A 23-year-old woman is hospitalised with severe anorexia nervosa. Her FBC shows WBC 3.5 x10^9 /l, neutrophil count 1.1 x 10^9 /l, Hb 100 g/l, MCV 104 fl and platelet count 70 x 10^9 /l. Blood film shows occasional acanthocytes. Neutrophils show normal segmentation. Her prothrombin time is slightly increased.

The most likely diagnosis is

A. Aplastic anaemia
B. Folic acid deficiency
C. Haematological features of anorexia nervosa
D. Hepatic steatosis
E. Vitamin B12 deficiency
Multiple Choice Questions for Haematology and Core Medical Trainees
Multiple Choice Questions for Haematology and Core Medical Trainees

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Preface

This book has been written to help haematology trainees preparing for the part 1 examination of the Royal College of Pathologists. It will also be of use to core medical trainees preparing for the examinations of the Royal College of Physicians and the Royal Australasian College of Physicians and to haematology and general medicine trainees in other countries where methods of examination are similar. There is a considerable paediatric content so the book will also be useful to those preparing for examination of the Royal College of Paediatrics and Child Health. The two formats that are most used by these Royal Colleges have been used, Single Best Answer and Extended Matching Question. Detailed feedback and, when appropriate, relevant references are given for each question so that those who select the wrong answer will understand why another answer is preferred. Because of the detailed feedback and because some of the questions are quite searching, the book is an educational tool as well as a way to prepare for examinations. It will thus be of value also to advanced trainees including those preparing for the part 2 RCPPath examination. Since the book incorporates much recent knowledge it may well also be of use to consultant haematologists wanting to update themselves as well as to those who are involved in training and examining.

Barbara J. Bain, 2016
Normal Ranges and Abbreviations

Core abbreviations and normal ranges
Standard abbreviations (not defined in text) and normal ranges for the full blood count (FBC) in Caucasian adults are shown in this table. Normal ranges for children and for other tests are given in relation to the individual cases when necessary.

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>White blood cell count (WBC)</td>
<td>3.7–7.9</td>
<td>3.9–11.1</td>
<td>× 10^9/l</td>
</tr>
<tr>
<td>Red blood cell count (RBC)</td>
<td>4.32–5.66</td>
<td>3.88–4.99</td>
<td>× 10^12/l</td>
</tr>
<tr>
<td>Haemoglobin concentration (Hb)</td>
<td>133–167</td>
<td>118–148</td>
<td>g/l</td>
</tr>
<tr>
<td>Haematocrit (Hct)</td>
<td>0.39–0.50</td>
<td>0.36–0.44</td>
<td>l/l</td>
</tr>
<tr>
<td>Mean cell volume (MCV)</td>
<td>82–98</td>
<td></td>
<td>fl</td>
</tr>
<tr>
<td>Mean cell haemoglobin (MCH)</td>
<td>27.3–32.6</td>
<td></td>
<td>pg</td>
</tr>
<tr>
<td>Mean cell haemoglobin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>concentration (MCHC)</td>
<td>316–349</td>
<td></td>
<td>g/l</td>
</tr>
<tr>
<td>Neutrophils</td>
<td>1.7–6.1</td>
<td>1.7–7.5</td>
<td>× 10^9/l</td>
</tr>
<tr>
<td>Lymphocytes</td>
<td>1.0–3.2</td>
<td></td>
<td>× 10^9/l</td>
</tr>
<tr>
<td>Monocytes</td>
<td>0.2–0.6</td>
<td></td>
<td>× 10^9/l</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>0.03–0.06</td>
<td></td>
<td>× 10^9/l</td>
</tr>
<tr>
<td>Basophils</td>
<td>0.02–0.29</td>
<td></td>
<td>× 10^9/l</td>
</tr>
<tr>
<td>Platelets</td>
<td>143–332</td>
<td>169–358</td>
<td>× 10^9/l</td>
</tr>
</tbody>
</table>
Other abbreviations

aHUS atypical haemolytic uraemic syndrome
ABVD doxorubicin, bleomycin, vinblastine, dacarbazine
ADAMTS13 a disintegrin and metalloproteinase with a thrombospondin type 1 motif, member 13
AIDS acquired immune deficiency syndrome
ALL acute lymphoblastic leukaemia
AML acute myeloid leukaemia
APTT activated partial thromboplastin time
ATLL adult T-cell leukaemia/lymphoma
BEACOPP bleomycin, etoposide, doxorubicin, cyclophosphamide, vincristine, procarbazine, prednisone
C complement
CD cluster of differentiation
CHOP cyclophosphamide, doxorubicin, vincristine, prednisolone
CLL chronic lymphocytic leukaemia
CT computed tomography
DNA deoxyribonucleic acid
DVT deep vein thrombosis
ESR erythrocyte sedimentation rate
G6PD glucose-6-phosphate dehydrogenase
HIT heparin-induced thrombocytopenia
HIV human immunodeficiency virus
HPLC high performance liquid chromatography
Ig immunoglobulin
INR international normalised ratio
LDH lactate dehydrogenase
MALT mucosa-associated lymphoid tissue
MRI magnetic resonance imaging
NK natural killer
NRBC nucleated red blood cells
PET positron emission tomography
PNH paroxysmal nocturnal haemoglobinuria
PT prothrombin time
R-CHOP rituximab + CHOP
RDW red cell distribution width
RiCoF ristocetin co-factor
RNA ribonucleic acid
SLE systemic lupus erythematosus
TdT terminal deoxynucleotidyl transferase
TTP thrombotic thrombocytopenic purpura
VWF von Willebrand factor
Section 1: Single Best Answers Questions 1–50

This section comprises 50 Single Best Answer (SBA) questions. They are divided into questions 1–31, which are more relevant to the part 1 MRCP examination and questions 32–50, which are more relevant to the part 2 MRCP examination. Although having a general medical slant, these questions are also appropriate for haematology specialist trainees. Normal ranges are given in parentheses. Answers and feedback will be found on pages 101–123.
A 69-year-old Afro-Caribbean woman is referred to rheumatology outpatients because of painful joints and morning stiffness. She is found to have a minor degree of lymphadenopathy and her spleen is tipped on inspiration. An FBC shows WBC $98 \times 10^9/l$, Hb 83 g/l, platelet count $221 \times 10^9/l$, neutrophils $7.2 \times 10^9/l$ and lymphocytes $91 \times 10^9/l$. Her blood film shows mature small lymphocytes with scanty cytoplasm, round nuclei and coarsely clumped chromatin. Smear cells are present. Rheumatoid factor is detected and her erythrocyte sedimentation rate (ESR) is 54 mm in 1 h (<20).

The most likely diagnosis is:

a. Adult T-cell leukaemia/lymphoma
b. Chronic lymphocytic leukaemia
c. Follicular lymphoma in leukaemic phase
d. Mantle cell lymphoma
e. Reactive lymphocytosis

A 69-year-old man who has received repeated courses of chemotherapy and chemo-immunotherapy for refractory mantle cell lymphoma presents with the gradual onset of cognitive impairment, dysphasia and dyspraxia. On lumbar puncture, pressure is normal, there is a slight increase in protein concentration, cell count is not increased and glucose is normal. Magnetic resonance imaging (MRI) of the brain shows multiple high intensity signals on T2-weighted and FLAIR sequences affecting mainly the white matter.

The most likely organism implicated is:

a. BK virus
b. Herpes simplex
c. JC virus
d. *Treponema pallidum*
e. Varicella-zoster virus
**SBA 3**

A 49-year-old woman is admitted to the intensive care ward with septic shock. Her FBC shows WBC $18 \times 10^9/l$, Hb 83 g/l, platelet count $150 \times 10^9/l$, neutrophils $17.2 \times 10^9/l$ and lymphocytes $0.5 \times 10^9/l$. Her blood film shows toxic granulation and left shift.

The appropriate haemoglobin threshold for blood transfusion in this patient would be:

- **a** 60 g/l
- **b** 70 g/l
- **c** 80 g/l
- **d** 90 g/l
- **e** 100 g/l

**SBA 4**

A 23-year-old woman is hospitalised with severe anorexia nervosa. Her FBC shows WBC $3.5 \times 10^9/l$, neutrophil count $1.1 \times 10^9/l$, Hb 100 g/l, MCV 104 fl and platelet count $70 \times 10^9/l$. Blood film shows occasional acanthocytes. Neutrophils show normal segmentation. Her prothrombin time (PT) is slightly increased.

The most likely diagnosis is:

- **a** Aplastic anaemia
- **b** Folic acid deficiency
- **c** Haematological features of anorexia nervosa
- **d** Hepatic steatosis
- **e** Vitamin $B_{12}$ deficiency
SBA 5
A 60-year-old Cypriot woman is referred back to rheumatology outpatients as she has suffered a flare of her rheumatoid arthritis. Her FBC shows WBC $12.0 \times 10^9$/l, RBC $3.62 \times 10^{12}$/l, Hb 83 g/l, Hct 0.27 l/l, MCV 74 fl, MCHC 310 g/l, platelet count $441 \times 10^9$/l and neutrophils $9.2 \times 10^9$/l. Her blood film shows increased rouleaux formation and the ESR is 65 mm in 1 h (<20). Serum ferritin is 47 μg/l (14–200), serum iron is 6 μmol/l (11–28) and total iron binding capacity 65 μmol/l (45–75).

The most likely explanation of the microcytic anaemia is:

a α thalassaemia trait
b Anaemia of chronic disease
c Anaemia of chronic disease plus iron deficiency
d β thalassaemia trait
e Iron deficiency

SBA 6
A 60-year-old Caucasian man presents with a history of fatigue, nausea, abdominal discomfort, altered bowel function, insomnia, anxiety and altered taste. He is a self-employed painter and decorator with a past history of a coronary artery bypass and is taking atorvastatin. His FBC shows WBC $7.8 \times 10^9$/l, Hb 105 g/l, Hct 0.30 l/l, MCV 79 fl, MCH 27.6 pg, MCHC 350 g/l, red cell distribution width (RDW) 15% (9.5–15.5), platelet count $403 \times 10^9$/l and reticulocyte count $120 \times 10^9$/l. His blood film shows anisocytosis, polychromasia, basophilic stippling and occasional nucleated red blood cells and myelocytes. A bone marrow aspirate shows dyserythropoiesis with abnormal sideroblasts including 3% ring sideroblasts.

The most likely diagnosis is:

a Lead poisoning
b Myelodysplastic syndrome (refractory anaemia)
c Myelodysplastic syndrome (refractory anaemia with ring sideroblasts)
d Pyrimidine 5’ nucleotidase deficiency
e Zinc deficiency
SECTION 1

**SBA 7**
A 57-year-old man with a history of hypercholesterolaemia, heart failure and atrial fibrillation is on warfarin with a satisfactory international normalised ratio (INR). He presents with the sudden onset of marked swelling of the left leg and thigh with pain in his foot and calf. Within a short period of time, the distal foot become purplish blue and cold with no palpable pulses in the leg.

The most likely diagnosis is:

a  Embolisation from the left atrium  
b  Femoral artery thrombosis  
c  Plegmasia alba dolens  
d  Plegmasia caerulea dolens  
e  Worsening heart failure

**SBA 8**
A 32-year-old woman with a history of irritable bowel syndrome is found to have iron deficiency anaemia and a serum folate of 1 μg/l (2–11). Her serum vitamin B₁₂ is normal. Her diet is assessed as nutritionally adequate, although she says she has to ‘watch what she eats’.

The test you would do next is:

a  Antibodies to deamidated gliadin peptide  
b  Antiendomysial antibodies  
c  Antiendomysial antibodies, making sure that the patient is first on a gluten-free diet  
d  Duodenal biopsy  
e  Ig (immunoglobulin) A anti-tissue transglutaminase antibodies
SBA 9
A 23-year-old African man who presents with an epileptiform convulsion and fever is found to have a microangiopathic haemolytic anaemia, thrombocytopenia and acute kidney injury.

The micro-organism you would test for is:

a Escherichia coli O104:H4
b Escherichia coli O157:H7
c Hepatitis B
d Human herpesvirus 8
e Human immunodeficiency virus

SBA 10
An 18-year-old medical student is permitted to perform an unsupervised venepuncture on a febrile Indian patient and suffers a needle prick injury. He is anxious that he may have contracted human immunodeficiency virus (HIV) infection.

Assuming that the patient is infected, transmission is most likely for:

a Dengue fever
b Hepatitis B
c Hepatitis C
d Human immunodeficiency virus (HIV)
e Leishmaniasis
SBA 11
A 39-year-old woman presents with haemoptysis and is found to have a pulmonary arteriovenous malformation. She is also noted to be pale and to have telangiectasia of the lips and tongue. There are no other abnormal physical findings. A full blood count shows WBC $7.2 \times 10^9/l$, RBC $3.10 \times 10^{12}/l$, Hb 70 g/l, Hct 0.23 l/l, MCV 75.6 fl, MCH 23.8 pg, MCHC 315 g/l and platelet count $221 \times 10^9/l$.

The most likely underlying diagnosis is:

a Acquired von Willebrand disease
b Advanced liver disease
c CREST variant of scleroderma (calcinosis, Raynaud phenomenon, oesophageal dysmotility, sclerodactyly, telangiectasia)
d Hereditary haemorrhagic telangiectasia
e Heyde syndrome

SBA 12
A 29-year-old man suffered a road traffic accident in West Africa and required a splenectomy. A few weeks after his return to the UK he presents with chills, fever, myalgia and vomiting. He is found to be hypotensive with no localising signs. His FBC shows WBC $18 \times 10^9/l$, Hb 177 g/l, platelet count $98 \times 10^9/l$, neutrophils $17.2 \times 10^9/l$ and lymphocytes $0.6 \times 10^9/l$. His blood film shows toxic granulation and left shift. No malaria parasites are seen on thick film examination. A coagulation screen shows a prolonged activated partial thromboplastin time (APTT) and increased D dimers.

The most likely cause of the fever is infection by:

a Capnocytophaga canimorsus
b Haemophilus influenza type b
c Neisseria meningitidis
d Plasmodium falciparum
e Streptococcus pneumonia
SBA 13

A 52-year-old man with poor prognosis acute myeloid leukaemia achieves a complete remission with daunorubicin and cytarabine. He then receives an allogeneic haemopoietic stem cell transplant from a matched unrelated donor after conditioning with busulphan and cyclophosphamide. He receives methotrexate and tacrolimus for graft-versus-host disease prophylaxis. A week after transplantation he complains of abdominal pain and is found to have a tender liver, weight gain, oedema and ascites. His bilirubin has risen to 35 μmol/l (<17) and alanine aminotransferase is twice the upper limit of normal. Creatinine has risen to 132 μmol/l (60–125).

The most likely diagnosis is:

a Graft-versus-host disease
b Hepatorenal syndrome
c Inferior vena cava thrombosis
d Methotrexate toxicity
e Sinusoidal obstruction syndrome

SBA 14

A 30-year-old woman is referred to medical outpatients with suspected hypothyroidism. On reviewing her clinical history it is found that she was treated abroad for Hodgkin lymphoma at the age of 16 years with mantle radiotherapy and combination chemotherapy (doxorubicin, bleomycin, vinblastine and dacarbazine).

The long term morbidity of the treatment administered to this patient includes a significantly increased rate of:

a Acute lymphoblastic and acute myeloid leukaemia
b Acute myeloid leukaemia, breast cancer, hypothyroidism and coronary artery disease
c Bladder cancer
d Breast and ovarian cancer
e Hypothyroidism
SBA 15
A 29-year-old Caucasian woman who is seen in outpatients for review of the management of her coeliac disease mentions that she has been trying to get pregnant for some time. She has previously been deficient in both folic acid and iron but her blood count is now normal.

You advise her that when trying to get pregnant:

a. She does not need any dietary supplements
b. She should take supplementary ferrous sulphate
c. She should take supplementary folic acid
d. She should take supplementary pyridoxine
e. She should take supplementary vitamin B₁₂

SBA 16
A 43-year-old woman presents with sudden onset of blurred vision in both eyes. She is tired and has suffered from recurrent aphthous ulcers. Ophthalmological examination shows multiple bilateral retinal haemorrhages without exudates; optic discs appeared normal. Visual acuity is reduced. FBC shows Hb 48 g/l, MCV 119 fl, WBC 6.1 × 10⁹/l and platelet count 86 × 10⁹/l. The blood film showed macrocytes, oval macrocytes and hypersegmented neutrophils.

The most likely cause of the retinal haemorrhages is:

a. Anaemia
b. Impaired platelet function
c. Raised intracranial pressure
d. Malignant hypertension
e. Thrombocytopenia