
Microbiology/Infectious Diseases I

III. RESPIRATORY INFECTIONS CASE STUDIES

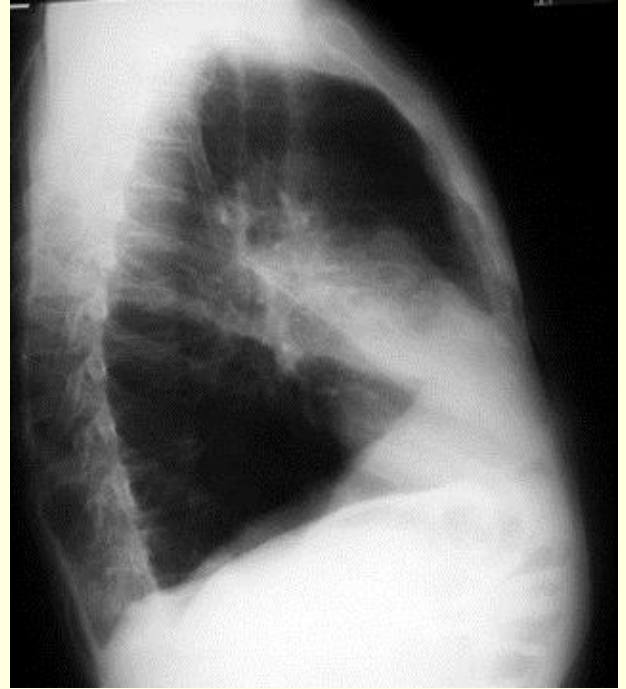
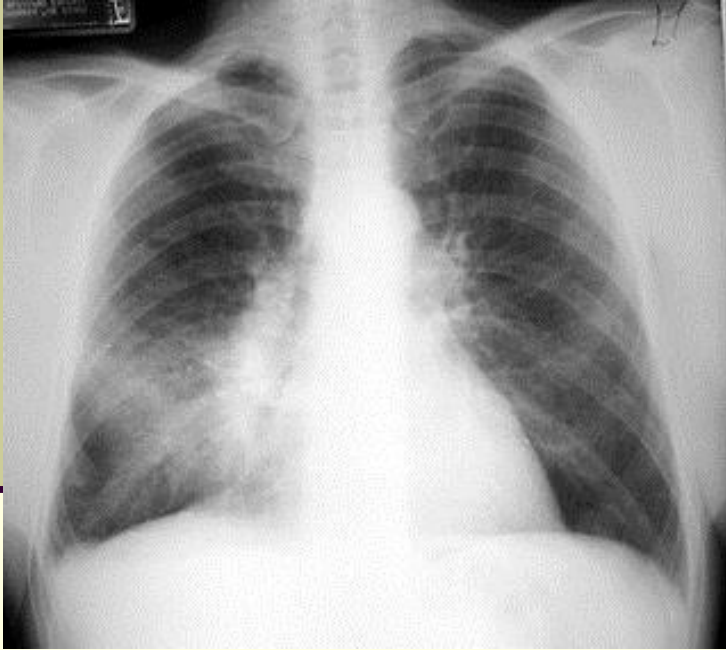
Case I

History: In January, Mr. P., a 68-year-old retired salesman and grandfather who is a heavy smoker noted that he had nasal congestion, muscle aches and a low-grade fever. He felt that his symptoms were resolving until two days ago when he abruptly developed a shaking chill, cough, and severe pain on the right side of his chest that worsened with breathing. The cough was productive of rust-colored (blood-tinged) sputum.

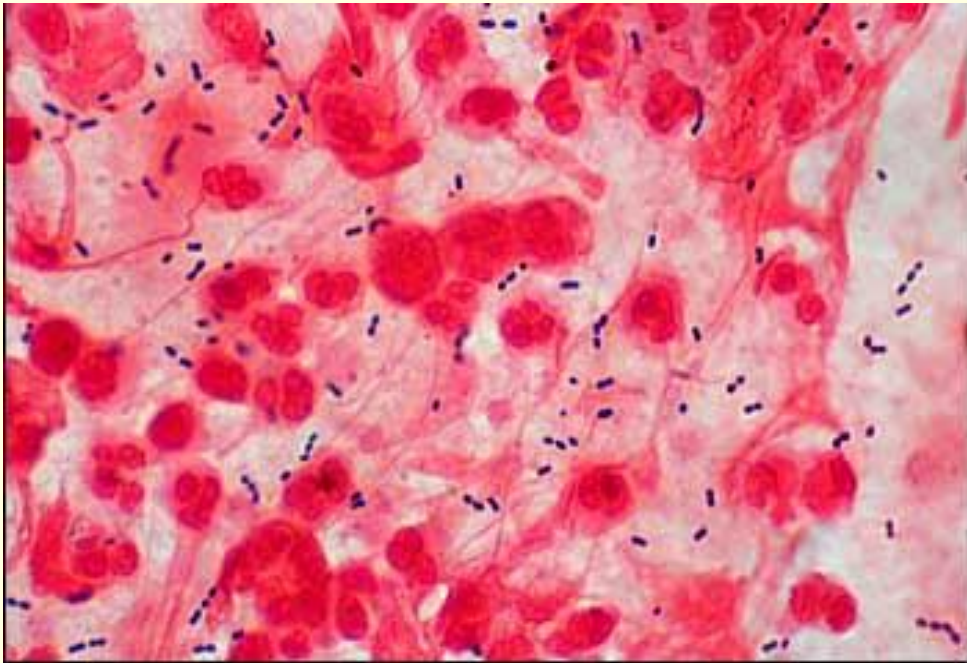
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- **Physical Examination:** When he was seen in the emergency room, he appeared acutely ill and had a temperature of 103°F. His respiratory rate was rapid at 30 breaths/minute. His breathing was shallow, with diminished breath sounds on over the right side of the thorax indicating consolidation of the air spaces of the lung.

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- **Laboratory:** The laboratory reported that his white blood cell count was 23,000/mm³ indicative of a leukocytosis with 68% neutrophils and 10% band forms (an increase in the number of circulating immature neutrophils often characterizes bacterial infection). A chest x-ray revealed a dense infiltrate (consolidation) in the right lung.

A Gram stain of the sputum showed many neutrophils and lancet-shaped Gram-positive diplococci



Blood was obtained for culture.



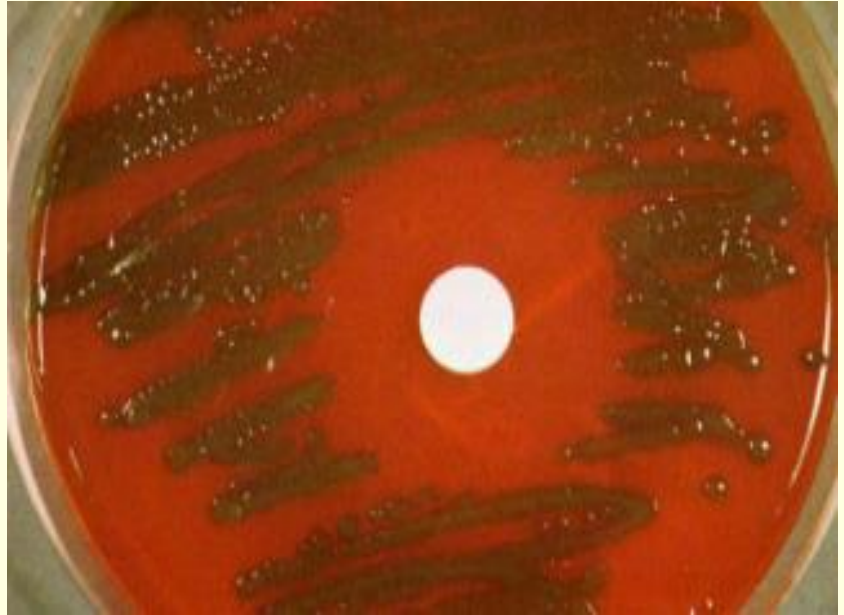
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- **Hospital Course:** He was placed on supplemental oxygen. Treatment for a community-acquired pneumonia was begun with the fluoroquinolone antibiotic, levofloxacin. Both the blood cultures and sputum cultures were positive for an α -hemolytic, Gram-positive cocci in chains, that was catalase negative, optichin sensitive, and had a positive Quellung reaction. Because the isolate was found to be sensitive to penicillin the antibiotic regimen was revised. Two days later Mr. P. was much improved, and, after eight more days of antibiotic therapy, he recovered completely.

α -hemolytic colonies on sheep blood agar
Gram-positive cocci in pairs and chains

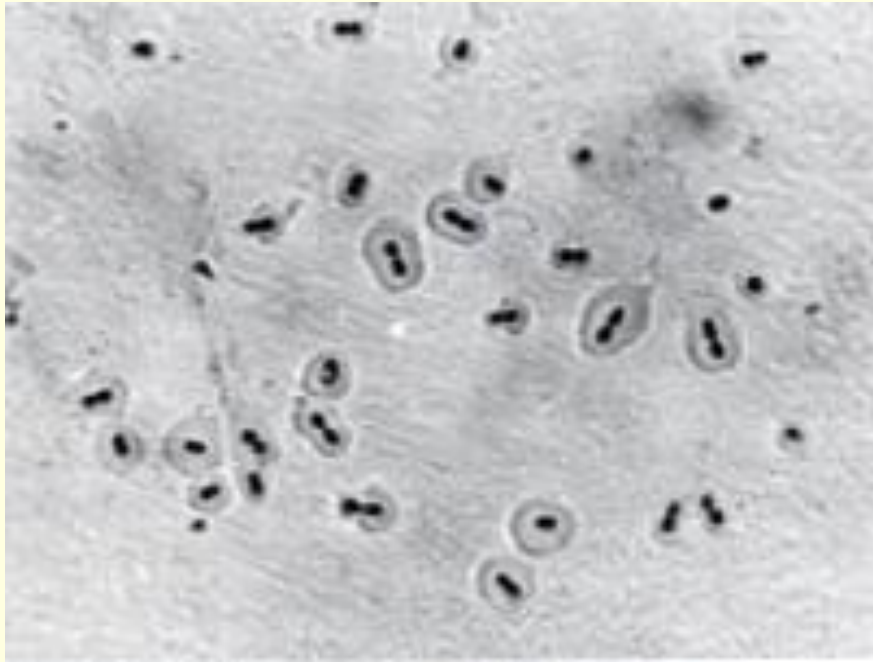


Catalase negative
(top panel)

Optichin sensitive



Positive Quellung reaction demonstrating capsule of Streptococcus pneumoniae.



The case of Mr. P. raises several questions:

1. What organism or organisms might have contributed to pneumonia in this patient?
2. How do you explain the biphasic nature of his illness?
3. Where did Mr. P. acquire this organism? What host factors might have contributed to the pneumococcus gaining entry into his lungs?
4. Why was levofloxacin selected for initial therapy? What were the reasons for switching his antibiotic if he was responding appropriately?

5. If Mr. P.'s own immune response was not sufficient to control this infection, why might immunization have ameliorated or prevented these events?

6. What are the four main effector mechanisms used by antibodies to clear bacterial infections? How would complement facilitate two of these activities and why are these activities advantageous for combating **pneumococcal** pneumonia?

7. How does opsonization of bacterial pathogens with complement facilitate/enhance antigen-specific B cell activation?

8. Near the completion of his course of antibiotics Mr. P develops severe diarrhea that tests positive for blood. What additional processes would you consider?

Case II

A 64 year old man with a history of smoking and alcohol abuse presented to the Emergency Department with a 3 month history of fever, drenching night sweats and a cough productive of blood-tinged sputum. He notes a 35 pound weight loss during this time and appears wasted on physical examination. The patient is homeless and spends most of his time underneath the train tracks at 30th Street Station. However, he occasionally spends the night in a shelter run by the city.

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1. How would you characterize the pace of this illness?
 2. What is causing the systemic symptoms (fever, weight loss and night sweats)?
 3. Does his social history give any clues for the diagnosis?

The following chest film was obtained:

■ Chest Film

■ Magnified View



4. What are the most likely explanations of this presentation? What is the pathogenesis of the upper lobe disease?

5. What precautions should now be taken in the Emergency Department and during his hospitalization?

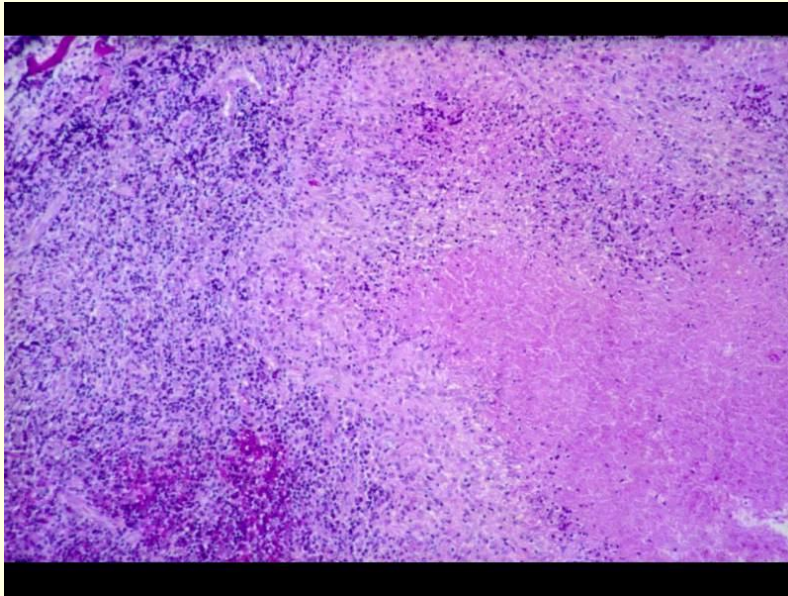
6. Should you be concerned about any additional risk factors at this point?

A sputum Gram's stain demonstrates mononuclear cells, but no bacteria. Three AFB smears of sputum are also negative and a bronchoscopy and transbronchial biopsy are performed.

7. Why are the sputum AFB smears negative?

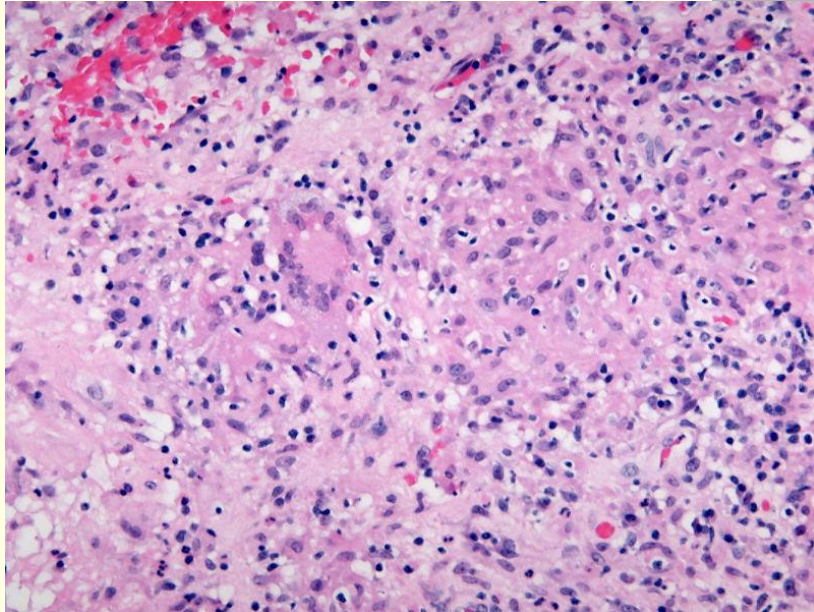
8. Can the patient be taken off airborne precautions?

9. How would you characterize the immune response? How does it differ from that seen in acute bacterial infections?



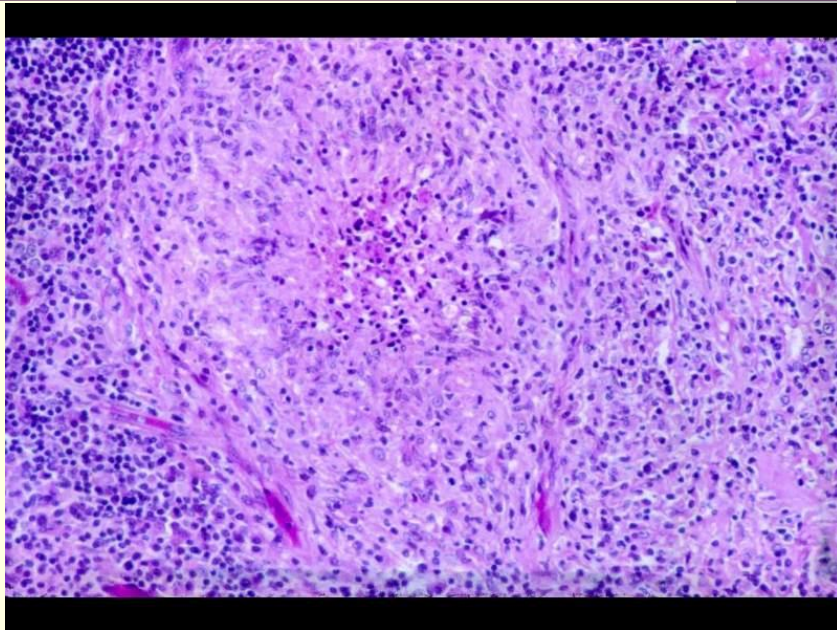
TRANSBRONCHIAL BIOPSY
Low Power

TRANSBRONCHIAL BIOPSY



High Power-Early Necrosis

9. How would you characterize the immune response? How does it differ from that seen in acute bacterial infections?

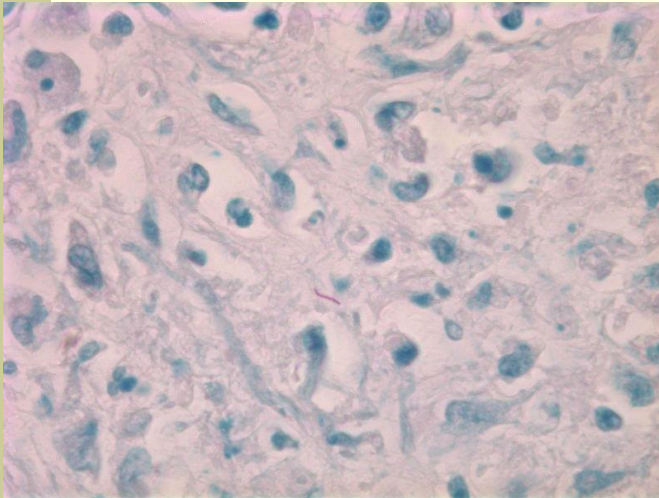


TRANSBRONCHIAL BIOPSY
High Power – Advanced Necrosis

10. CD4+ T cells are the chief source of interferon-g in tuberculosis. Which subtype of CD4+ T cells is classically associated with production of interferon-g? Review the basic paradigm responsible for the differentiation of interferon-g producing T cells.

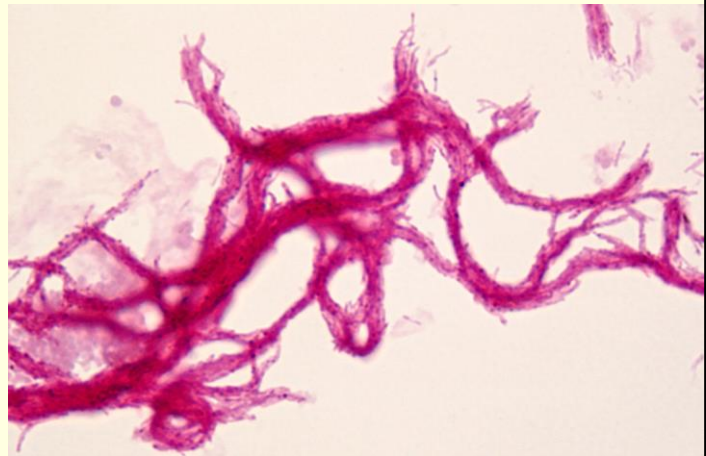
11. Individuals with T cell deficiencies such as in HIV are at increased risk for tuberculosis. Why is this, given that CD4+ T cells are rather ineffective at controlling this infection?

12. What is the most likely diagnosis?

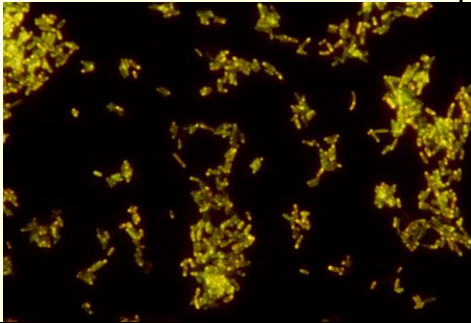


- AFB Tissue stain

- Kinyoun stain from culture plate (showing typical cording)



- Fluorochrome smear from sputum



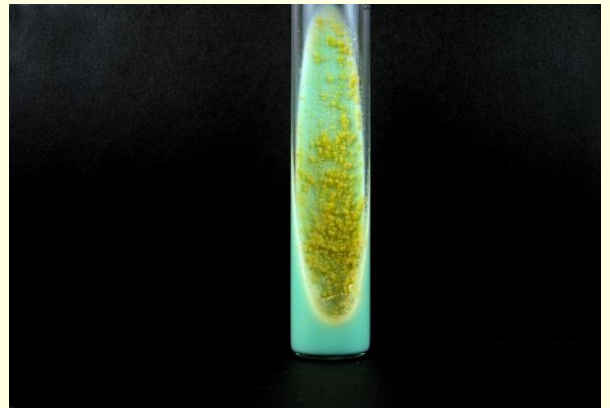
13. How should the patient be treated now?

14. What is the key aspect of immunity that is protective?

15. How does the laboratory detect *M. tuberculosis* in clinical specimens



M. tuberculosis on LJ medium



M. kansasii on LJ media,
note yellow pigmentation
of colonies

16. When can the patient leave the hospital?

17. Are there any concerns about antimicrobial resistance?

18. How should his medications be administered when he leaves the hospital?

19. Why is a prolonged course of therapy necessary?

20. Does this case raise any public health concerns and how should they be addressed?