Higher Specialist Diploma

Medical Microbiology

Examination - February 2021

Essay Paper

120 minutes

Attempt 2 out of 5 questions

Instructions to candidates

1. Record your candidate number and HSD discipline on the front sheet of the answer booklet.

2. Record your candidate number, the question number and the page number in the spaces provided on the answer sheets.

3. Begin each new answer on a new page.

4. Each question is worth 100 marks.
1. Explain the importance of public health microbiology and field epidemiology services giving examples to support your answer.

2. Critically evaluate test methodologies for the detection of CPE and discuss the technical challenges of each method.

3. Discuss the pathogenesis, diagnosis and management of a hazard group 3 parasitic or fungal pathogen of your choice.

4. *Campylobacter* infections make up some of the most common gastrointestinal infections in Europe. Discuss the epidemiology, laboratory diagnosis and antibiotic resistance mechanisms associated with *Campylobacter jejuni*.

5. *Staphylococcus aureus* can be described as a versatile pathogen capable of causing a range of infections. Write an essay to illustrate this statement.
Higher Specialist Diploma

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Case studies

120 minutes

Attempt all case studies

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SEEN CASE STUDY

1. The patient is a 24 year old male with type 1 diabetes which recently had become poorly controlled. He presented with a one week history of a productive cough which had progressed to fever, chills, rigors and loss of appetite. Chest X-ray revealed an upper lobe infiltrate with thin-walled cavitations and his C-reactive protein was elevated at 40 mg/dL.

Blood cultures from the patient flagged positive and colonies were observed following overnight incubation. On blood agar these were greyish-white, non-haemolytic, small, smooth and creamy which progressed to appear dry and wrinkled. The same colony type was recovered from a sputum sample. The organism was shown to be a short Gram negative rod with bi-polar staining and was oxidase positive.

The patient had no recent travel history but further information was requested regarding the travel history over the past few years.

a. Using only the information above review the case and possible pathogens present. (20 marks)

b. Why was an extended travel history requested in this case? (10 marks)

MALDI-TOF-MS performed on a colony identified this organism as *Burkholderia thailandensis* but with low discrimination.

c. Explain and justify what your next actions should be in this case. (20 marks)

The extended travel history showed that the patient had travelled extensively in South East Asia and Australia during a gap year 3 years ago. During these travels he had spent long periods in rural areas during the monsoon season and had regular contact with livestock and exposure with well water. The patient did recall having influenza-like symptoms during his return to the UK but this was self-limiting.

d. Using all the information above explain the case information and its progression over the past 3 years to the current situation. (20 marks)

e. Provide details on the antimicrobial therapy the patient should receive. (10 marks)

f. Review the risks of laboratory-acquired infection in this case and any actions required. (20 marks)
UNSEEN CASE STUDIES

2. A 20 year female attends her GP surgery with a suspected UTI. She informs the doctor that she suffered from UTIs as a child and was diagnosed with renal scarring.

a. Draw and label a diagram of the urinary tract indicating where scarring occurs. Briefly describe the sequelae of renal scarring. (15 marks)

The GP is concerned about further episodes of pyelonephritis hence manages the patient according to NICE Guidelines.

b. Provide details of the treatment options according to these guidelines (15 marks)

The GP performs a urine dipstick in the surgery which shows the presence of nitrite and white blood cells. The GP prescribes oral cephalexin and sends a urine sample to the lab. The GP advise the patient that the test results will be available the next day. The GP is able to say this with confidence as they know the local lab uses a direct sensitivity method.

c. Describe the advantages/disadvantages of performing direct sensitivities on microscopy positive urine samples (20 marks)

The GP receives the culture result the following afternoon via the electronic reporting system. The patient’s sample has grown >100,000 orgs/ml Escherichia coli. It is reported as being sensitive to trimethoprim and nitrofurantoin but resistant to both cephalexin and amoxicillin.

d. From the sensitivity profile above, indicate the possible resistance mechanism(s) and describe how you could confirm this. (30 marks)

The GP rings the patient at home but finds that she had been admitted to hospital with symptoms of sepsis.

e. List the symptoms of sepsis. (10 marks)

The patient had a blood culture taken on admission. Her treatment was switched to IV cefuroxime and metronidazole. The blood culture subsequently grew E.coli.
f. Explain how you would determine if the isolate from the urine and the blood culture were the same (10 marks)

3. A 70 year old man presented to the A&E department of his local hospital with a raised temperature of 38.6˚C and complaining of lower abdominal pain. His records showed that 10 days previously he had undergone surgery for a hernia repair and subsequently had urinary retention.

On admission he had a transurethral urinary catheter fitted. The physical examination was normal except for the febrile temperature and lower abdominal pain. CRP was slightly elevated.

a. Given the above scenario what is the likely diagnosis and what laboratory tests would you recommend: give clear justification for your choices (15 marks)

Tests showed the presence of mild pyuria and haematuria and the patient was started on IV ceftriaxone and changed after 3 days to amoxicillin-clavulanate but the patient continued to spike fevers up to 39.8˚C. It was noted at this point that his past medical history indicated that he had a transcatheter aortic valve fitted.

b. Given the above information should any other diagnosis now be considered? Give clear reasons for your decision. Detail any other laboratory tests that may be required and the reasons why. (15 marks)

Initially all samples tested within the Microbiology laboratory remained culture negative but after 5 days one set of blood cultures and a repeated urine sample yielded growth on blood and CLED agars, the appearance consistent with that of \textit{P.aeruginosa}.

c. Detail further microbiological tests required at this point. (15 marks)

The isolate was confirmed as \textit{P.aeruginosa} and proved susceptible to all antibiotics tested including piperacillin- tazobactam, ceftazidime, meropenem, imipenem, cefepime, gentamicin, tobramycin and ciprofloxacin, the patient was started on piperacillin-tazobactin and later changed to ceftazidime.

CT scans of the thorax and abdomen were unremarkable but the patient continued to spike raised temperature. By day 15 the patient was still spiking a temperature and blood cultures were positive for \textit{P.aeruginosa} but no focus of infection was identified.
d. Comment on the above findings and suggest the most likely diagnosis and possible (non-microbiological) test that may help to confirm this. 

The organism continued to be isolated from subsequent blood culture samples over the next 10 days however the isolate showed resistant to previously sensitive antibiotics including piperacillin-tazobactam, ceftazidime, and cefepime.

On day 31 *P. aeruginosa* isolated from a further set of blood cultures saw another change in resistance pattern with the isolate showing susceptibility to piperacillin-tazobactam, ceftazidime and cefipime but resistance to carbapenems.

e. Comment on the changing resistance patterns seen throughout the case history. 

On day 37 a free floating mass was identified on the aortic valve, at this point the patient was still febrile with a raised WCC and a high CRP.

f. Detail the final diagnosis given the latest finding and comment on the organism as a causative agent. What further action should now be taken to ensure the patient recovery?  

(15 marks)

(20 marks)