis of Pneumocystis

- **Hig**
- **Hig**

Negative BAL PCR rules out PCP

Positive BAL PCR *might* be PCP
- **Colonization vs Disease**

Don't Use Beta Glucan Test for Diagnosis of PCP!! (Controversial---See Kotton)



SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Sax PE. *Clin Infect Dis* 2011
DelCorpo. Clini Microb and Infection 2020

Question #5

A 45-year-old woman with HIV (CD4 = 50 cells/uL, HIV viral load = 500,000 copies/uL) presents with fever, shortness of breath, room air P02 =80mm Hg) and diffuse bilateral infiltrates and is started on TMP-SMX.

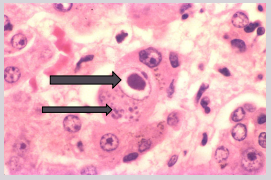
The bronchoalveolar lavage is positive for pneumocystis by direct fluorescent antibody test.

The microbiology lab also reports the BAL positive by PCR for CMV.

In addition to considering antiretroviral therapy, what would be the best course of action?

A. To add ganciclovir to the TMP-SMX regimen
B. To add prednisone to the TMP-SMX regimen
C. To add ganciclovir plus prednisone to the TMP-SMX regimen
D. To add ganciclovir plus IVIG to the regimen
E. To add nothing, i.e., continue TMP-SMX alone

CMV and Lungs



Eosinophilic Intranuclear Inclusion and Basophilic Cytoplasmic Inclusions

CMV almost never causes pneumonia …**In PWH**

CMV in pulmonary secretions or blood is a marker of severe immunosuppression but **not** usually the cause of pneumonia…**in this population**

Question #6

A patient with oral thrush and newly diagnosed HIV infection (CD4=10, VL= 200,000 copies/uL) was started on the following medications: dolutegravir, emtricitabine, tenofovir (TAF), dapsone, fluconazole.

Ten days later the patient returns with headache, exercise intolerance, shortness of breath, but no fever……and you order a chest CT which is…..normal

Pulse oximetry shows an O2 saturation of 85% which does not increase with supplemental oxygen.

Which is the most likely cause of this patient's syndrome?

A. Covid-19
B. Pneumocystis pneumonia unmasking
C. Fluconazole interaction with another drug
D. Dapsone
E. Dolutegravir

Two Pharmacologic Issues to Watch For

- **Methemoglobinemia** (>8-10% of hemoglobin)("Functional Anemia")
  - Symptoms: Dyspnea, Tachypnea, Tachycardia
  - Antimicrobial causes: dapsone and tafenoquine/primaquine
  - (and occasionally chloroquine, quinolones and sulfa)
  - O2 Saturation low compared to pO2 and does not improve with O2 (stays at 85%)
    - Specifically detected by co-oximetry but NOT routine pulse oximetry
  - Rx Methylene blue and stop offending drug
  - This is not " happy hypoxemia" associated with COVID-a dangerous scenario
  - Pt does not report dyspnea but may have tachypnea, tachycardia, cyanosis
- **Glucose-6-Phosphate Deficiency**
  - Hemolysis related to x linked mutation-mostly males
  - AntibioticTriggers: Dapsone, primaquine/tafenoquine
    - Sulfa and trimethoprim probably not important
    - Treatment: Transfusion, hydration

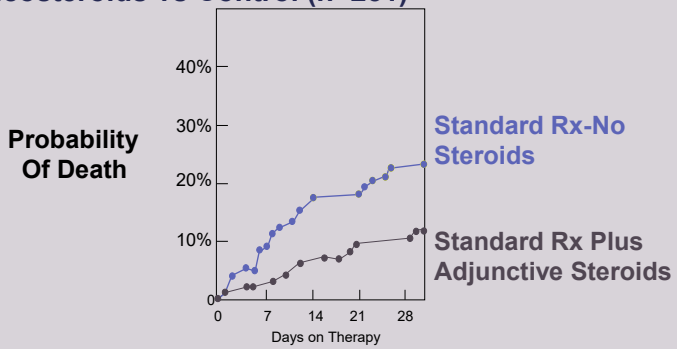
SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Therapy for HIV Related Pneumocystis Pneumonia

- **Specific Therapy**
  - First Choice
    - Trimethoprim-Sulfamethoxazole
  - Alternatives
    - Parenteral Pentamidine
    - Atovaquone
    - Clindamycin-Primaquine
- **Adjunctive Corticosteroid Therapy**
  - Moderate to Severe PCP
    - Room air p02 less than 70mmHg or A-a gradient >35mm Hg

Likelihood of Death in Patients with Moderate-Severe PCP

Corticosteroids vs Control (n=251)



SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

(Bozzette, NEJM 5/90)

How to Manage Patients Who Are Failing TMP-SMX

- Deterioration common first 1-2 days (steroids)
- Average Time to Clinical Improvement
  - 4-8 Days
- Radiologic Improvement
  - Lags clinical improvement

Reasons to Deteriorate During Treatment for PCP

- **Fluid Overload**
  - Iatrogenic, cardiogenic, renal failure (Sulfa or Pentamidine related)
- **Anemia**
- **Methemoglobinemia**
  - Dapsone, primaquine
- **Pneumothorax**
- **Unrecognized Concurrent Infection**
- **Immune Reconstitution Syndrome (IRIS)**

Reasons to Deteriorate During Treatment for PCP

- **Fluid Ov**
  - Iatroge
- **Anemia**
- **Methem**
  - Dapso
- **Pneumo**
- **Unrecog**
- **Immune**

elated)

Patients Failing TMP-SMX Not Testable!

- **Whether to Switch**
- **When to Switch**
- **What to Switch To**
- **How to Manage Steroid Dosing**

Can Pneumocystis Jiroveci Become Resistant to TMP-SMX?

Toxicities of TMP-SMX and Pyrimethamine-Sulfadiazine

Drug	Toxicities
TMP-SMX	Hypotension-infusion rate related ↑Creatinine, ↑Amylase, ↓WBC ↑ Early and then ↓Glucose Associated with ↑Creatinine May occur days-wks post therapy Torsade de Pointes
Pyrimethamine-Sulfadiazine	Similar to TMP-SMX Folinic acid necessary (not folate) to prevent cytopenias

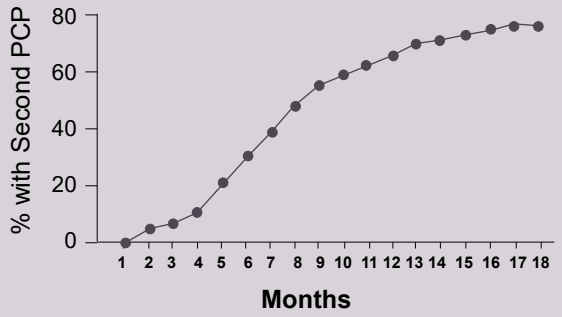
SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Toxicity and Other Considerations Regarding Antipneumocystis Therapy

Drug	Issues
Pentamidine - IV	↓WBC, ↓Plat, ↑LFT, ↑Creat, ↓Amylase, rash, fever, pruritic, "Sepsis" syndrome-distributive shock Hyperkalemia and increased serum creatinine (TMP competes with K and create for excretion) Cross reactivity: dapsone (*+ 50%)*
Atovaquone	Poor absorption if low fat diet Rash, N + V, diarrhea, LFT

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Without ART or Chemoprophylaxis
Second Episodes of HIV Associated PCP Are Amazingly Common



SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Fischl/ACTG 002, 10/88

Indications for Primary and Secondary PCP Prophylaxis
Persons With HIV Infection

Start	**CD4 < 200 cells/μL (14%)** ~~Oral candidiasis~~ ~~AIDS Defining Illness~~ ~~Prior PCP~~
Stop	**CD4 > 200 cells/μL x 3 M** (Consider stopping: CDA 100-200 and VL < 50 x 3 M
Restart	**CD4 < 200 cells/μL**

SEE ENLARGED SLIDE FOLLOWING ENTIRE PRESENTATION

Reminders About PJP in Non-HIV

PJP Prophylaxis in Non-HIV Patients

- **For Board Examination-Use prophylaxis if:**
  - Prednisone >= 20 mg/d for >= 2-4weeks
    - (Often overlooked by non-ID physicians!!)
- **Clinical Practice**
  - Look Up Diseases and Drugs…and Common Sense
    - Depends on concurrent immunosuppressive therapy
    - Much of recommendations are not firmly evidence based
      - See Hidden Slide

National Comprehensive Cancer Network. Updated 2026-03-11

PJP Prophylaxis in Non-HIV Patients

Why Is There More PJP in Non-HIV than HIV in the US?

- **Pneumocystis is ubiquitous in environment-person to person**
  - **Number of immunosuppressed Non-HIV pts increasing**
  - **PCR testing for PJP more available**
  - **Rules for prophylaxis are not as well accepted as HIV**

National Comprehensive Cancer Network. Updated 2026-03-11

Thank You!