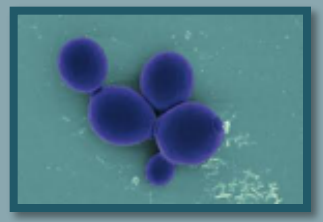
Bacteria Causing Respiratory Tract Infections



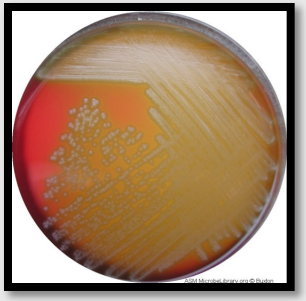
RESPIRATORY BLOCK

Dr. Khalifa Binkhamis

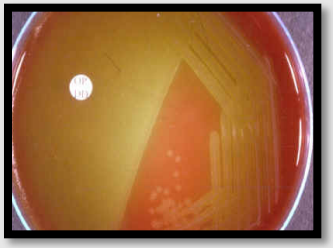
Objectives

- Recognize signs and symptoms of different bacterial respiratory tract infections
- Be able to come up with a short differential to relevant cases and identify the most likely causative organism
- Discuss the diagnosis and treatment of different bacterial respiratory tract infections
- Explain the laboratory work up of important respiratory pathogens and be able to interpret microbiological laboratory results

Types of Haemolysis on Blood Agar

HAEMOLYSIS TYPE	DESCRIPTION	IMAGE
Alpha haemolysis	colonies surrounded by partial haemolysis with greenish color	
Beta haemolysis	colonies are surrounded by a clear zone	

Different Tests Used in the Lab.

Test	Use	Positive	negative
CATALASE TEST	To differentiate between Staphylococcus & Streptococcus	 Staphylococcus	 Streptococcus
BACITRACIN SUSCEPTIBILITY	To differentiate between *Streptococcus pyogenes* (group A) & other beta haemolytic streptococci		
OPTOCHINSUSCEPTIBILITY	To differentiate between *Streptococcus pnumoniae* & other alpha haemolytic streptococci		

Case1

A 5 year boy was brought to KKUH, outpatient department complaining of fever and sore throat. His vaccination history was up to date. On examination his temp. was 38.5°C, the tonsillar area and pharynx were obviously inflamed with some foci of pus.

1. What is the differential diagnosis?

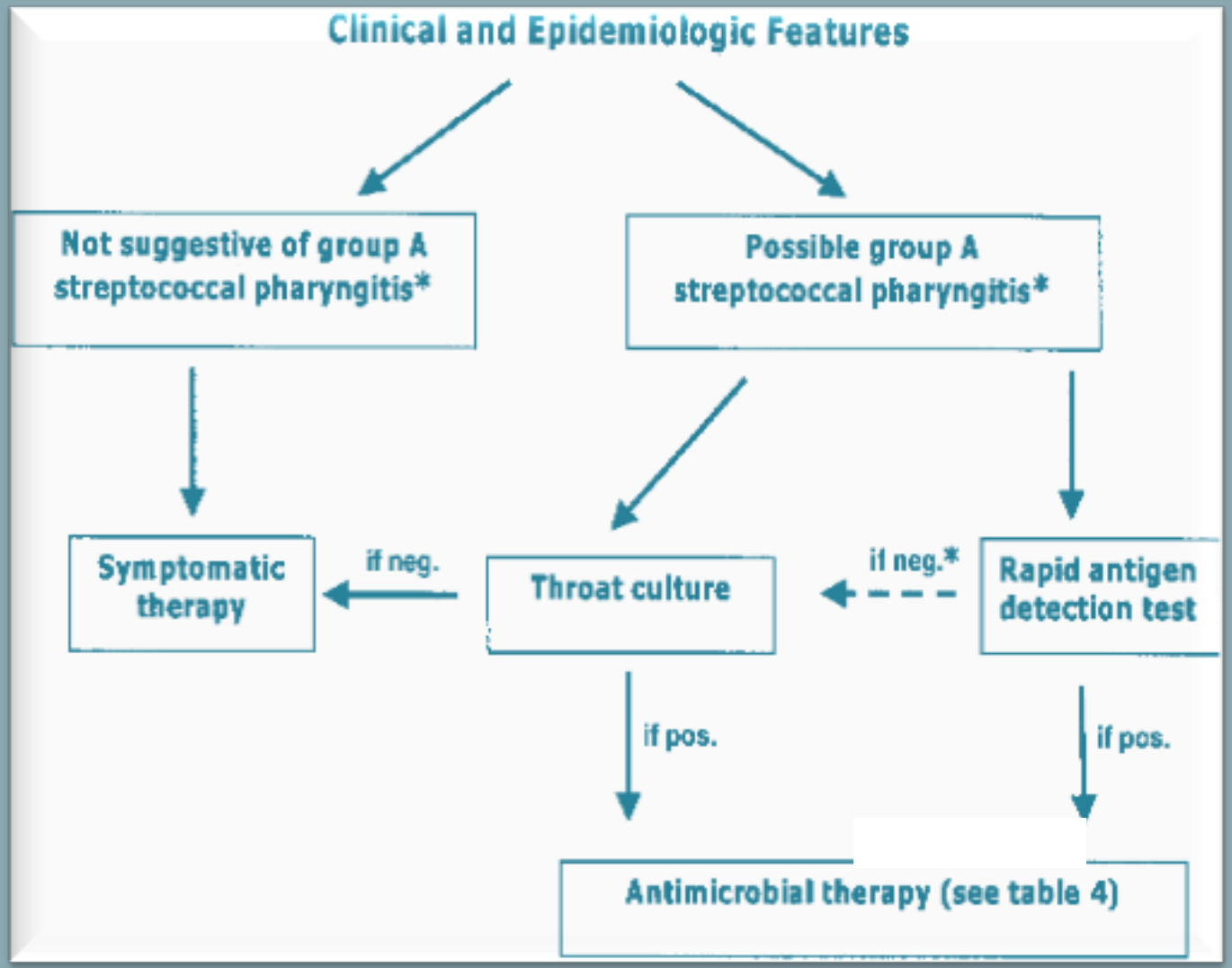
2. What investigations should be done?

LAB. TESTS

- Specimen => throat swab
  1. (Rapid Antigen Detection Test) RADT
  2. CULTURE ON BLOOD AGAR
  - ❖ Direct gram stain from throat swabs is not useful

- Culture work up
  1. CATALASE TEST
  2. GRAM STAIN
  3. BACITRACIN SUSCEPTIBILITY TEST

Clinical and Epidemiologic Features



RADT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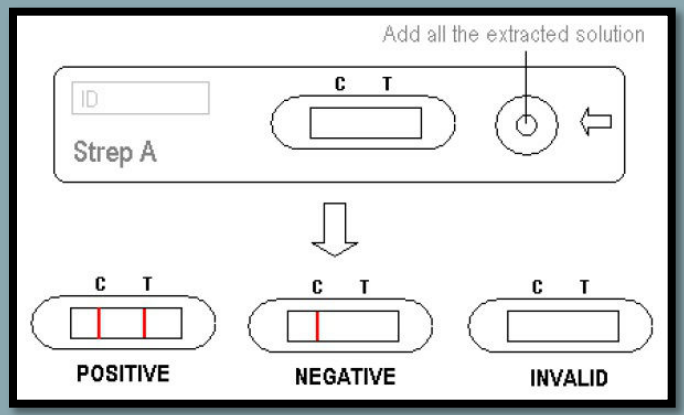
BinaxNOW
Strep A


Add all the extracted solution
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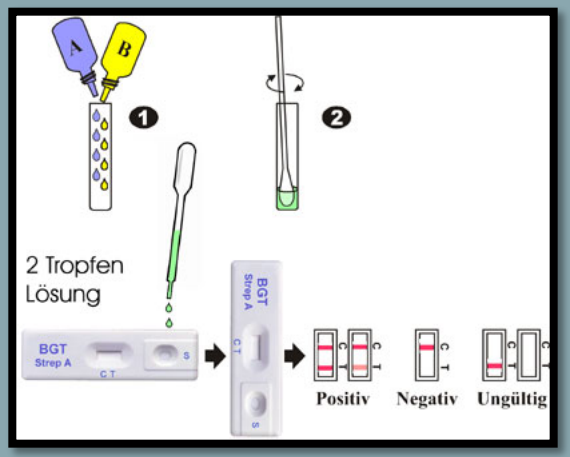
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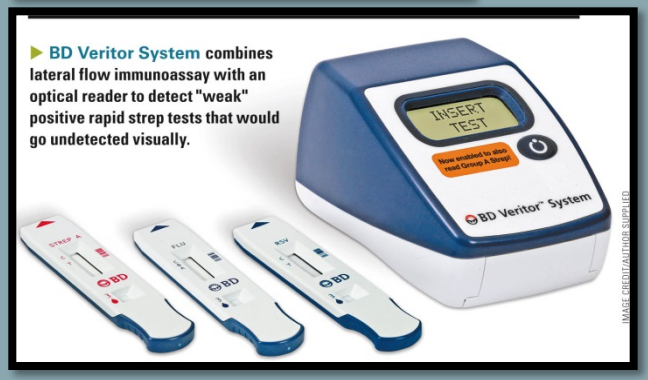
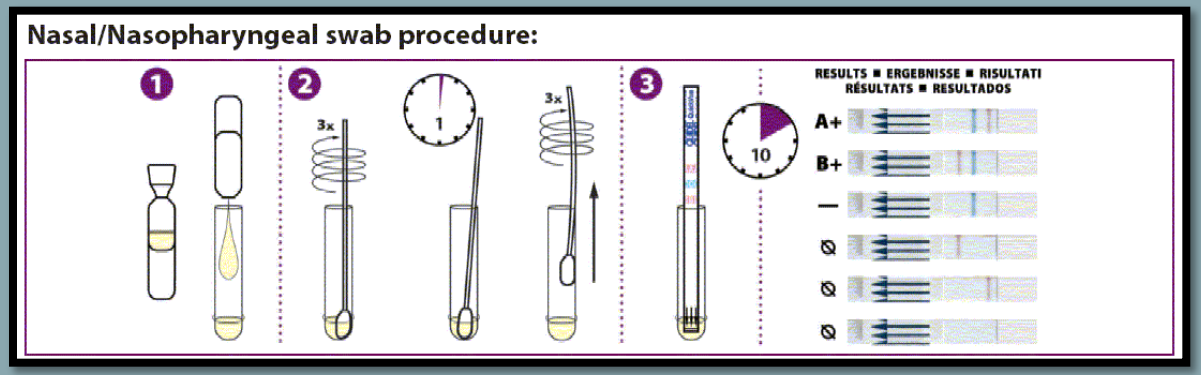

BD Veritor System combines lateral flow immunoassay with an optical reader to detect "weak" positive rapid strep tests that would go undetected visually.
INSERT TEST
BD Veritor™ System
IMAGE CREDIT/AUTHOR SUPPLIED


Nasal/Nasopharyngeal swab procedure:
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MICROSCOPIC APEARANCE

Gram stain From culture showed :

Gram positive cocci in Chains

Culture

Throat swab culture showed:

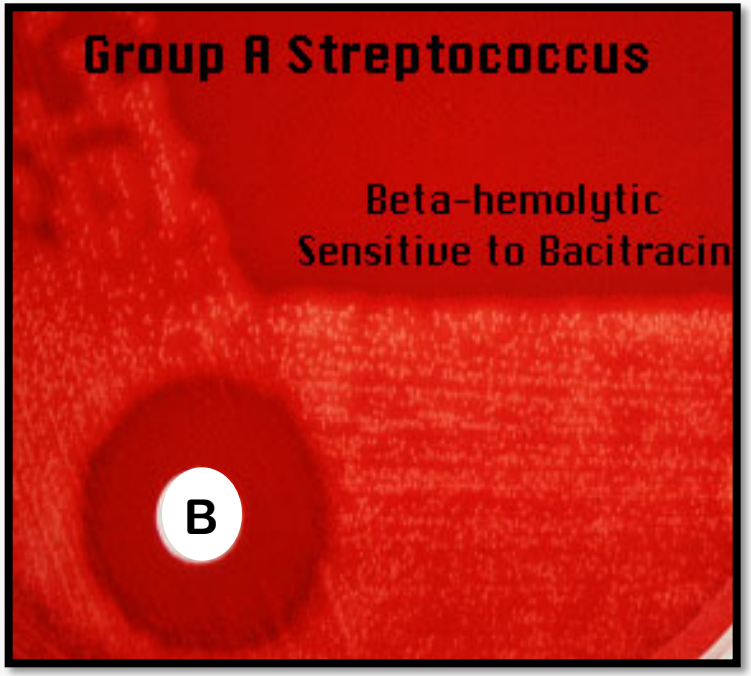
Beta haemolysis on blood agar (colonies are surrounded by a clear zone).

CATALASE TEST

Catalase –ve test

Bacitracin Susceptibility

Bacitracin susceptible colonies



Principle:

-Bacitracin test is used for presumptive identification of group A

-To distinguish between *S. pyogenes* (susceptible to B) & non group A such as *S. agalactiae* (Resistant to B)

-Bacitracin inhibits the growth of *S. pyogenes* giving zone of inhibition around the disk

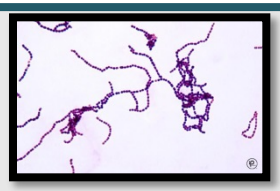
Procedure:

- Inoculate BAP with heavy suspension of tested organism

-Bacitracin disk (0.04 U) is applied to inoculated BAP

- After incubation, any zone of inhibition around the disk is considered as susceptible

Lab. Test Results (Summary)

TEST	RESULT	IMAGE
CULTURE ON BLOOD AGAR	Beta haemolyis (colonies surrounded with clear zone of haemolysis)	
CATALASE TEST	No bubbles → catalase negative	
GRAM STAIN FROM CULTURE	Gram positive cocci in chains	
BACITRACIN SUSCEPTIBILITY TEST	Bacitracin Susceptible colonies	

Streptococcus pyogenes

1. What is the likely identity of the organism?

2. What is the best antibiotic therapy for this child?

3. If not treated what complication may this child have after 6 weeks period?

Case2

A 3-year-old girl is brought to the emergency room by her mother because she has a fever and complains that her ear hurts. She has no significant medical history. Her temperature is 38.8°C and is found to have injected tympanic membranes.

1. What is the differential diagnosis?

2. What investigations could be done?

LAB. TESTS

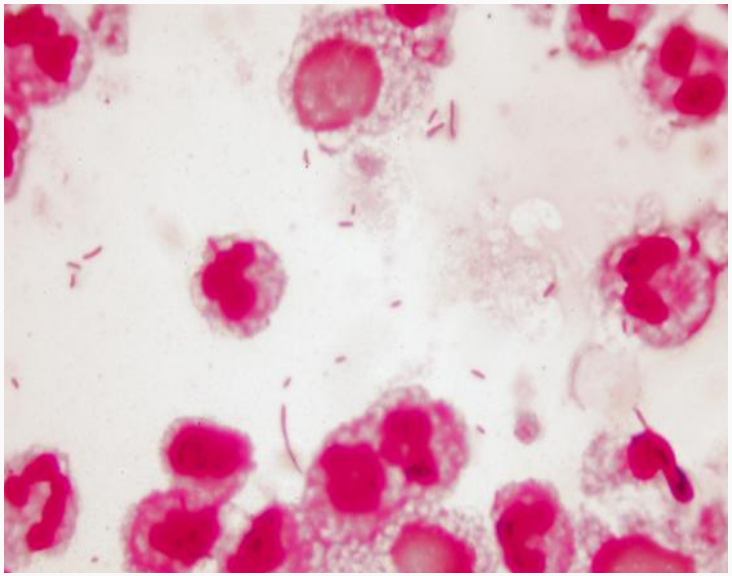
- Specimen => middle ear fluid
  1. Gram stain
  2. Culture of the specimen on blood, chocolate and MacConkey agar

- Culture work up
  1. Biochemical tests
  2. Antibiotic susceptibility test

MICROSCOPIC APEARANCE

Gram stain From ear discharge showed :

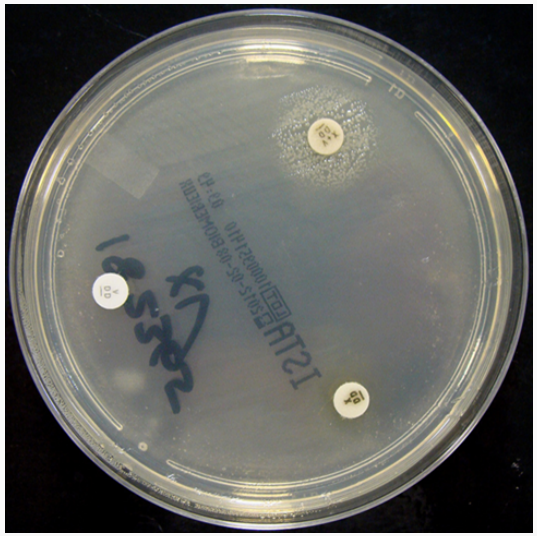
Gram negative coccobacilli



Culture on chocolate agar

Nutrient agar with X and V factors:

Haemophilus influenzae grow around the disc containing X and V factors



Case3

A 28 year old female presented to the accident and emergency of KKUH with sudden onset of fever, right sided chest pain and a productive cough of purulent sputum. On examination her temperature was 39 °C. There were rhonchi and dullness on the right side of the chest. X-ray showed massive consolidation on the right side of the chest.

1. What is the differential diagnosis?

2. What investigations should be done?

LAB. TESTS

- Blood work: CBC
- Sputum specimen :
  1. Gram stain
  2. Culture on blood, chocolate and MacConkey agar

- Culture work up
  1. Catalase test
  2. Optochin susceptibility test
  3. Antibiotic susceptibility test

X - Ray

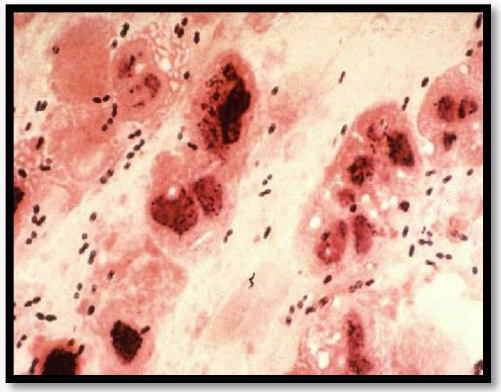
The chest X- ray showed massive consolidation on the right side of the chest.

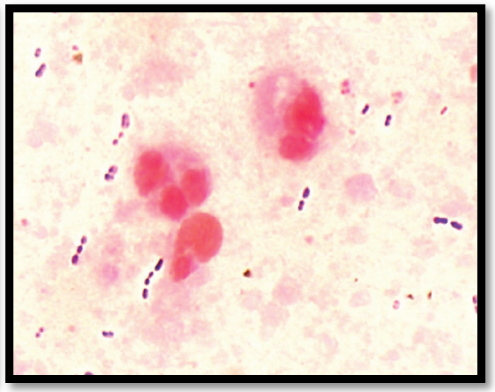
What should have been the empirical therapy for this case and why?

MICROSCOPIC APEARANCE

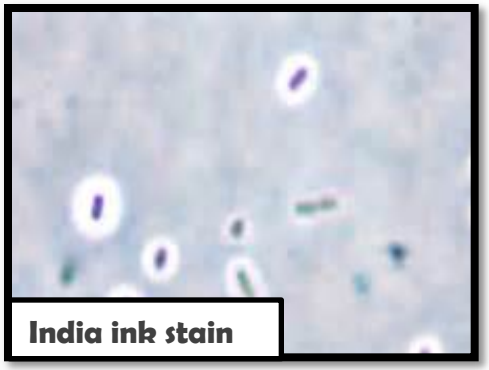
Gram stain From sputum showed :

Gram positive diplococci (arranged in piers





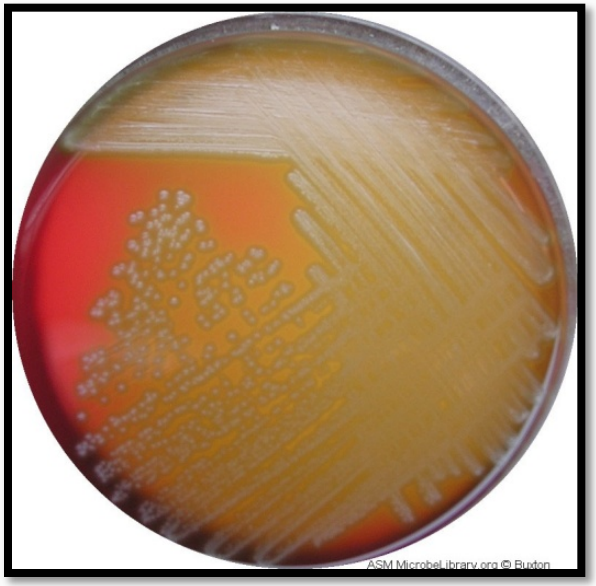
Negative Stains showing capsule:



Culture

Sputum culture showed:

Alpha haemolysis on blood agar (colonies surrounded by partial haemolysis with greenish color).

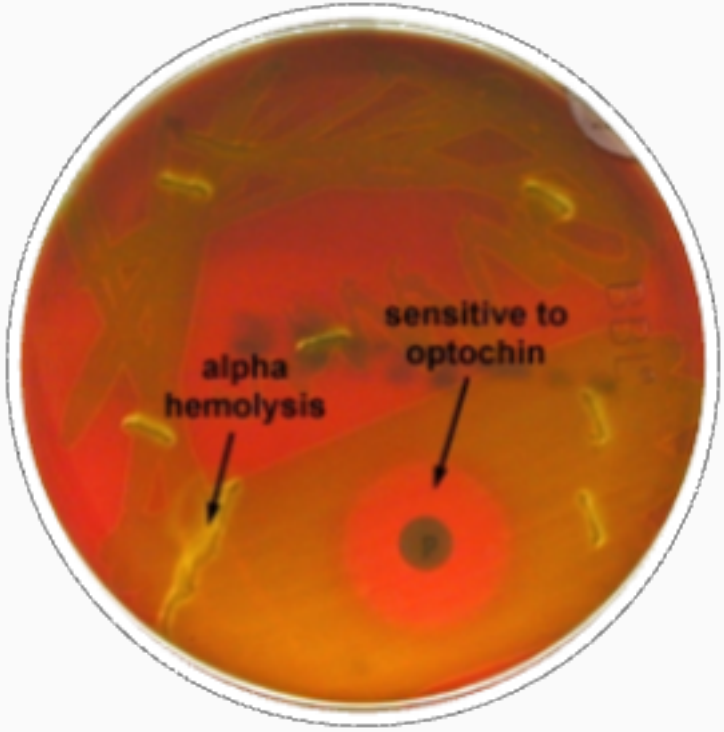


CATALASE TEST

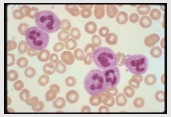
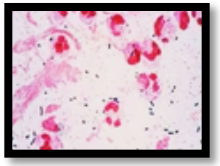
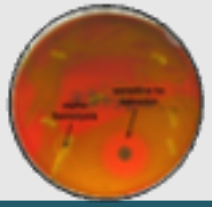
Catalase –ve test

Optochin Susceptibility

Optochin susceptible colonies



Lab. Tests Results (Summary)

TEST	Result	
CBC	45,000/ ml 90% of the cells were neutrophils	
CULTURE ON BLOOD AGAR	Alpha haemolysis (colonies surrounded by partial haemolysis with greenish color)	
CATALASE TEST	No bubbles → catalase negative	
GRAM STAIN	gram positive diplococci in pairs	
Optochin SUSCEPTIBILITY TEST	Optochin Susceptible colonies	

Streptococcus pneumoniae (Pneumococcus)

Case 4

Abdulkarim is a 65 year old Saudi man who was admitted to KKUH with a 2-3 month history of loss of appetite, weight loss, and on and off fever with attacks of cough. On examination Abdulkarim looked weak with a temperature of 38.6 °C. CVS and Respiratory system examination was unremarkable.

Two days before admission he coughed blood (haemoptysis). Abdulkarim is diabetic (for the last 5 years). His father died of tuberculosis at the age of 45 yrs.

1. What is the differential diagnosis?

2. What investigation should be done?

X - Ray

The chest X- ray showed multiple opacities and cavities

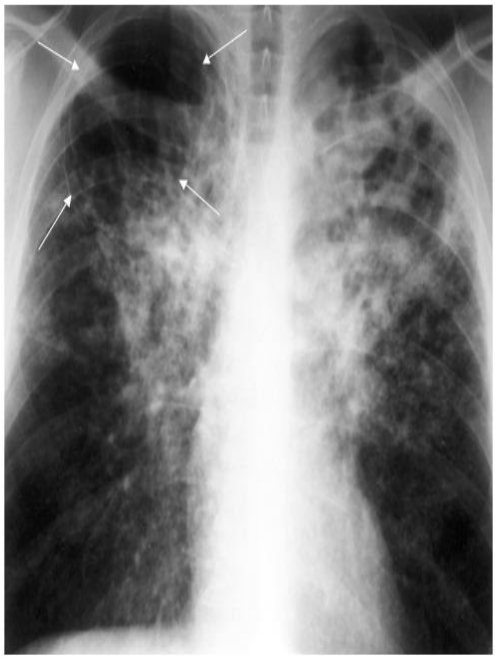


Figure 8. Chest x-ray with bilateral upper lobe opacities (white areas) with multiple cavities including a very large cavity in the right upper lobe (arrows).

Mycobacterium tuberculosis

- The chest X- ray showed multiple opacities and cavities.
- The ESR was increased (85 m /hour).

What further tests should be done?

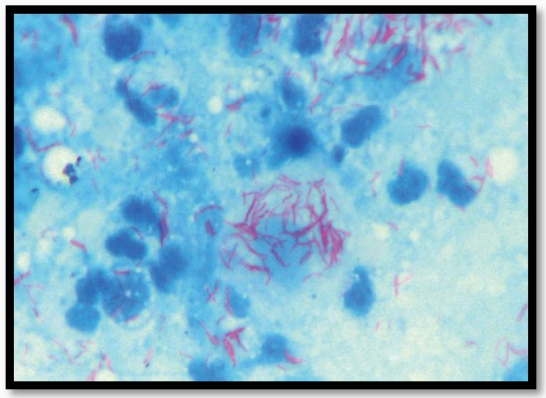
LAB. TESTS

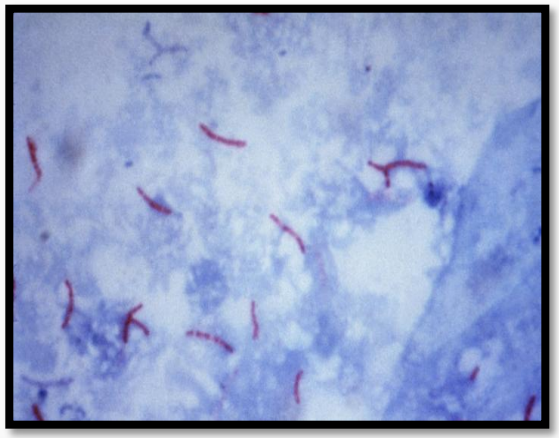
- Specimen => sputum
  1. Ziehl-Neelsen (ZN) stain
  2. Culture on L.J medium (selective for mycobacteria)

MICROSCOPIC APEARANCE

Ziel – Neelsen Stained Smear From Sputum Showing:

Acid – Fast Bacilli AFB



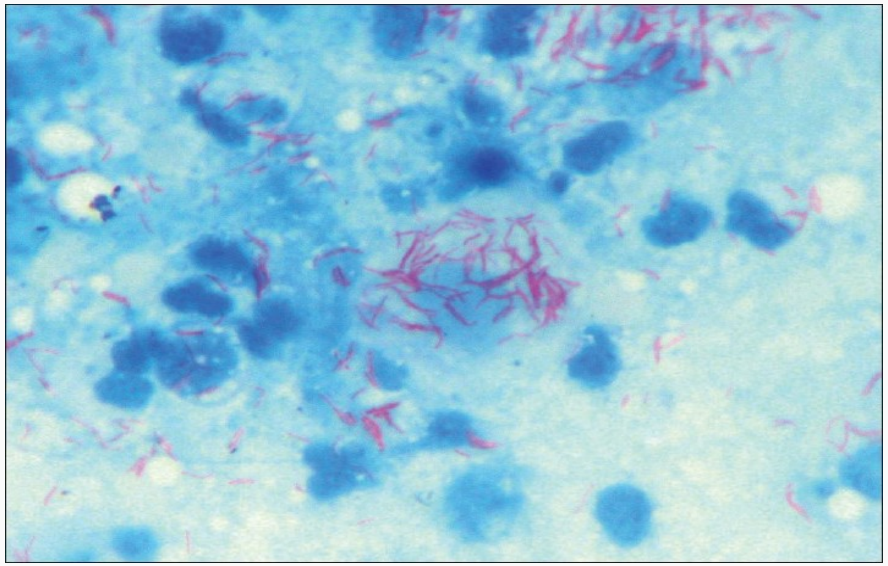


Culture

Sputum culture on Lowenstein–Jensen medium (selective for Mycobacteria) showed:

showing growth of Rough, Tough and Buff colonies

1. What is the probable diagnosis?
2. How can the diagnosis be confirmed?



Mycobacterium tuberculosis

Case 5

A 5 year-old boy was brought to the emergency department complaining of sore throat , fever (38.5°C), and was found to have pharyngeal pseudomembranes

1. What is the differential diagnosis?

2. What investigation should be done?

LAB. TESTS

- Specimin => throat swab
  1. Culture on blood tellurite
     - ❖ Direct gram stain from throat swabs is not useful

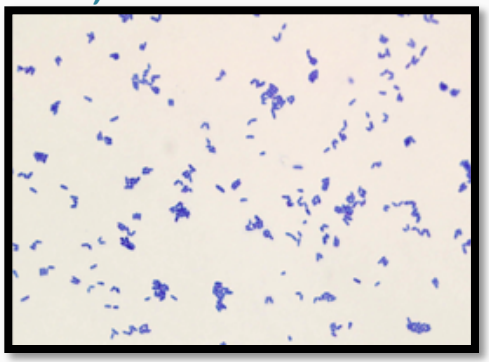
- Culture work up:

1. Gram stain From culture.
2. ELEK test
   - To confirm toxin production

MICROSCOPIC APEARANCE

Gram stain From culture showed :

Gram positive bacilli (Chinese letter appearance)



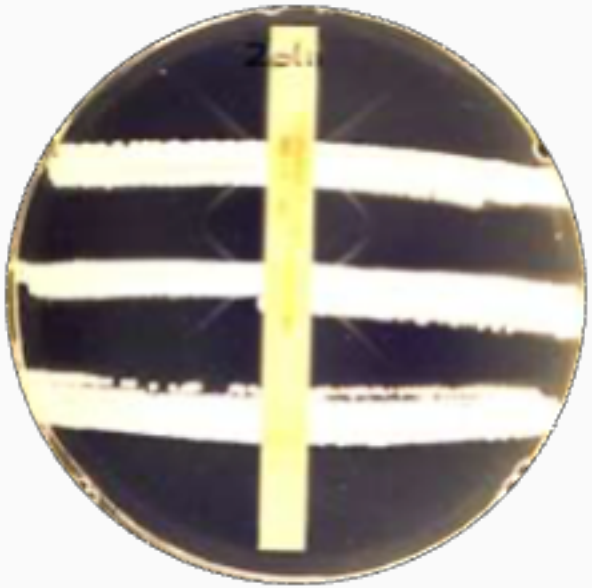
Culture

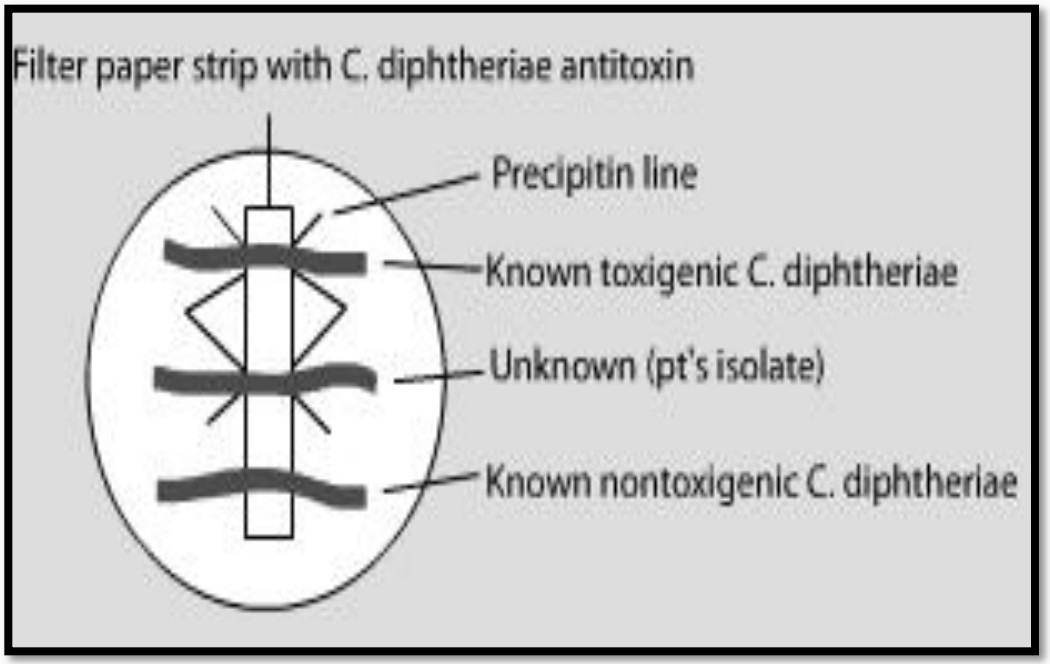
Throat swab culture on blood tellurite showed:

Black color colonies

Corynebacterium diphtheriae

» ELEK TEST





Toxin from culture of *C. diphtheriae* diffuses and reacts with the diphtheria antitoxin defused from the strip and produces precipitation lines → positive test (Diphtheria exotoxin production)

1. What is the likely identity of the organism?

2. What is the best antibiotic therapy for this child?

3. what complication may this child develop?