

Integrated CNS Practical

Biochemical & Microbiological

Examination of CSF

CENTRAL NERVOUS SYSTEM BLOCK
2017-2018



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CASE 1

A 15-year-old healthy male visited emergency room presenting with fever, headache, vomiting and drowsiness. Physical examination showed **decreased level of consciousness, neck stiffness, skin rash** and **high temperature (38°C)**. Cerebrospinal fluid (CSF) examination revealed opening pressure of 210 cm H₂O.

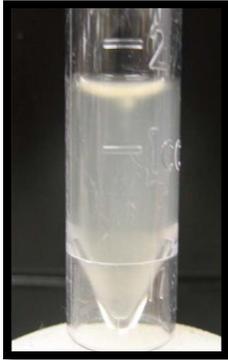
The doctor in the emergency department takes a detailed history and conducts a clinical examination. Because of clinical findings, he decides to do a lumbar puncture. The results of the lumbar puncture are shown below:



Normal and turbid CSF



CASE 1: LUMBER PUNCTURE RESULTS

CSF	Patient's results	Normal range
Appearance	Turbid 	Clear 
WBCs and differential	8,320 per mm³ Mainly polymorphonuclear leucocytes (84%)	Few (<5 cells/mm³)
Protein	5.0	01-0.4 g/L
Glucose	1.3	3.0-4.5 mmol/L
Chloride	110	115-130 mmol/L

QUESTION 1:

What is your diagnosis?

.....
.....

QUESTION 2:

What is the most likely infection responsible?(Select only one)

- A. Mycobacterium Avium
- B. Fungal infection
- C. Parasitic infection
- D. Viral infection
- E. Bacterial infection
- F. Trepanoma pallidum (Neurosyphilis)
- G. Mycobacterium tuberculosis

QUESTION 3:

What is your justification for your answer to question two?

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QUESTION 4:

What further investigation would you like to do at this stage?

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QUESTION 5:

Mention two of the recommended antibiotics that can be used as empiric treatment in such a case?.....

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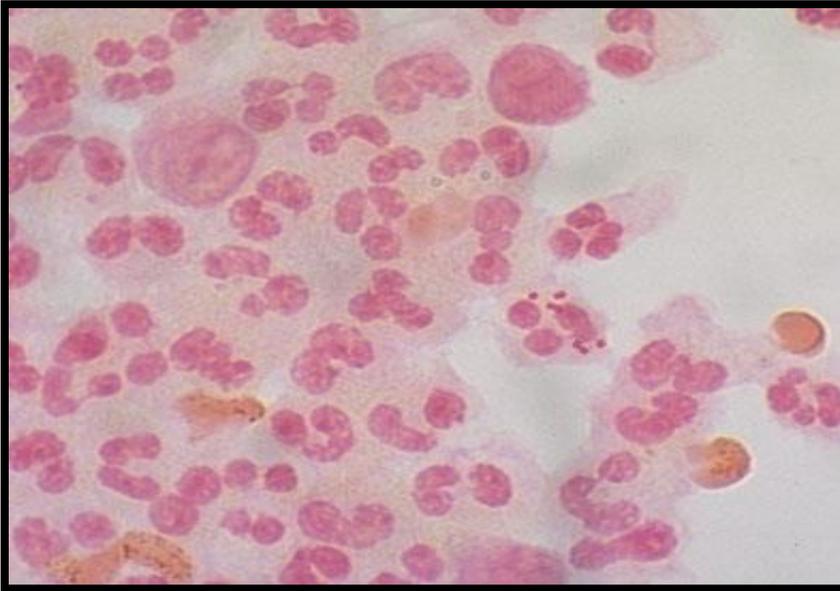
Microscopy of the cerebrospinal fluid •
showed gram -ve cocci.

The patient showed complete recovery •
after administration of ceftriaxone for 10
days.

The characteristic skin rash (purpura) of meningococcal septicemia, caused by *Neisseria meningitidis*



Bacterial meningitis: *Neisseria meningitidis*

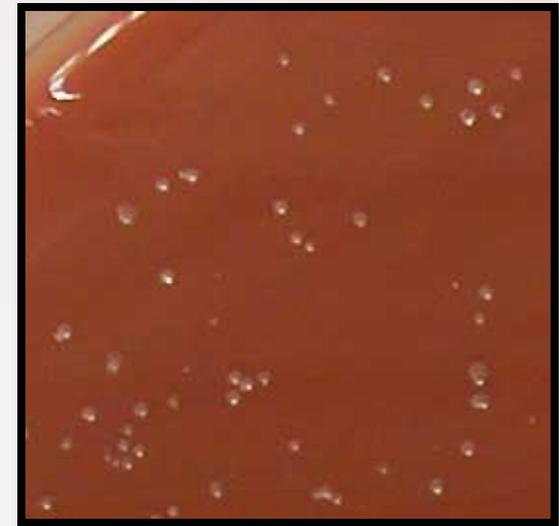


Microscopic Appearance

Gram stained smear from CSF deposit showing :
gram negative intracellular diplococci + many pus cells

Bacterial meningitis:

Neisseria meningitidis



Culture on Thayer-Martin agar

Case Study

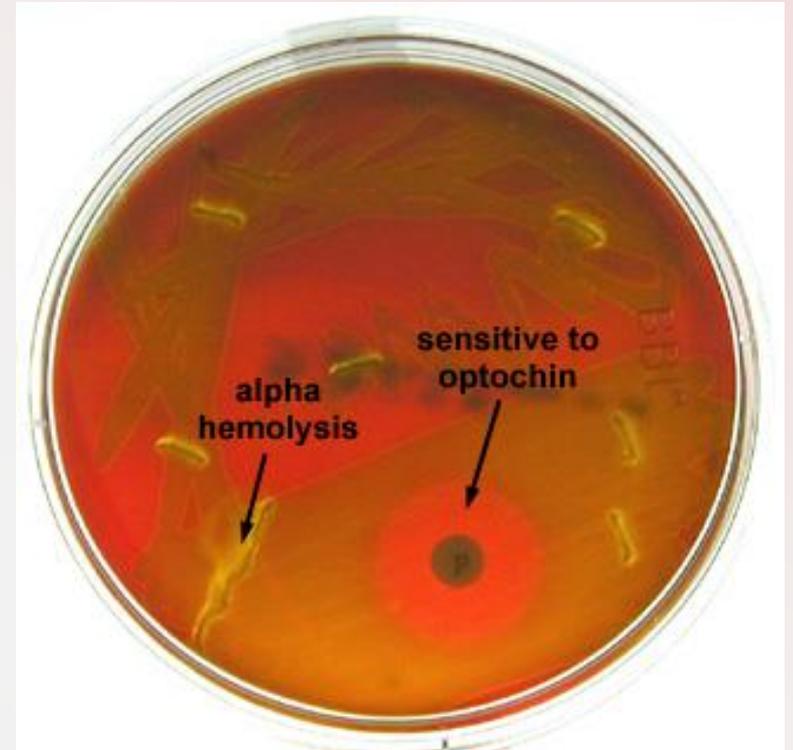
A 59 y.o. male farmer with sudden onset of fever, headache, neck stiffness and confusion

Peripheral Blood count:

12,800 WBCs/mm³ (73% neutrophils; 12% bands)

Cerebrospinal Fluid:

- **3520 WBC/mm³ (100% neutrophils)**
- **Glucose: <1 mg/deciliter**
- **Protein: 368 mg/deciliter**



Gray white, alpha-hemolytic colonies recovered on sheep blood agar with increased CO₂ from spinal fluid sediment was Optochin sensitive

Questions

What is your most likely diagnosis?

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What is the most probable pathogen isolated?

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Questions

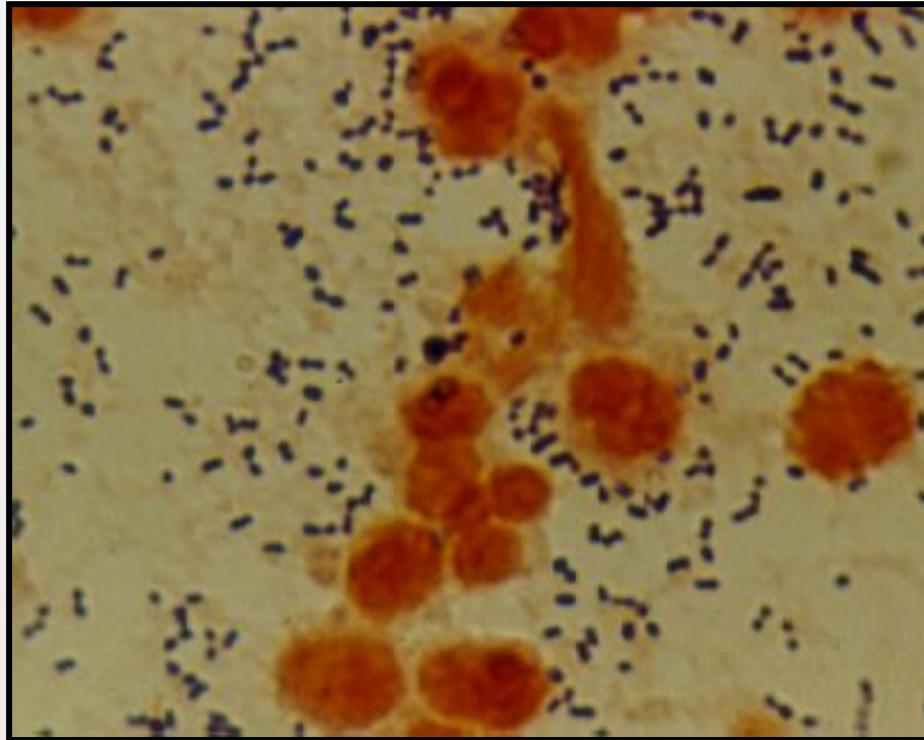
Mention two of the recommended antibiotics that can be used as empiric treatment in such a case?

.....

.....

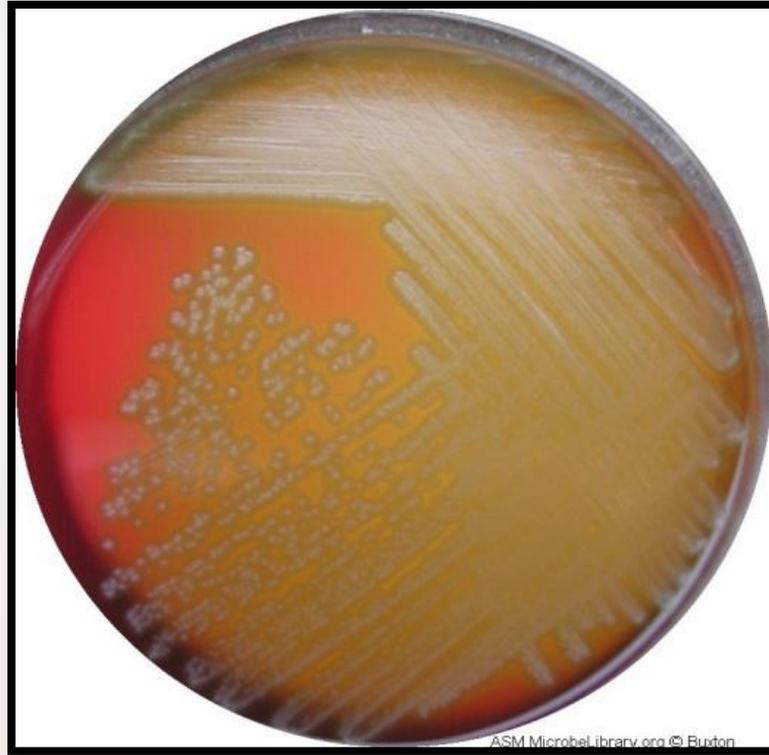
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Bacterial meningitis: Pneumococcal Meningitis



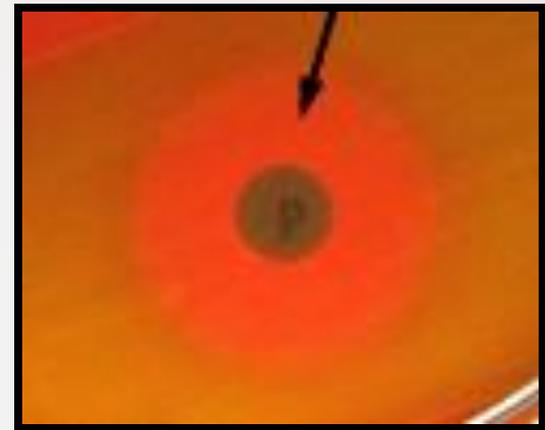
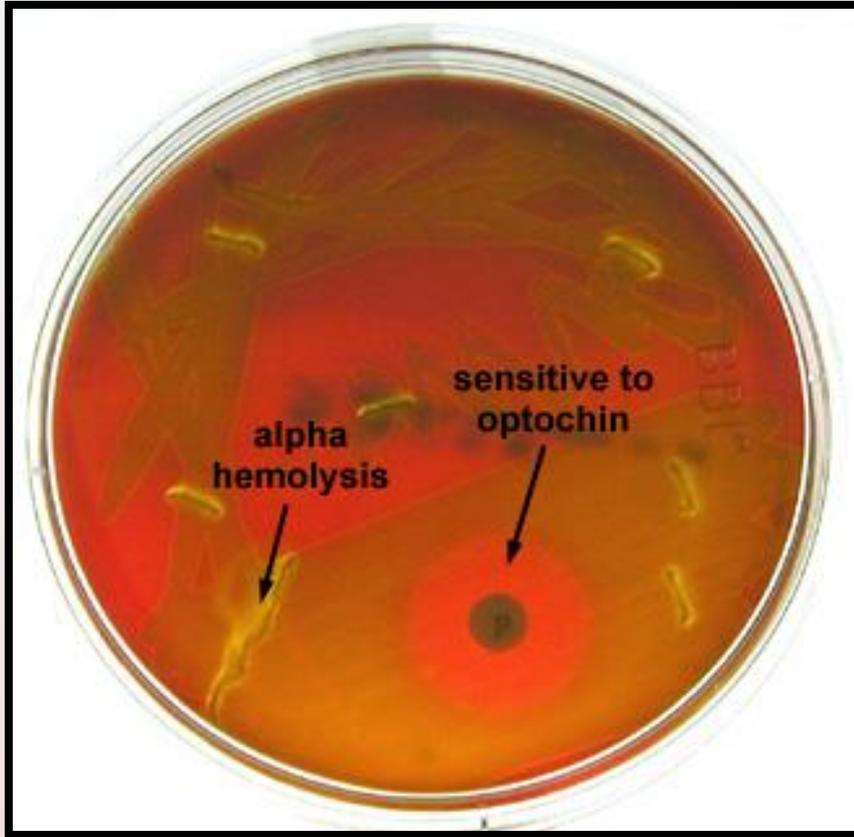
Direct gram stain of a CSF deposit shows gram-positive diplococci with lanceolate shape and polymorphonuclear leucocytes

Bacterial meningitis: **Pneumococcal Meningitis**



Culture on blood agar showing alpha-hemolytic colonies

Bacterial meningitis:
Pneumococcal Meningitis



OPTOCHIN SENSITIVE ALPHA-HAEMOLYTIC STREPTOCOCCI

Bacterial meningitis:
***H. influenzae* Meningitis**

Mainly caused by *Hemophilus influenzae*
type b

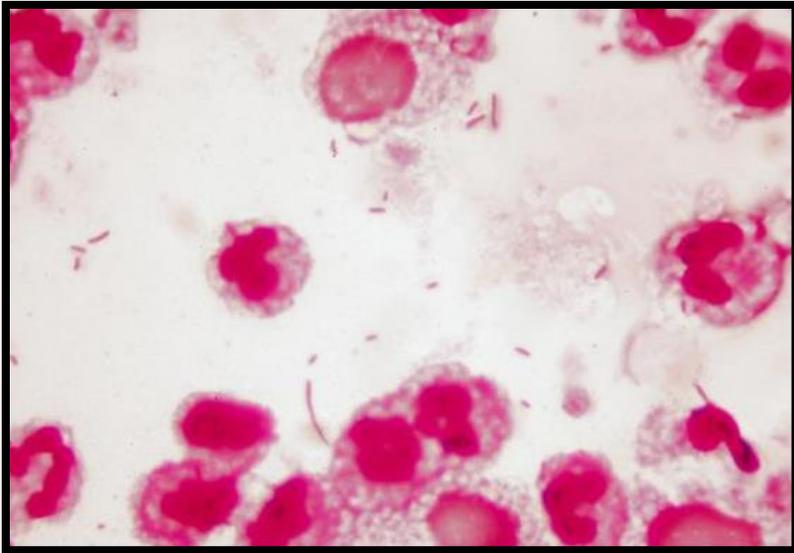
Gram negative coccobacilli

Requires X & V growth factors for growth

The optimum growth temperature is 35°C -
37°C in 5% CO₂

Bacterial meningitis:

H. influenzae

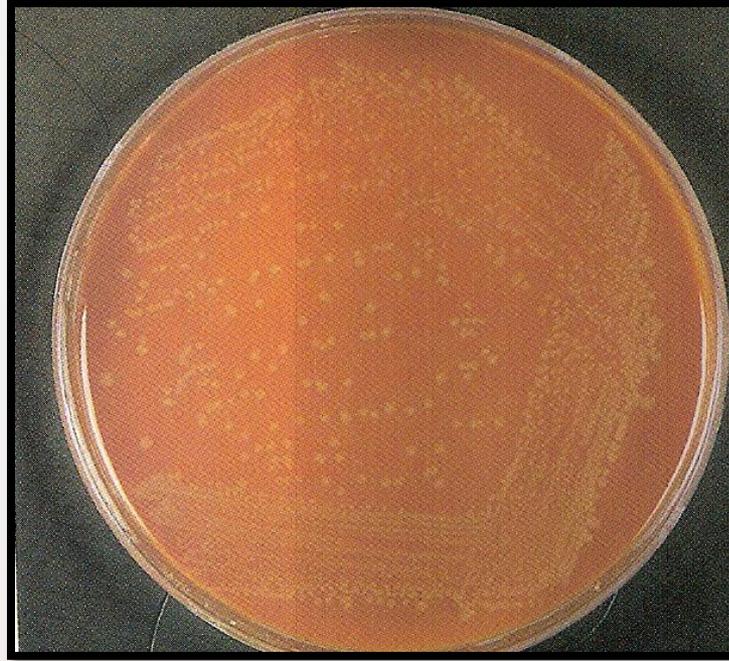


Microscopic Appearance

Direct gram stain of a CSF deposit shows Gram-Negative pleomorphic coccobacilli with many polymorphonuclear leucocyte

Bacterial meningitis:

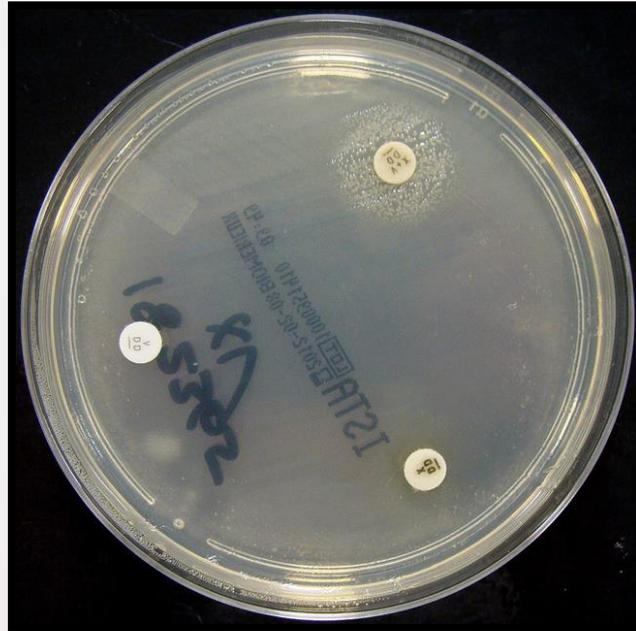
H. influenzae



Culture on chocolate agar

Bacterial meningitis:

H. influenzae



Culture on Nutrient agar

H. influenzae :Growth around XV factors(requires both factors XV)

no growth around X or V alone

Bacterial meningitis: *H. influenzae*

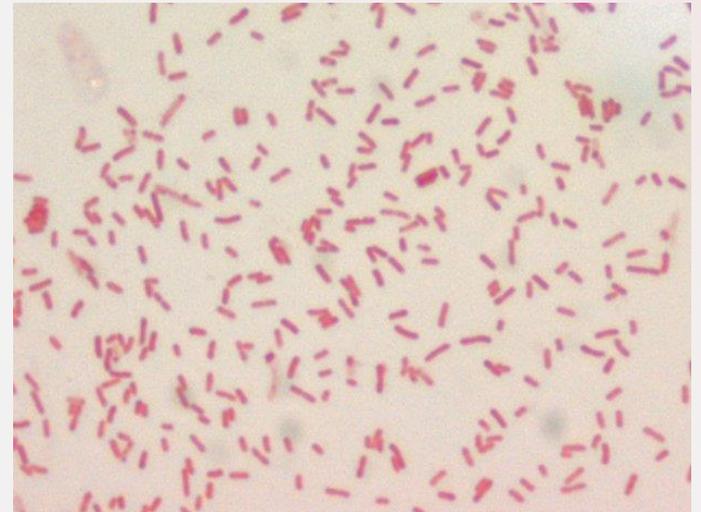
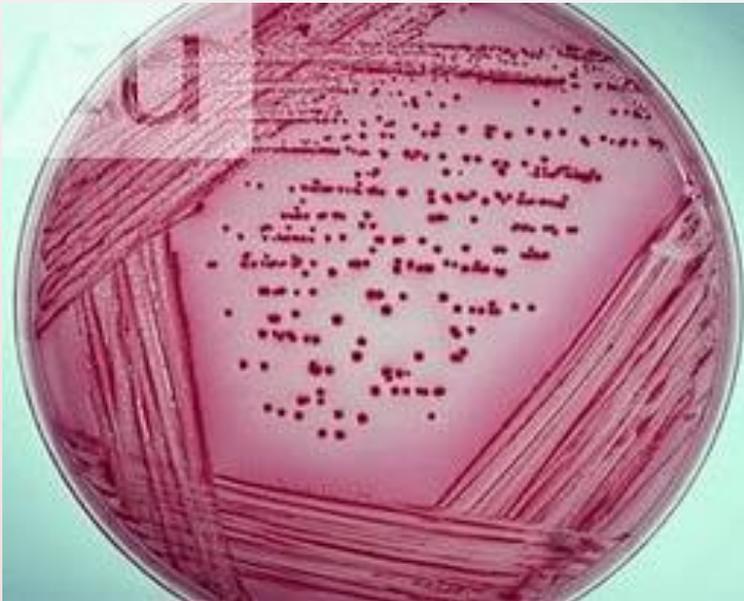


Culture on Blood agar

Growth on blood agar showing **satellitism** adjacent to a streak of *S. aureus*. *S. aureus* producing surplus factor increasing growth of adjacent *H. influenzae*

Bacterial meningitis: *E. coli*

Neonatal meningitis is most common due to
Colonization of infants with *E. coli* at delivery is



Escherichia coli on MacConkey
agar plate: appear pink as
they ferment lactose

gram negative bacilli

CASE 2

A 10-year old boy is brought to the emergency department (A&E) at King Khalid Hospital accompanied by his mother. He has fever, headache, and vomiting for the last 2 days. Clinical examination confirmed that he has meningeal irritation. The doctor decided to do a lumbar puncture.

The results of the lumbar puncture are shown below:

CASE 2: LUMBER PUNCTURE RESULTS

CSF	Patient's results	Normal range
Appearance	Clear 	Clear 
WBCs and differential	100 per mm ³ Mainly lymphocytes (80%)	Few (<5 cells/mm ³)
Protein	0.5	0.1-0.4 g/L
Glucose	3.7	3.0-4.5 mmol/L
Chloride	100	115-130 mmol/L

QUESTION 1:

What is your most likely diagnosis?

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.....

QUESTION 2:

What is the most likely infection responsible?(Select only one)

- A. Mycobacterium Avium
- B. Fungal infection
- C. Parasitic infection
- D. Viral infection
- E. Bacterial infection
- F. Trepanoma pallidum (Neurosyphilis)
- G. Mycobacterium tuberculosis

Question 3:

Justify your answer to question two?

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QUESTION 4:

What further investigation would you like to do at this stage?

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Microbiological Finding

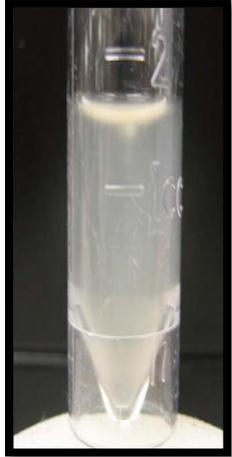
CSF Molecular testing is positive for
Enterovirus •

CASE 3

A **65-year-old** is referred from a general practitioner because of **headache, fever, excessive sweating at night, and weight loss over the last 4-5 months**. He has **lost his appetite for food**. On examination, there is neck rigidity. Laboratory tests including blood count, serum and electrolytes, blood urea, creatinine and blood culture are all normal. The doctors decides to do a lumber puncture.

The results of the lumber puncture are shown in the next slide:

CASE 3: LUMBER PUNCTURE RESULTS

CSF	Patient's results	Normal range
Appearance		
WBCs and differential	300 per mm ³ Mainly lymphocytes	Few (<5 cells/mm ³)
Protein	0.8	0.1-0.4 g/L
Glucose	2.0	3.0-4.5 mmol/L
Chloride	115	115-130 mmol/L

QUESTION 1:

What is your most likely diagnosis?

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.....

QUESTION 2:

What is the most likely infection responsible?(Select only one)

- A. Fungal infection
- B. Parasitic infection
- C. Viral infection
- D. Bacterial infection
- E. Trepanoma pallidum (Neurosyphilis)
- F. Mycobacterium tuberculosis

QUESTION 3:

What is your justification for your answer to question two?

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QUESTION 4:

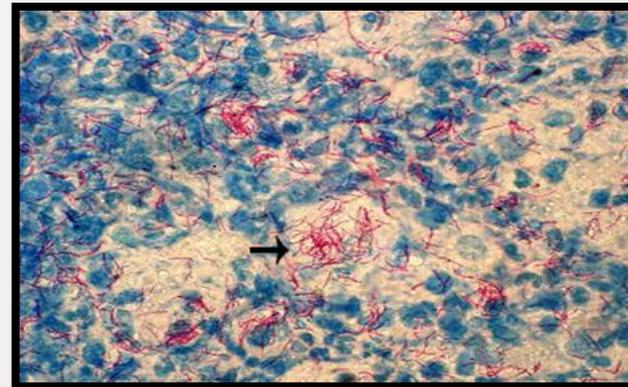
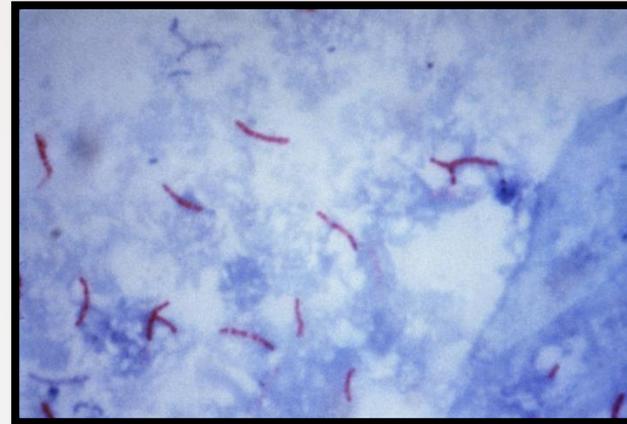
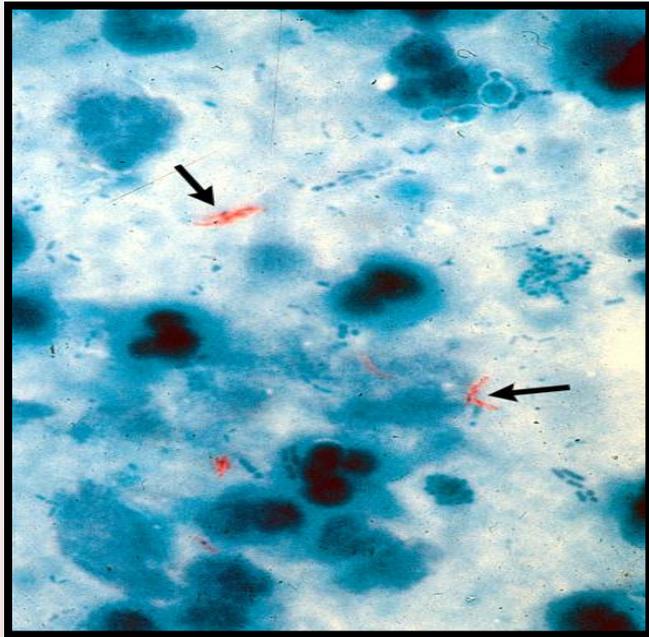
What further investigation would you like to do at this stage?

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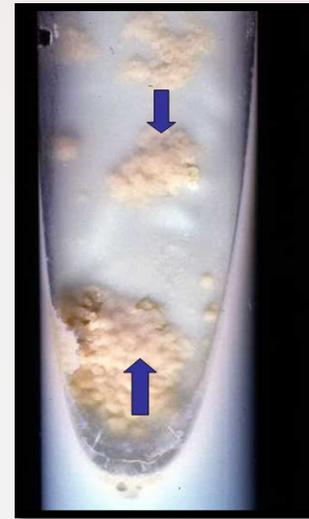
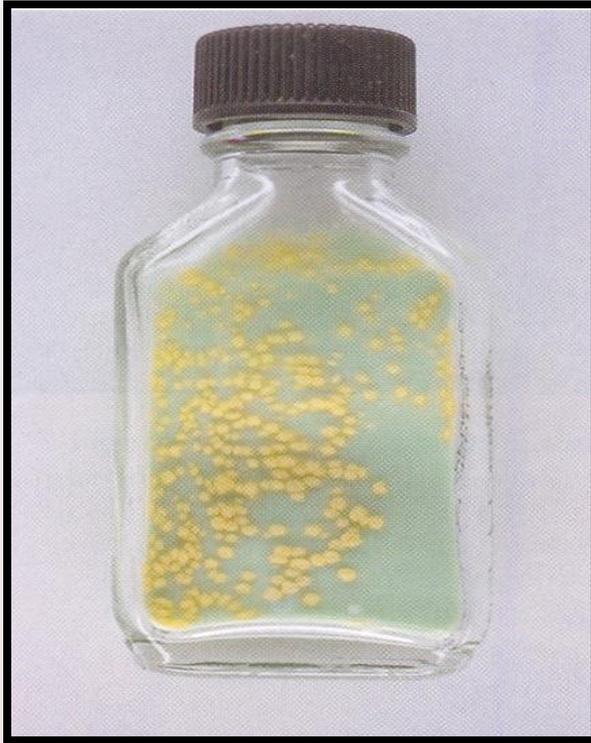
Bacterial meningitis: **Mycobacterium tuberculosis**



Microscopic Appearance

Direct Ziel – Neelsen Stained Smear of a CSF deposit shows
Acid – Fast Bacilli AFB

Bacterial meningitis: ***Mycobacterium tuberculosis***



Culture on Lowenstein – Jensen medium

Colonies or growth is Rough, Tough and Buff