Encapsulated Bacteria Session 1: identification and subtyping

Genomics and Clinical Microbiology 2024

Martin Maiden, Keith Jolley, Made Krisna, Kasia Parfitt

Department of Biology

UNIVERSITY OF
OXFORD

Clinical Scenario: the four specimens

Specimen	Source	Clinical diagnosis/suspicion
1	Right knee aspirate	? Septic arthritis/ ?? Meningitis
2	CSF	? Meningitis
3	CSF	? Sepsis/ ? Meningitis
4	CSF	? Recurrent meningitis

Specimen details

Specimen 1 Right knee aspirate appearance was cloudy with pus and blood-tinged, cell count and Gram stain was not possible as the sample was clotted. The aspirate was inoculated onto standard media producing an isolate that grew well on chocolate agar but not blood agar.

Specimen 2 CSF – small volume, clear and colourless. WCC 78 $x10^6$/L, protein 0.4 g/L, CSF glucose 2.9 mmol. Gram stain – no organisms seen. Blood glucose 4.6 mmol.

Specimen 3 CSF – clear colourless. WCC 1,153 $x10^6$/L, 60% polymorphs, protein 1.5 g/L, CSF glucose was 0.9 mmol. Gram stain – GPC (Gram positive cocci). No blood glucose was taken. Provisional culture – optichin positive.

Specimen 4 CSF – clear colourless. WCC 875 $x10^6$/L lymphocyte predominant, protein 1.2 g/L, CSF glucose 1.6 mmol. Gram stain – no organisms seen. Blood glucose 3.6 mmol.

Clinical Information

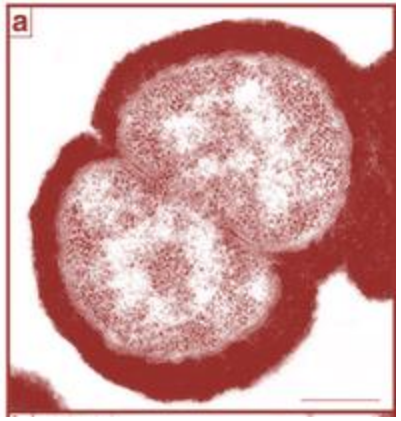
Specimen 1 was obtained from the joint fluid of a 45 years-old female with rheumatoid arthritis, who had been unwell for three days before presenting with a red, hot, swollen knee joint and intermittent confusion. She was on DMARDs (disease-modifying anti-rheumatic drugs) and had had a recent course of steroids for an arthritis flare.

Specimen 2 was obtained from the CSF of a 15 months-old child, was admitted to hospital with symptoms of lethargy, reduced consciousness, fever 39.2°C and a non-blanching rash. He was a previously fit and well infant with no admissions to hospital. He was born at full term in the Republic of Ireland and fully vaccinated according to the 2010-2015 Irish immunization schedule.

Specimen 3 was from a CSF sample from a 19 years-old male, who presented to the emergency department with a severe headache. He was febrile 38.8°C, with no evidence of neck stiffness and non-blanching rash on his abdomen. He reported that his friend had recently been admitted with meningitis. His spleen had been removed following a road traffic accident 4 years ago, he generally takes his penicillin prophylaxis, but is not sure his vaccination status is up to date since starting university.

Specimen 4 was from a four years-old boy with a history of previous culture negative meningitis treated with ceftriaxone one month ago. The child was admitted to the paediatric ward after complaining of fever and lethargy, with parental anxiety following his recent history. The parents reported mild cold-like symptoms about a week ago. The child was febrile 38.1°C, fully conscious and with the impression of neck rigidity. There were no other significant clinical signs apart from the residual effects of a runny nose.

Meningitis causing organisms

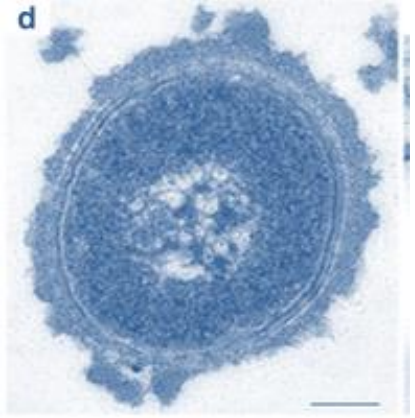


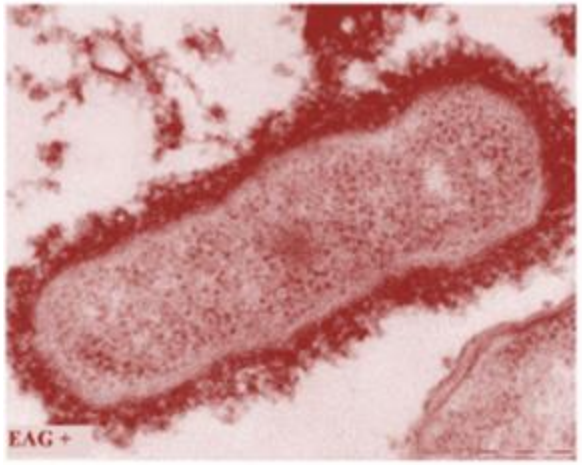
Neisseria meningitidis
Meningococcus
12 capsular serogroups
Genome: 2.27Mbp

Ganesh, K. *et al.* (2017) Molecular characterization of invasive capsule null *Neisseria meningitidis* in South Africa. *BMC Microbiol*. **17(1)**, 40.

Streptococcus pneumoniae
Pneumococcus
>100 capsular serotypes
Genome: 2.04Mbp

Ndlangisa, K.M., *et al.* (2016) Two cases of serotypeable and non-serotypeable variants of *Streptococcus pneumoniae* detected simultaneously during invasive disease. *BMC Microbiol*. **16,** 126.



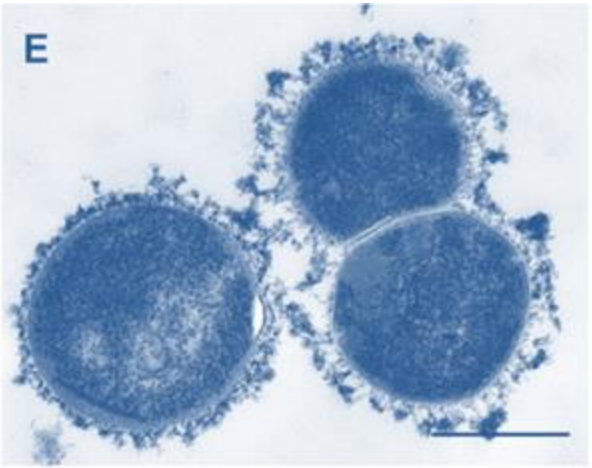


Haemophilus influenzae
'Hib'
6 capsular serotypes
Genome: 1.83Mbp

Schouls L., *et al.* (2008) Two variants among *Haemophilus influenzae* serotype b strains with distinct *bcs4*, *hcsA* and *hcsB* genes display differences in expression of the polysaccharide capsule. BMC Microbiol. **8,** 35.

Streptococcus agalactiae
Group B Strep. (GBS)
10 capsular serotypes
Genome: 2.16Mbp

Lecours M.P., *et al.* (2012) Sialylation of *Streptococcus suis* serotype 2 is essential for capsule expression but is not responsible for the main capsular epitope. *Microbes Infect*. **14(11)**, 941-50.



What are the causative organisms?

Specimen	Suspected organism	Laboratory confirmed organism
1		
2		
3		
4		

Discussion points

- What microbiological testing is available in your local laboratory?
- To what extent can isolates be distinguished and using what methods?
- How quickly can this be done and what is the impact on clinical management?

Into the Lab!

What are the causative organisms?

Specimen	Suspected organism	Laboratory confirmed organism
1	*Haemophilus influenzae*	
2	*Neisseria meningitidis*	
3	*Streptococcus pneumoniae*	
4	*Neisseria meningitidis/ Streptococcus pneumoniae*	

Discussion points

- How should these patients be managed?
- Is any public health action necessary at this point?
- What, if any, further action might you take?

What are the causative organisms?

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2	*Neisseria meningitidis*	*Neisseria meningitidis*
3	*Streptococcus pneumoniae*	*Streptococcus pneumoniae*
4	*Streptococcus pneumoniae*	*Streptococcus pneumoniae*

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Another specimen

The laboratory has received a CSF specimen from a further clinical case of meningitis. The child had received antibiotics prior to CSF collection, and the laboratory performed a real-time PCR along with culture. The real-time PCR demonstrated the presence of *N. meningitidis* in this new sample. No organism was cultured.

Specimen 5 – A CSF sample from a 3 year-old boy, a relative of the patient from which Specimen 2 was derived.

- Why is there no microbiological culture, to what extent is this a problem?
- What information do you now need?
- How will you obtain it?
- What actions might you now take?

Into the Lab!