Higher Specialist Diploma

Clinical Chemistry

Examination 2019

Paper 3

Discipline-specific questions

120 minutes

Attempt 3 out of 6 questions

<u>Instructions to candidates</u>

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. What are the possible causes of hypercalcemia? Describe a strategy for the investigation of a patient with an unexpected high serum calcium.

2. "Liver Function Tests (LFTs) do not measure liver function". Discuss this statement, and explain how abnormal LFTs are interpreted.

3. Using examples, compare and contrast the information gained by the measurement of 'tumour markers'?

4. As part of a Pathology reorganisation project it has been proposed to set up a 'hot lab' within the A&E department. Discuss how the Clinical Chemistry laboratory should be involved in this process, and which 'Clinical Chemistry' investigations should be made available.

5. A local newspaper claims that your hospital is performing an out of date test for renal disease, and describes a recent report that concludes a new test it is much better than the one you provide. The CEO wants you to provide an explanation of why you continue with your test so the Trust can respond and reassure patients they are not getting an inferior service and if anything your test is better for the general population. What factors might you use to support the Trusts test of choice?

6a. Provide an account of how the buffer, renal and respiratory systems contribute to hydrogen ion homeostasis.   (50 marks)

6b. Describe the principles and applications of electrochemistry (amperometry and potentiometry).   (50 marks)

Higher Specialist Diploma

Clinical Chemistry

Examination 2019

Paper 4

Case studies

120 minutes

Attempt all case studies

<u>Instructions to candidates</u>

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 35 year old man presents to his GP with a three month intermittent history of abdominal pain, blood in his stools and diarrhoea. The patient also complained of feeling feverish and of tiredness/fatigue. Following an endoscopy and other investigations, a diagnosis of ulcerative colitis was made. Initial laboratory investigations gave the following results;

Investigation	Result	Reference Range
Sodium	137 mmol/L	135 – 145 mmol/L
Potassium	2.9 mmol/L	3.3 – 4.9 mmol/L
Urea	8.1 mmol/L	2.6 – 6.7 mmol/L
Creatinine	80 µmol/L	60 – 125 µmol/L
CRP	82 mg/L	< 10 mg/L
ESR	25 mm/hour	< 7 mm/hour
Hb	112 g/L	130 – 180 g/L
MCV	75 fL	80 – 100 fL
MCHC	290 g/L	330 – 360 g/L
WCC	15.8 x 10^9/L	4.3 – 10.8 x 10^9/L

a. Explain the significance of the results, shown in the table above.   (20 marks)

The patient was put on a course of prednisolone which was initially successful in controlling symptoms. After 6 months the patient was found to have raised blood glucose levels.

b. How do steroids affect blood glucose levels?   (10 marks)

c. What are the criteria for a diagnosis of diabetes?   (10 marks)

d. Which High-Risk Groups that do not have diabetes are more likely to develop hyperglycemia when put on steroid therapy?   (10 marks)

e. Describe how steroid-induced diabetes could initially be treated.   (5 marks)

f. How would you treat this individual if this initial treatment option fails?   (15 marks)

After a further 6 months the patient's symptoms returned, and it was decided to start treatment with azathioprine.

g. Explain how azathioprine works against this disease. What investigation should be carried out before starting azathioprine, (and what information does this give)?

(20 marks)

h. What are the potential side effects of azathioprine, and how may these be monitored?

(10 marks)

Unseen Case Studies

2.

A 55 year old female was referred to the endocrine clinic because of skin pigmentation, obesity, hypertension and muscle weakness. Results of initial investigations were as follows;

Investigation	Result	Reference Range
Sodium	149 mmol/L	135 – 145 mmol/L
Potassium	2.8 mmol/L	3.3 – 4.9 mmol/L
Urea	6.5 mmol/L	2.6 – 6.7 mmol/L
Creatinine	75 µmol/L	60 – 125 µmol/L
Calcium	2.25 mmol/L	2.15 – 2.55 mmol/L
Albumin	42 g/L	35 – 45 g/L
Glucose	13.8 mmol/L	5.5 – 11.1 mmol/L

A preliminary diagnosis of Cushing's syndrome was made.

a. Outline the causes of Cushing's syndrome. (20 marks)

b. On the assumption that this initial diagnosis is correct, explain the physiological causes of the abnormal results shown above. (10 marks)

c. What other diagnoses should be considered? (15 marks)

d. What investigations can be carried out to confirm or rule out these differential diagnoses? (15 marks)

e. Critically evaluate the investigations available to confirm or rule out a diagnosis of Cushing's syndrome. (40 marks)

3.

A 59 year old gentleman presented at A/E complaining of a sudden onset, severe headache with an associated stiff neck early the day before but due to his relatively remote location and adverse weather did not attend A/E until late on the following day. The pain persisted and was very localized to the posterior R side of the head. His temperature was normal.

a. What are the potential diagnosis for this patient? (10 marks)

b. What would the initial investigations be for this patient and why? (5 marks)

His results were as follows:

Investigation	Result	Reference Range
Na	150	135 – 145 mmol/L
K	6.9	3.3 – 4.9 mmol/L
Urea	8.1	2.6 – 6.7 mmol/L
Creatinine	80	60 – 125 mmol/L
eGFR	>90	>90 ml/min
CRP	2	< 10 mg/L
Ca	1.56	2.15-2.55 mmol/L
Albumin	39	35-55 g/L
TBil	12	5.1 – 20.5 µmol/L
ALP	3	32-126 U/L
TP	75	60 to 83 g/L.
Glucose	4.1	4.0-5.4 mmol/L
Hb	145	130 – 180 g/L
MCV	95	80 – 100 fL
WCC	6.9	4.3 – 10.8 x 10^9/L

c. Discuss these results. (20 marks)

His CT scan was negative.

d. What further tests would you suggest, stating the justification for the test, its methodology/principle and any limitations or precautions? (20 marks)
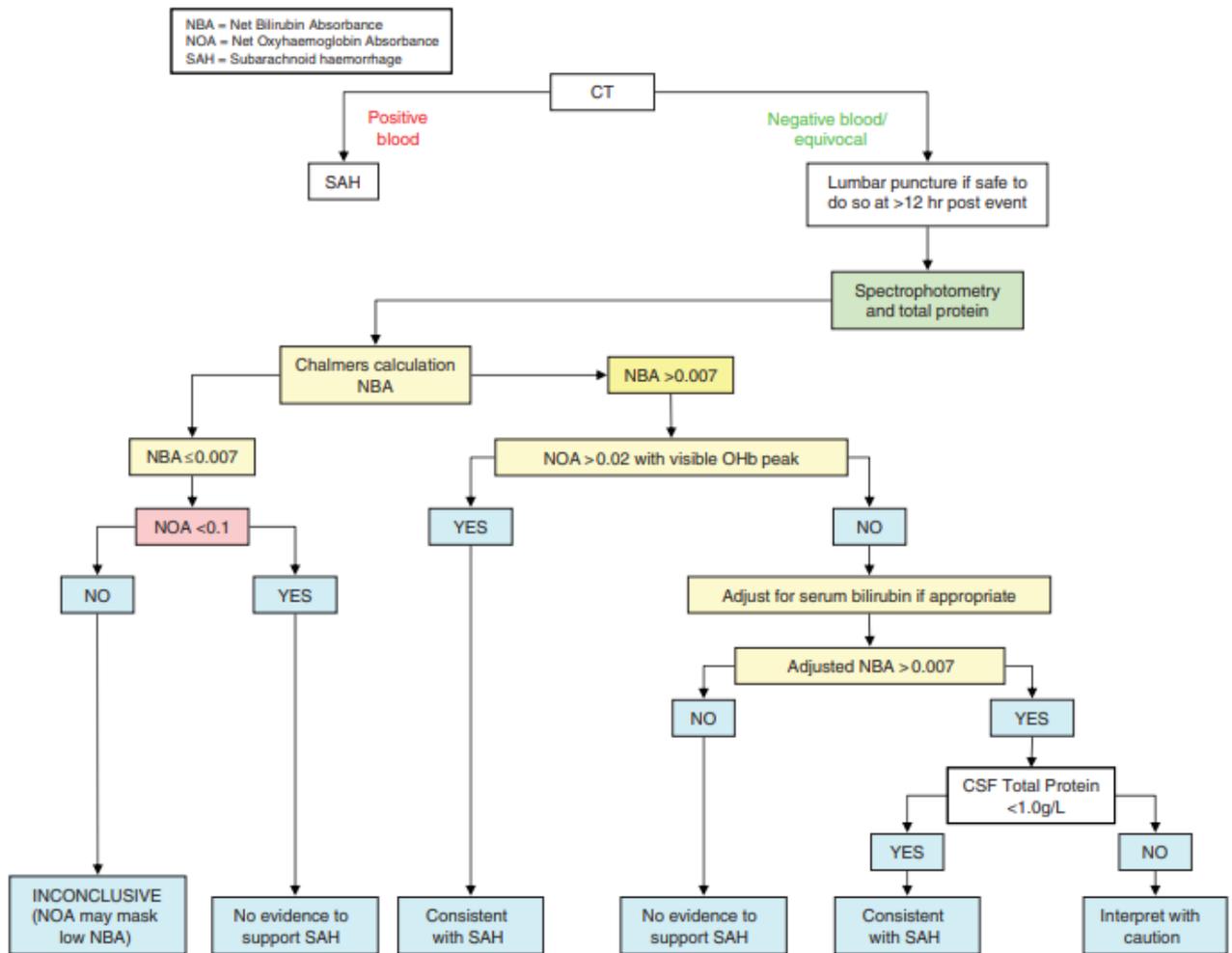
Further results were as follows:

Investigation	Result	Reference Range
CSF cell count	<5 cells per mm^3	
CSF Glucose	3.6	2.5-4.4 mmol/L
CSF Protein	0.15	<1.0g/L
Na	146	135 – 145 mmol/L
K	4.2	3.3 – 4.9 mmol/L
Urea	6.9	2.6 – 6.7 mmol/L
Creatinine	80	60 – 125 mmol/L
eGFR	>90	>90 ml/min
CRP	2	< 10 mg/L
Ca	2.21	2.15-2.55 mmol/L

e. What do these results tell us? (10 marks)

f. Review the scan below and using the flow chart provided, interpret the results and state what would be reported to the clinician (5 marks)
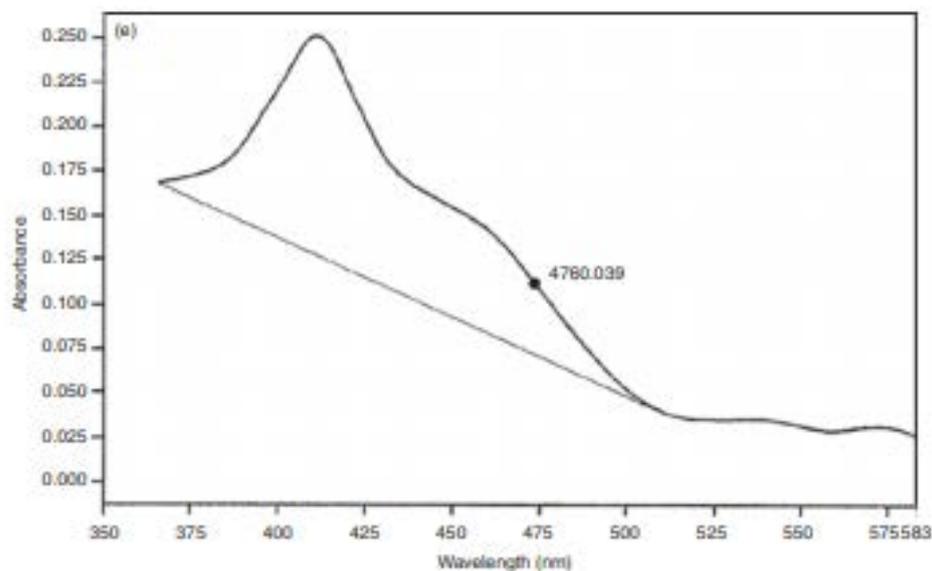
Results for this patient are NOA 0.125 AU and NBA 0.05 AU with visible oxy-haemoglobin peak.

NBA = Net Bilirubin Absorbance
NOA = Net Oxyhaemoglobin Absorbance
SAH = Subarachnoid haemorrhage

CT
- Positive blood → SAH
- Negative blood/ equivocal → Lumbar puncture if safe to do so at >12 hr post event → Spectrophotometry and total protein

Chalmers calculation NBA
- NBA ≤0.007 → NOA <0.1
  - NO → INCONCLUSIVE (NOA may mask low NBA)
  - YES → No evidence to support SAH
- NBA >0.007 → NOA >0.02 with visible OHb peak
  - YES → Consistent with SAH
  - NO → Adjust for serum bilirubin if appropriate → Adjusted NBA >0.007
    - NO → No evidence to support SAH
    - YES → CSF Total Protein <1.0g/L
      - YES → Consistent with SAH
      - NO → Interpret with caution

g. What is the significance of measuring Bilirubin and oxyhaemoglobin in the CSF?
(20 marks)

h. Why is a paired blood sample required when investigating either meningitis or SAH?
(10 marks)