Higher Specialist Diploma

Medical Microbiology

Examination 2018

Paper 3

Discipline-specific questions

120 minutes

Attempt 3 out of 6 questions

Instructions to candidates

1. Record your candidate number, qualification title and where appropriate the discipline and examination paper number on the front sheet of the answer booklet
2. Record your candidate number and the page number in the spaces provided on the answer sheets
3. Begin each new answer on a new page
4. Write on one side of the answer sheet only
5. Each question is worth 100 marks
1. ‘Detection of enteric parasites by manual microscopy is an unsustainable service.’ Discuss this statement.

2. ‘Does the cost of providing a dedicated orthopaedic microbiology suite outweigh the benefits?’ Discuss.

3. ‘The World Health Organisation recently stated that Gonococcal antimicrobial resistance is a major global problem.’ Discuss the evidence that supports this statement.

4. Discuss the resistance mechanisms of *S. aureus* to meticillin and evaluate the current screening methods for MRSA.

5. Why do UK laboratories need to retain and develop their expertise in the investigation of diseases caused by *Clostridium* species?

6. Review the epidemiology and laboratory diagnosis of infections caused by members of the genus *Bordetella*, with particular emphasis on *B. pertussis*. 
Higher Specialist Diploma

Medical Microbiology

Examination 2018

Paper 4

Case studies

120 minutes

Attempt all case studies

Instructions to candidates

1. Record your candidate number, qualification title and where appropriate the discipline and examination paper number on the front sheet of the answer booklet
2. Record your candidate number and the page number in the spaces provided on the answer sheets
3. Begin each new answer on a new page
4. Write on one side of the answer sheet only
5. Each case study is worth 100 marks
Seen Case Study

1. A 58-year-old man attended the A&E department complaining of pain in his left lower leg and abdomen. Two years previously, he had been diagnosed with Hepatitis B liver cirrhosis but was not taking any medication, he was obese and a heavy smoker. He reported that whilst working on a construction site the previous day he had stumbled and fallen on his left side. At the time, he experienced severe pain in his abdomen and leg and both areas began to gradually develop redness and painful swelling.

On arrival at hospital, he was struggling to walk but was alert. He had a BP of 107/55, heart rate of 92 beats/min, respiratory rate of 21 breaths/min and a temperature of 36.3°C. On examination local tenderness, pain beyond the area of redness, swelling, and warmness and were noted.

a. Given the above information, what are the possible conditions and causative agents? (15 marks)

Laboratory tests were taken and the results showed a high WBC with an elevated percentage of polymorphonuclear leukocytes, a decreased sodium level, and elevated serum creatinine and C-reactive protein levels.

Within hours, the patient’s temperature rises to 38.4°C, BP dropped to 80/40, and the patient complained of nausea and increased severe pain and small bullae were clearly visible on his abdomen.

b. Given the above results what is the likely diagnosis? Justify your choice and explaining your reasons for discounting previously suggested conditions? What further tests/procedures should be carried out and why? Explain how any samples sent to the microbiology laboratory would be dealt with. (20 marks)

A CT scan of the lower extremities showed a marked subcutaneous oedema without haematoma or abscess throughout the leg and the patient was diagnosed with Necrotising Fasciitis. Surgical debridement was undertaken and Gram staining of bullous fluid confirmed the presence of Gram-negative coccobacilli. The following day similar findings were seen in Gram films taken from positive blood cultures.

ci. Outline the pathophysiology, classification and known risk factors of the condition.

cii. What further laboratory tests should be carried out at this point and why? Give clear details of all processes suggested.

ciii. Suggest antibiotic therapy choices prior to full identification of the organism and the need for swift administration. (35 marks in total)

The following day culture on CLED revealed a non-lactose fermenting oxidase-negative, catalase-positive, indole-negative organism.
d. What empirical treatment would you suggest given the microbiological results so far, detail your reasons? (15 marks)

e. The organism proved sensitive to the treatment for the Gram-negative organism and no other organism was isolated. What monitoring and possible further treatment/support is the patient likely to need? (15 marks)

Unseen Seen Case Studies

2.
Jamie is a 23 year old graduate who had taken a gap year following completion of his degree. He has spent 6 months exploring the East coast of Australia before flying into Thailand to continue his adventure. He eventually travelled by train to India where he had planned to meet a group of friends. The friends hired motorbikes and made their way to New Deli. The roads in the city were treacherous especially for unfamiliar motorists and Jamie was unfortunately involved in a collision with a local bus.

He was admitted to hospital suffering from a serious head injury. Jamie required neurosurgery to relieve the pressure on his brain. His family were frantically worried. They raised money to fly him back to the UK for specialist treatment. He was repatriated 2 weeks after his accident. Jamie was initially admitted to Manchester Royal Infirmary for further neurological treatment before being transferred to your local hospital.

a. Solely from the ABOVE scenario indicate what screening samples would be required on admission of the patient to your hospital and explain how these would be processed. (10 marks)

Jamie was stable on admission and responding well to treatment. He was able to communicate although he remembered nothing of his accident. On day-3, however he became disorientated. His heart rate and respiratory rate increased. His temperature rose to 38.4°C. His clinicians decided to treat empirically with Ceftazidime.

b. Provide a differential diagnosis based upon the symptoms described and consider what new samples need to be collected from the patient. (10 marks)

The CPE screens collected on day-0 were culture negative. Day-2 CPE screens were still in progress. You were assigned to read CPE screens and you detected scanty colonies on Jamie’s CPE plates. On looking back at Jamie’s previous results, you could see that there was no faecal material evident on the initial rectal swab taken on day-0 nor were there any clinical details provided about his travel history.
c. Explain the significance of these findings and describe how you would investigate the colonies growing on the CPE plates and interpret the results obtained. (30 marks)

The colonies from Jamie’s CPE screen were confirmed as *Klebsiella pneumoniae*.

d. Outline the ‘BIG 5’ classes of CPE. (30 marks)

Jamie’s blood culture bottle flagged positive after 18hr incubation. Gram negative bacilli were observed on microscopy. Using Maldi-TOF Mass Spectroscopy the organism was identified as *Escherichia coli*. PCR investigation confirmed the *Klebsiella pneumoniae* from the blood culture as KPC and the *E.coli* from the rectal swab as NDM.

e. Provide an explanation of why/how Jamie was colonised/infected with two different strains of CPE. (20 marks)

3. A 30-year-old male farm worker was admitted to hospital with abdominal pain and bloody diarrhoea without fever. He was previously healthy and had no specific past medical history. Direct stool culture was performed and he received intravenous hydration. On the second day of admission, his urine volume decreased and he was transferred to ICU. Initial laboratory tests gave the following results.

<table>
<thead>
<tr>
<th>Test</th>
<th>Patient result</th>
<th>Reference range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum creatine</td>
<td>300 µmol/L</td>
<td>64-104 µmol/L</td>
</tr>
<tr>
<td>eGFR</td>
<td>23 ml/min/1.73m²</td>
<td>&gt;60 ml/min/1.73m²</td>
</tr>
<tr>
<td>Blood urea nitrogen</td>
<td>18.5 mmol/L</td>
<td>8-16.4 mmol/L</td>
</tr>
<tr>
<td>Haemoglobin</td>
<td>92 g/L</td>
<td>130-180 g/L</td>
</tr>
<tr>
<td>Platelets</td>
<td>19 x10⁹/L</td>
<td>150-450 x10⁹/L</td>
</tr>
<tr>
<td>Total bilirubin</td>
<td>23 µmol/L</td>
<td>&lt;21 µmol/L</td>
</tr>
<tr>
<td>Direct bilirubin</td>
<td>1 µmol/L</td>
<td>0-5 µmol/L</td>
</tr>
<tr>
<td>Peripheral blood smear</td>
<td>Microangiopathic haemolytic anaemia</td>
<td>n/a</td>
</tr>
</tbody>
</table>

a. Using only the information above make a diagnosis, with full justification of the condition this patient is suffering from. In your answer you should explain how the test results are interpreted. (10 marks)
No pathogens were isolated from stool culture and there were no sorbitol non-fermenting colonies seen on CT-SMAC media. He received haemodialysis for four days, and plasma exchange and fresh frozen plasma for two weeks. After 21 days he was discharged and received follow-up care as an outpatient.

b. What additional work could be done to provide evidence of Shiga toxin-producing *E. coli* (STEC) infection? (25 marks)

c. Explain how Cefixime Tellurite Sorbitol MacConkey (CT-SMAC) selects for *E. coli* O157:H7 and what are its limitations? (25 marks)

d. How might the patient have acquired an STEC infection? (20 marks)

e. Why is antibiotic therapy not advised in the management of STEC infection? (10 marks)

f. Excluding problems with media choice and quality control, what are the possible reasons for the failure of primary culture in medical bacteriology? (10 marks)