

ANAEMIA

Year Two

Anaemia is NOT a lack of blood, but a lack of haemoglobin.

Anaemia is a level of haemoglobin below 130 g/L in males and 120 g/L in females and children.

It is vital to determine the cause of any anaemia.

SYMPTOMS - HISTORY

Symptoms are often minimal until anaemia is well advanced.

COMMON

Tiredness
Weakness
Headache
Malaise

UNCOMMON

Paraesthesiae (pins and needles sensation) in periphery
Palpitations
Fever
Vertigo
Dyspnoea from congestive cardiac failure
Jaundice

Skin and eye colour are poor guides to the severity of anaemia.

QUESTIONING

Heavy periods?
Rectal bleeding?
Melaena?
Abdominal pain?
Unusual diet? (lack of iron or greens, vegetarian)

RISK FACTORS

Family history of pernicious anaemia
Vegetarian (iron deficiency)
Unusual diet.
Chemical exposure (eg. lead)
Naturopathic remedies (eg. black cohosh - may contain toxins).

SIGNS - EXAMINATION

In alphabetical order (not order of importance, which varies depending on type).

See below for explanation of signs.

Bounding pulse
Diastolic murmur
Hepatomegaly
Hypotension
Koilonychia – spooning of nails (iron deficiency)
Red painful tongue (pernicious)

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Retinal haemorrhages (pernicious and aplastic)
Splenomegaly (haemolytic)
Systolic murmur (severe)
Water-hammer pulse (severe)

INVESTIGATIONS - PATHOLOGY, RADIOLOGY ETC.

Blood tests

(expected result in anaemia in brackets – L = low, H = high, AB = abnormal, N = normal)

Haemoglobin - Hb (L)
Red blood cell or erythrocyte count - RBC (L or hypochromic or AB)
Mean corpuscular volume - MCV (L - microcytic anaemias, H - macrocytic anaemias)
Mean corpuscular haemoglobin concentration - MCHC (L or N)
Mean corpuscular haemoglobin - MCH (L - hypochromic, H - macrocytic)
Packed cell volume – PCV (L or N)
Vitamin B12 (L in pernicious anaemia, N in other types)
White cell count - WCC (N or AB)
Platelets (N or AB)
Heinz bodies (+ or –)

Other tests

Bone marrow biopsy

POSSIBLE CAUSES

Iron deficiency – blood loss, dietary lack
Folate deficiency
Pernicious anaemia (B12 deficit)
Marrow failure
Red blood cell haemolysis (haemolytic anaemia)
Chronic disease (eg. chronic infection, neoplasia, renal failure)
Hepatic disease (eg. excess destruction of erythrocytes)
Idiopathic

TYPES OF ANAEMIA

Acute Haemolytic Anaemia

Test: Hb (L), RBC (normocytic, normochromic), RCC (L), WCC (VH), platelets (H), B.reticulocytes (H), marrow biopsy (hyperplastic), U.Hb (+), U.urobilinogen (+), S.G6PD (L), HbS (+ or -)

Phys: Induced by drugs, infection, cancer, malaria or unknown causes

Aplastic Anaemia

Test: Hb (L), RCC (L), B.reticulocytes (L), WCC (L), platelets (L), S.bilirubin (L), bone marrow biopsy (fatty)

Phys: Aetiology often unknown, but may be due to drugs, toxins or radiation. Depression of blood cell production occurs

Iron Deficiency Anaemia

Test: Hb (L), RCC (L or N, microcytic, hypochromic), B.reticulocytes (H), platelets (H or N), WCC (N), S.iron (L), iron binding capacity (H), marrow stain for haemosiderin (-), S. ferritin (L)

Sign: Brittle nails, onycholysis

Phys: Due to blood loss, pregnancy, haemosiderosis or malnutrition

Megaloblastic Anaemia

Test: Hb (L), WCC (AB), MCV (VH), S.folic acid (L or N), S.vit. B12 (L or N).

Phys: May be due to folic acid or vitamin B12 deficiency.

Pernicious Anaemia

Test: S.vit. B12 (L), B.intrinsic factor autoantibodies (+), S.parietal cell antibodies (+), S. gastrin (H), Hb (L), WCC (L), MCV (H), platelets (L), bone marrow biopsy (megaloblastic), S.folic acid (L or N), S.bilirubin (N or H), S.LDH (H), LFT (AB), gastric pH (H)

Phys: Pernicious anaemia is one cause of megaloblastic anaemia. Due to lack of intrinsic factor in the stomach and subsequent failure of vit. B12 absorption. If vitamin B12 low, but intrinsic factor, parietal cell antibodies and gastrin normal, unlikely to be pernicious anemia.

+ = positive, - = negative, N = normal, AB = abnormal, H = high, VH = very high, L = low

TREATMENT of ANAEMIA

Blood transfusion in emergency, then cause must be identified.

Aplastic Anaemia

1. Prevent and treat infection by isolation, scrupulous nursing and aggressive antibiotic therapy
2. Androgens in high doses, eg. oxymetholone, methandienone
3. Prednisolone
OR methylprednisone reducing over a month (experimental).
4. Transfusion of appropriate cells.
5. Antilymphocytic globulin and bone marrow transplantation in specialist centres.
Mortality 50% in 6 months, 80% in 2 years; most survivors can live normal, but often shortened, lives.

Haemolytic Anaemias, Idiopathic

1. Transfusion of carefully matched blood if acute.
2. Prednisone for 2-4 weeks.
3. Exclude any treatable cause, eg. leukaemia, lymphoma, drugs, diabetes.
4. Splenectomy.
5. Immunosuppressive drugs, eg. 6-mercaptopurine, azathioprine.
Prognosis depends on cause; significant mortality.

Iron Deficiency Anaemia

1. Determine and correct cause of iron deficit, eg. poor diet, gut bleed, pregnancy, menorrhagia.
2. Ferrous gluconate or sulfate orally OR parenteral iron IMI.
3. Folic acid.
4. Blood transfusion if acute.
Prognosis depends on cause.

Megaloblastic Anaemias

Pernicious anaemia

Vitamin B12/hydroxycobalamin IMI twice weekly initially, then every 1-3 months.

Folic acid deficiency

Folic acid after B12 levels stable.

Diuretics and digitalis for cardiac failure.

Very good prognosis. Symptomatic recovery in 2-3 days, haematological recovery in 4-6 weeks.

Long term therapy required.

ADDITIONAL INFORMATION

SIGNS

Exp. = explanation Int. = Interpretation Phys. = physiology. + = sign present

Bounding Pulse

Exp: Full, exaggerated arterial pulsation

Int: (+) Thyrotoxicosis, fever, pregnancy, anaemia, other hyperkinetic circulatory states, drugs (eg. adrenaline)

Phys: Vasodilatation and increased cardiac output exaggerates peripheral pulsations

Koilonychia

Exp: Spooning of nails

Int: (+) Iron deficiency anaemias, Plummer-Vinson syn.

Retinal Haemorrhages

Exp: Red spots and patches adjacent to blood vessels are noted on ophthalmoscopic examination of the retina. Various types described as punctate, splinter and flame

Int: (+) Pernicious anaemia, leukaemia, aplastic anaemia, hypertension, diabetes mellitus, bacterial endocarditis, anticoagulants, haemorrhagic disease

Phys: Damaged retinal capillaries

Water-Hammer Pulse

(Collapsing Pulse)

Exp: With patient's hand raised as high as possible above head, a pulse is felt that appears to hammer at the examiner's fingers and then suddenly collapse

Int: (+) Aortic incompetence, arteriovenous fistula (eg. patent ductus arteriosus), severe anaemia, ventricular septal defect, complete heart block, fever, thyrotoxicosis, vasodilatory drugs

Phys: Low diastolic pressure and subsequent flaccidity of arterial walls

INVESTIGATIONS

RI = reference index (normal range). Ind. = Indication for test Int. = Interpretation Phys. = physiology.

Haemoglobin, Blood [Hb]

RI: Male 130 - 170 g/L (13 - 17 g/dL)

Female 120 - 155 g/L (12 - 15.5 g/dL)

Neonate 170 - 220 g/L (17 - 22 g/dL)

Infant 110 - 125 g/L (11 - 12.5 g/dL)

Child 120 - 140 g/L (12 - 14 g/dL)

Pregnancy 110 - 150 g/L (11 - 15 g/dL)

Int: LOW - Acute or chronic blood loss, deficient RBC production (iron, copper, cobalt, vit. B12 or folic acid deficiencies), bone marrow failure (aplastic or sideroblastic anaemia, myelofibrosis), excess RBC destruction, thalassaemia, sickle cell anaemia, chronic disease (cancer, arthritis), renal disease, liver disease, coeliac disease, many types of carcinoma, rheumatoid arthritis, myxoedema, protozoal infections, autoimmune diseases, pregnancy, analgesic nephropathy, elite athletes

HIGH - Haemosiderosis, polycythaemia rubra vera, haemochromatosis, smoking, diuretics

FALSE HIGH - Hyperlipoproteinaemia, hyperbilirubinaemia, very high WCC

Phys: The Hb in RBC is essential for the transport of oxygen to the tissues. Measured by photometry

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Erythrocyte Count, Blood

(Red Blood Cell Count) [RBC] [RCC]

RI: Male 4.5 - 6.0 x 10¹²/L
Female 3.8 - 4.9 x 10¹²/L

Ind: Haematological disorders

Int: **Abnormal number**

HIGH - Polycythaemia rubra vera, thalassaemia trait, renal disease (eg. tumours, cysts, transplant), dehydration, hypoxia, high altitudes, congenital heart disease, some lung diseases, hepatoma, Cushing syn., Gaisböck syn., idiopathic, smoking, diuretic therapy

LOW - Haemolytic anaemia, malignancy, chronic disease, aplastic anaemia, dilution by IV fluids, pregnancy

Abnormal forms

Spherocytes - Hereditary, immune haemolytic anaemia (Coombs' test?), severe burns, *Clostridium welchii* septicaemia

Elliptocytes - Hereditary, iron deficiency anaemia (Fe?)

Sickle cells - Sickle cell disease

Spur cells - Severe hepatic disease

Target cells - Liver disease

Burr cells - Renal disease

Fragmented RBC - Disseminated intravascular coagulation, renal disease, Bassen-Kornzweig syn.

Phys: RBC carry Hb. Reticulocytes are the immature form

Mean Corpuscular Haemoglobin [MCH]

RI: Adult: 27 - 31 pg
Child: 24 - 30 pg
Neonate: 24 - 34 pg

Ind: Anaemia

Int: LOW - Iron deficiency (Fe?), chronic blood loss, sprue, achlorhydria, pregnancy, thalassaemia, sideroblastic anaemia, megaloblastic anaemia

HIGH - Pernicious anaemia (vit.B12?), folic acid deficiency, starvation, reticulocytosis (FBC?), hypothyroidism, aplastic anaemia

Phys: Useful to determine type of anaemia MCH = Hb / RBC

Mean Corpuscular Haemoglobin Concentration [MCHC]

RI: 315 - 345 g/L (31 - 34%) (18.6 - 21.2 mmol/L)

Int: LOW - Iron deficiency (Fe?), blood loss, pregnancy, thalassaemia, anaemias of chronic disease, sideroblastic anaemia

NORMAL - Other anaemias

Phys: In iron deficiency, there is less Hb in each RBC

MCHC = Hb / PCV

Mean Corpuscular Volume [MCV]

RI: Adult 82 - 101 fL (82 - 101 cubic microns)
Child 73 - 89 fL (73 - 89 cubic microns)
Neonate 85 - 106 fL (85 - 106 cubic microns)

Ind: Anaemia

Int: V.LOW - Iron deficiency (Fe, MCHC?), chronic blood loss, pregnancy, chronic disease (eg. rheumatoid arthritis)

LOW (microcytosis) - Acute blood loss, haemolytic anaemia, bone marrow neoplasia, sideroblastic anaemia, thalassaemia trait, elderly

HIGH (macrocytosis) - Pernicious anaemia (vit. B12), alcoholism, folic acid deficiency, sprue, starvation, reticulocytosis, aplastic anaemia, hypothyroidism, liver disease, hyperlipidaemia, scurvy, sideroblastic anaemia, leukaemia, megaloblastic anaemia, chronic respiratory failure, myelomatosis, cytotoxic drugs

Phys: Useful to determine type of anaemia

MCV = PCV / RBC

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Heinz Bodies, Blood

RI: Absent

Int: PRESENT - Intravascular haemolysis, post-splenectomy, G-6-PD deficiency, haemoglobinopathies, drug or chemical exposure

Phys: Heinz bodies created by oxidation of Hb. Seen by microscopy as red cell inclusions

Packed Cell Volume [PCV]

(Haematocrit)

RI: Adult male 40-50%

Adult female 36-47%

Child 32-42%

Ind: Haematological disorders

Int: HIGH - Polycythaemia rubra vera, dehydration

LOW - Anaemia (Hb, FBC?), pregnancy

Phys: A blood specimen is centrifuged and the percentage of packed cells to plasma in the tube is measured

Platelet Count, Blood

RI: 150-450 x 10⁹/L (150,000-450,000/mm³)

Ind: Bleeding disorders

Int: HIGH (**thrombocytosis**) - Myelofibrosis, chronic leukaemia, polycythaemia rubra vera, essential thrombocythaemia, infection, trauma, post-splenectomy, strenuous exercise, labour of childbirth, familial

LOW NUMBER, NORMAL TYPE (**thrombocytopenia**) - Marrow suppression or infiltration, carcinoma, myeloma, cytotoxic drugs, infections, megaloblastic anaemia, SLE, acute leukaemia, disseminated intravascular coagulation, haemolytic-uraemic syn., massive transfusion, autoimmune diseases, hypersplenism, rheumatoid arthritis, Fanconi syn., HELLP syn., sticky platelet syn., Wiskott-Aldrich syn., alcohol, viral or bacterial infections (eg. rubella, infectious mononucleosis), idiopathic, congenital, post-transfusion, drugs (eg. quinidine, quinine, heparin, aurothiomalate, NSAIDs)

NORMAL NUMBER, ABNORMAL TYPE (**thromboasthenia**) - Glanzmann's disease

LOW NUMBER, ABNORMAL TYPE - May-Hegglin anomaly

Phys: Platelets are essential for blood clotting

Vitamin B12, Serum

(Cyanocobalamin)

RI: 150-660 pmol/L (200-900 ng/mL)

Ind: Megaloblastic anaemia

Int: LOW - Pernicious anaemia (Hb?), gastrectomy, intestinal blind loops, Crohn's disease, sprue, chronic pancreatitis, subacute combined degeneration of the cord, congenital, vegan diet. False low due to folate deficiency, late pregnancy, oral contraceptives, multiple myeloma, megadose vitamin C therapy
HIGH - Hepatic disease. False high due to chronic leukaemia, polycythaemia rubra vera, metastatic malignancy

Phys: Vit. B12 is required for the formation of erythrocytes. Intrinsic factor of stomach required for its absorption from the gut

ANAEMIA

CURIOSITY

LEAD POISONING

*Lead (Pb) has been widely used in industry including batteries, paints (particularly dangerous in flaking old paint), crystal glass, ceramics, old plumbing fixtures, leaded petrol and some old-fashioned medications. Swallowing or inhaling lead compounds may lead to lead poisoning (plumbism) which causes belly pains, irritability, tiredness, loss of appetite, **anaemia**, poor coordination, slurred speech, convulsions, coma and death. Permanent damage to nerves (neuropathy) and kidneys is possible in survivors.*

TOTALLY, COMPLETELY AND UTTERLY USELESS MEDICAL INFORMATION

An abnormal fear of blood is called haematophobia.

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