BOND UNIVERSITY
BRINGING AMBITION TO LIFE

LECTURE NOTES

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STUDENT NOTES

for the

LECTURES

given by

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CONTENTS

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 (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)
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 haemglobin 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

Erythrocyte Count, Blood

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

RI: Male 4.5 - 6.0 x 10^{12}/L
Female 3.8 - 4.9 x 10^{12}/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

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

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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www.medwords.com.au

BELL'S PALSY

The facial nerve is a mixed motor and sensory nerve supplying the muscles of the face below the eyebrows, sensation to the tongue, and controls tear and saliva secretion. It is the seventh cranial nerve, arising directly from the brain. It comes out of a hole in the skull just below and in front of the ear. Damage to the nerve (eg. Bell's palsy) causes paralysis of the face.

Inflammation of the facial nerve at the point where it leaves the skull causes the facial muscles to stop working. The exact reason for this inflammation is unknown, but there is some evidence that a Herpes Simplex infection of the nerve may be a trigger.

Patients with Bell's palsy (idiopathic facial paralysis) experience a sudden paralysis of the facial muscles on one side only. They can no longer smile or close the eye properly. There may be some mild to moderate pain at the point where the nerve leaves the skull beside the ear, but this settles after a few days. There may also be a disturbance to taste sensation.

Theoretically, no treatment is necessary for most patients, but in practice, particularly if the patient is elderly, if the paralysis is total, or if there is severe pain, treatment with high doses of prednisone (a steroid) may be tried, provided it is started within five days of onset. Also, because the palsy may be caused by a Herpes infection, many doctors also prescribe aciclovir, again provided it is within a few days of the onset of symptoms, but this medication is expensive and not subsidised by the PBS for this indication.

10% of patients are significantly affected long term by facial paralysis, but two thirds of patients recover completely within a few weeks with no treatment. Most of the others obtain almost complete recovery.

Possible causes of Facial Weakness

Bell's palsy (unilateral, temporary)
Cerebrovascular disease (other neurological defects common)
Cerebral neoplasm
Multiple sclerosis
Motor neurone disease (bilateral)
Parkinson's disease (tremor, gait abnormal)
Parotid tumours (unilateral)
Cholesteatoma (ear discharge, ear pain)
Brain stem encephalitis
Sarcoidosis
Poliomyelitis
Herpes zoster infection (vesicular rash, pain)
Mumps
Other serious viral infections
Tetanus (pain, paralysis)
Lyme disease
Brucellosis
Other serious bacterial infections

Myasthenia gravis
Guillain-Barré syn.
Muscular dystrophies
Trauma
Emotional and psychogenic

CURIOSITY

Bell's palsy is named after the Scottish surgeon, Charles Bell (1774 to 1842).

TOTALLY, COMPLETELY AND UTTERLY USELESS MEDICAL INFORMATION

CROCODILE TEARS SYNDROME

The crocodile tears syndrome is a complication of Bell's palsy. It is possibly due to regenerating nerves that normally control salivary glands being misdirected to the tear gland during recovery from Bell's palsy. The only symptom is tears pour from the affected eye when eating. Surgically cutting the responsible abnormal nerve fibre gives good relief.

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BLEEDING DIATHESES

Year 2

A diathesis is an inherited tendency towards a specific condition.

There are some people who are born with defects in the chemical pathways that cause blood to clot, or who develop a lack of one of the essential elements for clotting, and become bleeders. Instead of stopping within a few minutes of an injury, bleeding may persist for hours, and the slightest injury may cause massive bruises, or bleeding into joints that leads to arthritis.

The serious bleeding diatheses are X-linked and occur only in males

SYMPTOMS - HISTORY

Those with a bleeding diathesis may :-

- bruise easily
- develop petechiae or purpura
- bleed for a prolonged time when cut
- develop painful joints
- become fatigued due to anaemia
- bleed into the intestine (melaena), lungs (haemoptysis) or genitourinary tract (haematuria).
- have excessively prolonged and heavy menstrual periods

RISK FACTORS

In virtually all cases of inherited bleeding abnormalities, both parents must be carriers in order for a person to be affected.

Any interference with the complex clotting factors and the involved factors and cells may lead to excessive bruising and bleeding.

SIGNS - EXAMINATION

PETECHIAE

Petechiae are tiny flat red spots that are scattered across the skin. They are caused by bleeding from capillaries in the skin, which occurs in diseases such as generalised viral infections, bleeding disorders (eg. thrombocytopenia), meningococcal infections, capillaritis and advanced typhoid fever.

PURPURA

Purpura are small red or dark blue marks made in the skin by abnormal bleeding from capillaries. The most common cause is a low level of platelets in the blood (thrombocytopenia).

HESS TEST

A sphygmomanometer cuff inflated to 80 mmHg (10.6 kPa) around the upper arm for five minutes causes purpuric spots to appear below the cuff when the patient suffers from diseases associated with purpura (eg. thrombocytopenia, diseases of vascular endothelium, thromboasthenia, uraemia). Tests the resistance of capillaries to increased venous pressure. Obsolete test that should not be performed if more sophisticated tests for vascular disease available

INVESTIGATIONS - PATHOLOGY

RI = Reference interval (normal result) Int = Interpretation Phys = physiology

Screening tests include :-

Bleeding Time

RI: 1 - 7 minutes
Int: HIGH - Drugs (eg. aspirin, NSAIDs), thrombocytopenia, thromboasthenia (platelets?), haemophilia, Christmas disease, von Willebrand's disease, Bernard-Soulier syn., Glanzmann syn.
Phys: Normal with anticoagulant therapy (eg. heparin, warfarin). Measures platelet function.

Platelet Count, Blood

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

Fibrinogen, Blood (Factor 1)

RI: 2 - 6 g/L
Int: LOW - Defibrination syn., Waterhouse-Friderichsen syn., endotoxic shock, abruptio placentae, intrauterine fetal death, amniotic fluid embolism, disseminated intravascular coagulation
HIGH - Nephrotic syn., Hodgkin's disease, pemphigus, pulmonary embolism, pregnancy
Phys: Fibrinogen is involved in the first stage of the blood clotting cycle

Full Blood Count [FBC]

(Complete Blood Examination [CBE]; Full Blood Examination [FBE])

This includes the following investigations: Haemoglobin; White Cell Count; mean corpuscular volume (MCV); mean corpuscular haemoglobin (MCH); mean corpuscular haemoglobin concentration (MCHC); Haematocrit; Platelet Count; Red Cell Count

Activated Partial Thromboplastin Time, Plasma [APTT]

RI: Adult : 28 to 38 seconds
11-16 years : 31 to 44 seconds
6-10 years : 30 to 46 seconds
1-5 years : 29 to 45 seconds
<1 year : 26 to50 seconds
Int: HIGH - Heparin therapy, coagulopathy requiring further investigation

Phys: Nonspecific test measuring numerous factors except numbers VII and XIII

Prothrombin Time [PT]

RI: 12-16 seconds
Therapeutic range 20-30 seconds on anticoagulant
Int: LONG - Lack of fibrinogen, prothrombin, factors V, X, or VII.
Liver disease, anticoagulant therapy, vit. K deficit
Phys: Tissue factor (brain extract), calcium chloride, and test plasma are incubated and compared to a control. The time for clotting is noted

Thrombin Clotting Time, Plasma

RI: 10-15 seconds
Int: HIGH - Low fibrinogen levels, heparin therapy

Further detailed investigations may include :-

Factor VIII, Blood

RI: Very wide variation in normal levels. Assay of the molecular components of factor VIII (a and c) may give a more accurate diagnosis, but interpretation is difficult and false positives and negatives occur. Consult with haematologist
Int: LOW - Haemophilia, von Willebrand's disease. Diagnosis of these diseases and the carrier state may be determined with careful analysis. Increased in pregnancy.

von Willebrand Factor, Plasma (vWf)

(Ristocetin Cofactor; Collagen Binding Assay, von Willebrand Factor)
RI: Variable
Ind: von Willebrand's disease
Int: LOW - von Willebrand's disease
Phys: ELISA test, measuring qualitative and quantitative abnormalities of von Willebrand factor. Subtypes of disease can be identified by variables within test

Vitamin K, Serum

(Phytomenadione)
RI: Refer to laboratory
Int: LOW - Malabsorption, cholestasis, small bowel diseases, haemorrhagic disease of newborn, dietary insufficiency, long term antibiotics
Phys: Lack of vitamin K causes excessive bleeding and bruising.

POSSIBLE CAUSES OF ABNORMAL EXCESSIVE BLEEDING

BLEEDING DIATHESES

Haemophilia A (factor VIII deficiency)
Haemophilia C (factor XI deficiency)
Christmas disease (factor IX deficiency)
von Willebrand's disease
Other blood factor deficiencies
Bernard-Soulier syndrome (inherited platelet defect)

OTHER CAUSES

AIDS (splenomegaly, fever, cachexia)

Aplastic anaemia (lassitude, pallor, purpura)
Bacterial endocarditis (heart murmur, fever)
Bone marrow suppression (may be iatrogenic)
Cushing syndrome (moon face, obese, amenorrhoea)
Defibrination syndrome
Disseminated intravascular coagulation (rare, secondary to severe disease, clotting occurs within normal arteries and veins in one area of the body to deplete platelets and clotting factors)
Following massive blood transfusions
Glanzmann syndrome (mucocutaneous bleeding)
Henoch-Schoenlein syndrome (abdominal pain, excess bleeding)
Hepatic failure
Idiopathic thrombocytopenia (bruising, purpura)
Insect and snake bite
Ionising radiation (eg. X-rays, gamma rays)
Leukaemia, acute (abnormal white cell count, malaise, arthralgia, fever)
Meningococcal meningitis (fever, headache, vomiting)
Meningococcal septicaemia
Polycythaemia (rubra) vera
Renal failure
Scurvy (inflamed and bleeding gums)
Subacute bacterial endocarditis
Typhus (fever, malaise)
Vitamin K deficit
Waterhouse-Friderichsen syn. (petechiae, pallor)
Drugs (eg. warfarin, heparin, aspirin, steroids, arsenic, quinine, chlorothiazide)

DISEASE EXPLANATIONS

HAEMOPHILIA A

Haemophilia A is an inherited lack of factor VIII, one of the essential factors responsible for the clotting of blood. The gene for the disease is carried by women on the X chromosome, but can only affect men.

These people have excessive bleeding from a cut, severe bruising from a minor injury, bleeding into joints to cause arthritis, internal bleeding into the gut and other organs. The excessive bleeding may result in arthritis, infertility, damage to other organs from bleeding, chronic weakness, and a shorter than normal life span. Specific blood tests can confirm the diagnosis.

Injections of the missing coagulation factor must be given to prevent excessive bleeding when it occurs. Insufficient is available to be given regularly to prevent bleeding at present, but genetic technologies are likely to change this in the near future. The factor is obtained from blood donations at present. Recombinant factor VIII is available also, but in the future may be obtained from genetically modified pig milk. There is also some evidence that the use of the medicine desmopressin (which is normally used to treat bed wetting and diabetes insipidus) can increase the level of circulating factor VIII, but the mechanism for this is unknown.

The severity may vary from one patient to another and no permanent cure available. Statistically, half the children of a woman who carries the responsible gene will have the disease, but the overall incidence is only 1 in 10,000, which means there are about 1000 men in Australia with the condition.

CHRISTMAS DISEASE

Christmas disease (factor IX deficit or haemophilia B) is named after the patient Stephen Christmas, who was a child with the disease. It is an inherited lack of factor IX, one of the essential factors responsible for the clotting of blood. The gene for the disease is carried by women on the X chromosome, but can only affect men (sex linked inheritance). Statistically, half the children of a woman who carries the responsible gene will have the disease. The incidence is one in 40,000 people.

Symptoms include excessive bleeding from a cut, severe bruising from a minor injury, bleeding into joints to cause arthritis, internal bleeding into the gut and other organs. Specific blood tests can confirm the diagnosis.

Injections of the missing coagulation factor are given to prevent excessive bleeding when it occurs. Insufficient supplies are available for it to be given regularly to prevent bleeding, as the factor can only be obtained from blood donations.

Arthritis, infertility, damage to other organs from bleeding, chronic weakness, and a shorter than normal life span may occur.

HAEMOPHILIA C

Haemophilia C (Rosenthal syndrome) is an inherited form of haemophilia caused by a lack of factor XI, and found mainly in Ashkenazi Jews. It causes a minor degree of abnormal bleeding and bruising, heavy menstrual bleeding and excessive bleeding with surgical procedures and childbirth. It is not life threatening or nearly as severe as haemophilia A, and life expectancy is relatively normal.

von WILLEBRAND DISEASE

Von Willebrand disease (vascular haemophilia) is an autosomal dominant inherited cause of prolonged bleeding that may be detected in as many as one in every one hundred people, but only one in every thousand people has significant symptoms. It affects both sexes. Patients lack the von Willebrand factor, a protein that mediates platelet adhesion.

There are six different types of the disease that vary in their severity depending on the level of vWF and factor VIII. Interestingly, it is less common in people with blood type O.

Most cases are mild, and patients experience nose bleeds, heavy periods, bleeding gums and bleeding into the gut. Excessive bleeding also occurs with any cut or surgery, bleeding into joints may cause premature arthritis, and the condition is dramatically worsened by aspirin. The diagnosis is confirmed by appropriate blood tests (eg. bleeding time, von Willebrand factor).

No treatment is required in the majority of patients, but aspirin and NSAID (arthritis drugs) must be avoided. Iron supplements may be necessary for those who bleed regularly, and contact sports are not the best form of recreation. An injection of a blood extract that contains the missing factors is given before surgery and to those who experience excessive bleeding from a severe case of the disease. The long-term prognosis is excellent.

BERNARD-SOULIER SYNDROME

The Bernard-Soulier syndrome is an inherited defect of platelets (blood cells essential for clotting), which fail to stick together to form a clot. Excessive bleeding occurs, particularly from mouth and nose. Bruises and red spots and patches under skin, particularly on feet. The condition is aggravated by aspirin.

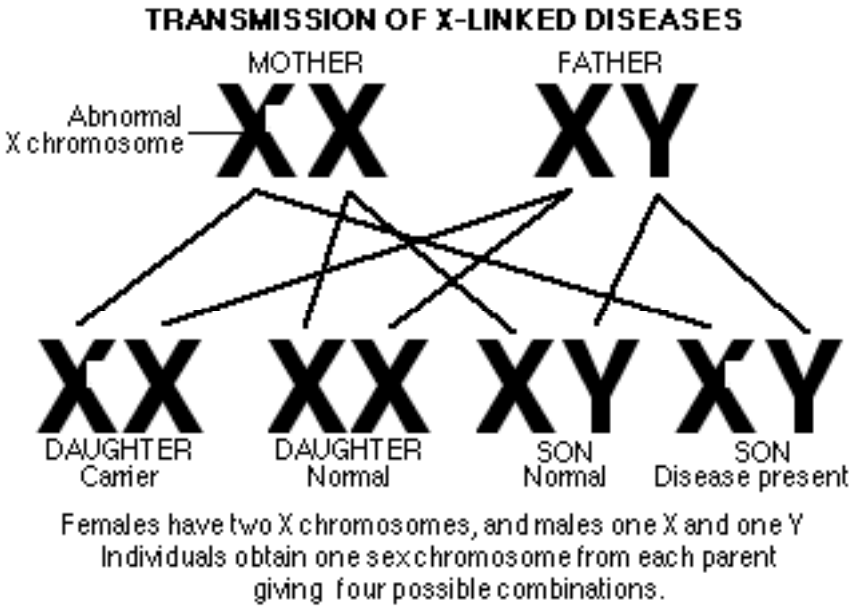
Blood tests on platelet function and bleeding time are diagnostic.

Blood transfusions on a regular basis are the only treatment for this lifelong defect that may cause significant disability.

ADDITIONAL INFORMATION

X-LINKED CONDITION

Women have two X chromosomes, while men have one X chromosome and a much smaller Y chromosome. If one X chromosome is defective, in women the other X chromosome can compensate. In males this compensation cannot occur, so there are a number of X-linked inherited conditions that only affect males. Statistically one half of sons will have the disease and one half of daughters will be carriers.



FACTOR

The factors within blood are any one of the 13 substances that allows the process of blood clotting to occur. They include:-

- Factor I - fibrinogen
- Factor II - prothrombin
- Factor III - thromboplastin
- Factor IV - the calcium used in blood clot formation
- Factor V - converts prothrombin to thrombin
- Factor VI - an as yet unidentified but essential component in the clotting process
- Factor VII - proconvertin
- Factor VIII - a compound factor made from two components. The lack of one causes von Willebrand disease, while a lack of the other is responsible for haemophilia A
- Factor IX - a deficiency causes Christmas disease (haemophilia B).
- Factor X - thrombokinase or the Stuart-Prower factor.
- Factor XI - a deficiency causes haemophilia C
- Factor XII - activation factor or Hageman factor
- Factor XIII - fibrinase.

CURIOSITY

SCURVY

Scurvy was the scourge of sailors on long voyages over two centuries ago, when fresh food supplies could not be relied upon. The cause is a lack of ascorbic acid (vitamin C) in the diet, and it may occur in people on unusual fad diets or in malnourished alcoholics. Captain James Cook made a name for himself early in his career by insisting that all his crew had rations of lime juice (which contains high levels of vitamin C) every day.

In early stages patients develop vague tiredness and weakness. As the vitamin deficiency becomes more severe, ***bleeding*** *into the skin, rashes,* ***bleeding*** *gums, joint pain and* ***bleeding*** *into joints, slow wound healing and tender bones are experienced. The patient becomes severely anaemic, and* ***bleeds*** *readily. In advanced cases the kidneys fail, the body swells,* ***bleeding*** *occurs in the brain, and death follows..*

TOTALLY, COMPLETELY AND UTTERLY USELESS INFORMATION

The application of a quantity of cobweb may be resorted to in stopping the bleeding of obstinate cuts.

Assoc. Prof. Warwick Carter

CHILDHOOD DISEASES AND VACCINATIONS

Year One

Parents who refuse to vaccinate their children are inflicting a form of child abuse. They are saying that their opinion is better informed than that of virtually all doctors, university researchers, local councils, state governments, national governments and the World Health Organisation.

In 1956 I can remember as a child queuing for hours at the Hobart Town Hall to receive a polio vaccine as the last polio epidemic to rage across Australia occurred in that year.

THE ONLY DISEASE TO BE EVER ERADICATED BY VACCINATION IS SMALLPOX.
Measles and polio are on the verge of eradication.

March 2008
AUSTRALIAN CHILDHOOD VACCINATION SCHEDULE

Age	Disease Immunised Against (Abbreviation) [Trade name of vaccine]
Birth	Hepatitis B
2 months	Hepatitis B, Haemophilis Influenzae type B (Hib), Tetanus, Diphtheria, Pertussis, Polio **[Infanrix Hexa]** Pneumococcal (Strep. Pneumoniae) (7vPCV) [**Prevenar**] Rotavirus (oral) [**Rotateq**]
4 months	Hepatitis B, Haemophilis Influenzae type B (Hib), Tetanus, Diphtheria, Pertussis, Polio **[Infanrix Hexa]** Pneumococcal (Strep. Pneumoniae) (7vPCV) [**Prevenar**] Rotavirus (oral) [**Rotateq**]
6 months	Hepatitis B, Haemophilis Influenzae type B (Hib), Tetanus, Diphtheria, Pertussis, Polio **[Infanrix Hexa]** Pneumococcal (Strep. Pneumoniae) (7vPCV) [**Prevenar**] Rotavirus (oral) [**Rotateq**]
12 months	Hepatitis B, Haemophilis Influenzae type B (Hib) [**Comvax**] Measles, Mumps, Rubella (MMR) [**Priorix**] Meningococcal C (MenCCV) [**Meningitec**] Pneumococcal (7vPCV) [**Prevenar**] (Aboriginal and Torres Strait Islander children only)
18 months	Chickenpox (VZV) [**Varilrix**] Hepatitis A [**Vaqta**] (Aboriginal and Torres Strait Islander children only)
2 years	Pneumococcal [**Pneumovax 23**] (Aboriginal and Torres Strait Islander children only) Hepatitis A [**Vaqta**] (Aboriginal and Torres Strait Islander children only)
4 years	Diphtheria, Tetanus, Pertussis, Polio [**Infanrix IPV**] Measles, Mumps, Rubella (MMR) [**Priorix**]

THIS SCHEDULE CHANGES REGULARLY AS NEW AND MODIFIED VACCINES ARE INTRODUCED
DIFFERENT SCHEDULES ARE USED IN OTHER COUNTRIES

13 injections and 3 oral vaccinations to protect against 12 diseases.
In Aborigines, four additional injections and one additional disease.

CHILDHOOD VIRAL DISEASES PREVENTED BY VACCINATION

CHICKENPOX

Chickenpox (varicella) is a generalised infection caused by the virus *Herpes zoster.* Infection occurs when the virus passes to another person from the fluid-filled blisters that cover the body of patients, or in their breath and saliva. Patients are infectious for a day or two before the spots appear, and remain infectious for about eight days. The incubation period is 10 to 21 days.

Early symptoms are similar to those of a common cold, with a vague feeling of being unwell, headache, fever and sore throat. The rash usually starts on the head or chest as red pimples, then spreads onto the legs and arms, and develops into blisters before drying up and scabbing over. New spots may develop for three to five days, and it may be two weeks or more before the last spot disappears. The diagnosis can be confirmed by varicella antibody blood tests, but none are usually necessary.

Treatment involves bed and home rest until the patient feels well, and medications to relieve the itch (eg. calamine lotion, antihistamines), fever and headache. Children must be excluded from school for at least five days from the appearance of the first blisters and until all blisters have developed a dry scab.

There is a vaccine has been available since 2000 to prevent the disease. One injection is necessary if given between 12 months and 12 years of age, but two injections six weeks apart in older children and adults.

Complications are more common in adults, and include chest infections and a type of meningitis. It is unusual for the pockmarks to scar unless a secondary bacterial infection occurs.

Complete recovery within ten days is normal. Once a person has had chickenpox, it is unlikely (but not impossible) that they will ever catch it again.

Once a patient has had chickenpox, the virus never leaves their body but migrates to the nerves along the spinal cord where it remains forever. The virus may be reactivated years later at times of stress to give the patient the painful rash of shingles.

HEPATITIS B

Hepatitis B is not, of course, an exclusively childhood disease, but is vaccinated against in childhood.

Hepatitis B (serum hepatitis) is a viral infection of the liver that can only be caught by intimate contact with the blood or semen of a person who has the disease or is a carrier of the disease. Examples include receiving blood from a carrier, using a contaminated needle, rubbing a graze or cut on an infected person's graze or cut, being bitten by an infected person, or most commonly by having sex (homosexual or heterosexual) with them. 90% of babies born to mothers who are carriers catch the disease. The highest incidences are amongst homosexual men, drug addicts who share needles, Australian Aborigines, and the disease is widespread in Southeast Asia. Blood banks screen all donations for hepatitis B. Splashes of blood into an eye or onto a cut or graze can spread the disease, and doctors, dentists, nurses and other health workers are therefore at risk.

There is a long incubation period of six weeks to six months, and the infection cannot be detected during this period. Once active it causes the patient to be very ill with a liver infection, fever, jaundice, nausea and anorexia. Some patients develop only a very mild form of the disease but they are still contagious and may suffer the long-term effects.

Blood tests are available to detect antibodies against the various hepatitis viruses and diagnose the type of hepatitis and monitor its progress.

It has been possible to vaccinate against hepatitis B since 1986. Three injections at intervals of one month and six months gives at least five years protection. It should not be used during pregnancy unless essential, but accidental vaccination during pregnancy is unlikely to cause any significant problem. It is now given routinely to children from birth onwards. Local soreness, swelling, redness and tissue hardness are the most common side effects. Unusually headache, dizziness, fever, myalgia, tiredness, nausea, diarrhoea, arthralgia and a rash may occur.

Treatment involves bed rest, and a diet that is low in protein and high in carbohydrate, and alcohol is forbidden. Sometimes it is necessary to give medication for nausea and vomiting and to feed severely affected patients intravenously for a short time.

Patients must ensure that they are no longer infectious before having sex with anyone and have regular blood tests throughout their life to detect any liver damage. Nine out of ten patients recover completely after a few weeks, but one in ten become chronic carriers. 10% of patients develop cirrhosis, failure of the liver or liver cancer, and about 1% of patients develop a rapidly progressive liver disease that causes death.

MEASLES

Measles (technically called morbilli or rubeola) is a highly contagious *Morbilli* virus infection that is contagious from five days before the rash appears until it disappears. The incubation period is 10 to 14 days. It was originally a disease of cattle that was only passed to humans after these animals were domesticated 8000 years ago.

It starts with the cold-like symptoms of a snuffly nose, cough and red eyes. A rash develops about four days later, starting in the mouth where tiny white spots appear on the lining of the cheeks (Koplik spots). Dark red blotches then develop on the face and gradually spread across the body, remaining for a week or more before gradually fading. Other symptoms include a high fever and eye discomfort with bright lights. The patient often starts to feel better once the rash has reached its maximum spread.

The diagnosis can be confirmed by blood tests if necessary, and previous exposure to the measles virus or vaccine can also be confirmed by specific antibody blood tests.

There is no specific treatment. Rest, paracetamol and medication are used to relieve the cold symptoms, and vitamin A supplements appear to reduce the severity of an attack. Children must be excluded from school for at least four days after the appearance of the rash.

Measles may be prevented by a vaccination, which is usually given at one and four years of age in combination with the mumps and rubella vaccine, and with widespread vaccination, it is becoming a rare infection in developed countries, and may be totally eradicated by 2020.

Complications include encephalitis (a serious brain infection), pneumonia, ear infections and damage, and possibly the increased risk of developing multiple sclerosis later in life. Immediately after an attack patients are susceptible to other infections, and a significant number will develop tonsillitis, ear and lymph node infections.

The prognosis is usually very good, but significant complications occur in one in every 200 cases, and death occurs in one in every 5000 cases in developed countries, while in third-world countries one in ten children or adults who catch measles will die.

MUMPS

In the 19th. Century, mumps was believed to be "a specific morbid miasma, generated during peculiar conditions of the atmosphere." We now know that it is a viral infection of the salivary glands in the neck caused by a paramyxovirus, and it usually occurs in childhood. The responsible virus spreads in microscopic droplets of fluid that come from the nose and mouth. The incubation period is two to three weeks, and the patient is infectious from one or two days before the symptoms appear until all the swelling of the glands has disappeared. An attack usually gives lifelong immunity.

The symptoms may include fever, swollen tender salivary glands just under and behind the jaw, headache, and malaise. Sometimes one side of the neck is involved, and not the other, then the other side may swell up several days after the first side has subsided. Patients often experience additional pain in the gland if spicy or highly flavoured food is eaten, or even smelled. It may be a significant disease, particularly in adults, when inflammation of the brain, testicles (orchitis) and ovaries (oophoritis) may occur. The kidneys, heart and thyroid gland may also be damaged, and very rarely, death may occur. Mumps orchitis may result in permanent damage to the testicles and infertility, particularly in adults.

Treatment involves rest, with aspirin or paracetamol and/or codeine for the pain and fever. Recovery is usually uneventful after an eight to twelve day course. Exclusion from school is mandatory for the course of the disease.

A vaccine is available that gives lifelong protection, and is usually given combined with those against measles and rubella at twelve months and five years of age. The mumps vaccine was first introduced in 1980.

ROTAVIRUS

The rotavirus is responsible for many cases of gastroenteritis, particularly in children. It is named because of it appears like a rotating spoked wheel when seen under an electron microscope. It spreads from the faeces of one person to the mouth of another to continue its infective cycle. Many animals may also act as a reservoir of infection.

Children should be excluded from school until no loose bowel movement for 24 hours.

An oral vaccine became available in 2007.

RUBELLA

German measles (rubella) is a contagious viral infection caused by a Togavirus, which is widespread in the community, and causes epidemics every few years. It spreads from one person to another with coughs and sneezes, but can be caught only once in a lifetime, although an infection in a child may be so mild that it is completely overlooked. The incubation period is two to three weeks.

Infection occurs most commonly in children, and produces a fine rash over the body that lasts only two or three days, is not itchy, and is not accompanied by the sore eyes and cold symptoms associated with common

measles. There are often some enlarged lymph nodes at the back of the neck, and in severe cases there may be a fever, runny nose and joint pains.

If a pregnant woman catches the disease between the sixth and twelfth weeks of pregnancy, infection may cause blindness, deafness, heart damage and other serious defects to her child. As a result, an antibody blood test is sometimes done to confirm the disease or determine the immune status of a pregnant woman.

Paracetamol for fever and discomfort is all the treatment that is necessary. Children must be excluded from school for four days after the rash first appears.

An effective vaccine is available, and all children are now given mumps, measles and rubella as a combined vaccine at one and four years of age. Once infected with, or vaccinated against rubella, antibody levels rise permanently and reinfection is not possible.

CHILDHOOD BACTERIAL DISEASES PREVENTED BY VACCINATION

DIPHTHERIA

Diphtheria is a childhood respiratory infection that is now rare in developed countries.

It is caused by infection of the throat and trachea by the bacterium *Corynebacterium diphtheriae* which releases a toxin that is responsible for most of the symptoms and complications. It spreads from one person to another in the breath, and the incubation period is two to seven days.

Symptoms include pharyngitis, fever, rhinitis, hoarse voice, overwhelming malaise, weakness and muscle aches. A thick, grey, sticky discharge forms a membrane across the throat that the patient constantly fights to clear. The diagnosis is confirmed by throat swabs, and heart involvement by an electrocardiograph (ECG).

Rapid, early treatment is critical and involves diphtheria antitoxin injection, antibiotics (kill the bacteria but do not remove the toxin), and medications to control or prevent complications. In severe cases a tracheotomy (cut into the front of the throat) is performed to allow air into the lungs.

Diphtheria can be totally prevented by vaccination. These vaccinations were first introduced in the 1930s. It is normally given in combination with other vaccines at two, four and six months and four years of age, then every ten years through life.

Severe cases may affect the heart, nose, skin and nerves. Survivors may be affected for life by damage to the heart or lungs.

The death rate varies from 10% to 30%, and most deaths occur within the first day or two. Survivors improve in a few days, but must be kept at rest for at least three weeks to prevent complications, as it will take this time to for all the toxin to be removed from the body.

HAEMOPHILUS INFLUENZAE B INFECTION

Haemophilus influenzae B (HiB) is a bacterial infection spread by close contact and can cause infections in any age group, but is far more serious in children.

In children it may cause:-

- Meningitis that results in a fever, irritability, lethargy, seizures and coma. The onset of meningitis may be so rapid that the child may be permanently affected (eg: by deafness, learning difficulties and other forms of brain damage) before any treatment can work.
- Epiglottitis which is a life threatening infection of the epiglottis that may swell and block the pharynx leading to death by asphyxiation.

In adults it may cause a serious form of pneumonia and less serious types of pharyngitis, sinusitis, otitis media, bronchitis, septic arthritis, skin infection, endocarditis and meningitis. Adults with reduced immunity (eg: in AIDS) may have the same serious infections as children.

Blood and fluid from the spinal cord can be tested to confirm the diagnosis.

Infections in adults can be readily treated with appropriate oral antibiotics with minimal long-term complications. In children far more potent parenteral antibiotics are needed. The swollen epiglottis may choke the child before the antibiotics can work, so urgent hospitalisation and intubation is essential.

Good recovery occurs if the infection is diagnosed and treated early, but permanent damage or death are possible in children if treatment delayed.

A vaccine for infants has been available since 1993 to prevent HiB infections, starting at two months of age. It is not recommended for use in adults, but is unlikely to cause problems if given accidentally. Common side effects may include redness and soreness at the injection site, while unusual effects may include irritability, tiredness, sleeplessness, diarrhoea and a rash. It should be used with caution in fever, acute infection or immune system problems. It must not be inject into a vein.

MENINGOCOCCAL MENINGITIS

Meningococcal meningitis is an uncommon, serious bacterial infection of the meninges and blood (septicaemia). Sporadic outbreaks occur worldwide, usually in winter, but up to 40% of the population carry the responsible bacteria in their nose and throat without any symptoms. Infection is more common in closed communities such as military camps and boarding schools. It affects about one person in every 100,000 every year.

The infection is caused by the bacteria *Neisseria meningitidis*, which occur in 5 common strains (forms), and several dozen uncommon strains. The C strain is the most serious, while strains M, W and Y are probably next in severity, but this varies between patients. It is spread by prolonged close contact with a person who has the disease by inhaling their sputum or phlegm in coughs and sneezes.

Symptoms include a high fever, severe headache, vomiting, neck and back stiffness, limb pains, confusion, convulsions and a rapidly spreading bruise like rash that starts on the arms and legs. The rash does not go white with pressure under a glass slide, a symptom that is critical in differentiating Meningococcal infections from other rashes, although there are some other infective rashes that do the same thing. In terminal stages the patient becomes delirious, and goes into a coma. Rarely, abscesses may form in the brain, and pneumonia may develop.

Cultures of blood and/or spinal fluid from the lower back can confirm the presence of the responsible bacteria, then penicillin, or more potent antibiotics, are given by injection as soon as the diagnosis is suspected. The patient should be admitted to hospital for confirmation of the diagnosis, and continuation of intravenous antibiotics. Life support in an intensive care unit may be necessary. The infection may be rapidly progressive causing death within hours, but overall 80 to 90% of all cases survive, with only 5% of survivors developing long-term consequences such as epilepsy.

A vaccine is available and is now part of the routine childhood vaccination schedule at 12 months of age.

PERTUSSIS

Whooping cough (pertussis) was originally an infection of ducks that only passed to humans after these birds were domesticated many thousands of years ago. It is now a preventable bacterial infection of the respiratory tract that may be very serious in children. A much milder form of the disease (parapertussis) is also known, against which the pertussis vaccine gives no protection.

The cause is the bacterium *Bordetella pertussis*, which is widespread in the community. In adults an infection merely has the symptoms of a cold, but in young children the disease is more severe, and spreads from person to person in the breath, so an adult with minimal symptoms may carry the disease from one infant to another. The incubation period is one to two weeks.

It starts in a child as a cold that lasts a week or two, but then the cough becomes steadily more severe and occurs in increasingly distressing spasms, characterised by a sudden intake of breath before each cough. Coughing spasms may last up to 30 minutes, and leave the child exhausted, then another spasm starts after only a few minutes. As the infection worsens, the child may become blue, lose consciousness, and thick stringy mucus is coughed up and vomited. The patient has no appetite and rapidly loses weight. Severe coughing may cause bleeding in the lungs, throat and nose, that may be severe enough to cause suffocation. If the child survives, the spasms start to ease after a few weeks, but mild recurrences may occur for months. Permanent lung damage is also possible.

The diagnosis can be confirmed by analysis of a sputum or throat swab. Pertussis IgA antibodies are normally not present, but a positive result indicates a recent or current pertussis infection. A swab taken from the nasopharynx is tested. The result is positive early in infection, but short lasting. The equivalent blood test (pertussis IgA antibodies) increase late, and persist long term, but only occur with infection, not vaccination.

No cure is available, but the disease may be completely prevented by a vaccination that is usually combined with those for tetanus, diphtheria and other vaccinations, and is given three times before six months of age, and again at four years of age. The vaccination was first used in the 1930s. The vaccine should not be given if suffering from acute illness, significant fever or epilepsy or if previously infected with whooping cough. The side effects are normally minimal but may include local redness and tenderness at the injection site, a persistent lump, fever, tiredness, irritability and a faint.

The treatment of whooping cough involves oxygen, sedatives and careful nursing isolated within a hospital for several weeks. Antibiotics can be used to prevent the spread of the disease to others.

Even in good hospitals about 2% of patients die, and up to 10% have long term complications. In poorer countries, the mortality rate is much higher.

PNEUMOCOCCUS

The *Pneumococcus* bacteria are a subspecies of the bacteria *Streptococcus pneumoniae* that may cause pneumonia and meningitis. More than 85 subtypes of *Pneumococcus* are known. A vaccine has been developed to

give protection against 17 of the most common subtypes responsible for infection in humans. The vaccine is given to children at 2, 4 and 6 months of age. An additional dose is given at 18 months to Aboriginal children who are at higher risk of catching this infection later in life. A similar vaccine is now also used routinely for most older people.

TETANUS

Tetanus (lockjaw) is a very serious worldwide disease that attacks muscles. The bacterium *Clostridium tetani*, which lives harmlessly in the gut of many animals, particularly horses, is responsible. When it passes out in faeces it forms a hard microscopic cyst, which contaminates soil. It can remain inactive for many years until it enters a cut or wound where it starts multiplying and produces a toxin which spreads throughout the body . Deep wounds, such as treading on a nail, are particularly susceptible to a tetanus infection.

The toxin attacks the small muscles used for chewing making it difficult to open the mouth (thus the common name of lockjaw). Larger and larger muscles are then attacked, irritating them and causing severe spasm. Excruciating pain from widespread muscle spasms may be triggered by the slightest noise. The patient remains conscious, but eventually the muscles that control breathing and the heart are affected.

There is no effective treatment other than muscle relaxants and mechanical ventilation. Although the bacteria may be killed by antibiotics, the toxin remains in the body. Death occurs in about 50% of patients, even in good hospitals.

A vaccine (tetanus toxoid) is available, but it does not give lifelong protection, and revaccination is necessary every ten years until age 50, or after five years with a deep wound.

OTHER COMMON CHILHOOD VIRAL DISEASES

BRONCHIOLITIS

The respiratory syncitial virus (RSV) is responsible for bronchiolitis, a lung infection of children under two years of age. The infant develops a cough and wheeze, dyspnoea and rhinorhoea. In severe cases, the child may be very weak, blue around the mouth and dehydrated.

Antibiotics cannot cure this viral condition but are sometimes given to prevent pneumonia. Bronchodilator medications may be used but often are of little help. Placing the child in a warm room with a humidifier, or in a steam tent may give relief. More severe cases will require hospitalisation, where steroids are given and oxygen may be administered into a steam tent to assist with breathing. Tribavirin is an antiviral medication that was introduced 1999 to treat severe bronchiolitis

The vast majority of cases settle without complications in a few days to a week.

COXSACKIE VIRUS INFECTION

There are two main types of *Coxsackie* virus (A and B), but these are further broken down into more than 50 subtypes.

The symptoms depend on where the infection occurs. It may cause viral meningitis, cold like symptoms, fevers, ulceration of the mouth and throat (herpangina), inflammation of the pleura around the lungs (Bornholm disease), hand foot mouth disease, myositis (inflammation of muscles), and inflammation of the heart or the pericardium that surrounds the heart. Rarely, if the heart is infected, it may be permanently damaged.

There is no cure other than time and rest, but symptoms may be eased by appropriate medication when necessary. Most patients recover uneventfully unless the heart is involved.

See also HAND, FOOT MOUTH DISEASE

CROUP

Croup (or stridor) causes a harsh whistling when breathing in, and is usually followed by a cough.

By far the most common cause is a minor viral respiratory infection of children under five years of age, affecting the pharynx (lower throat). If a constant high fever occurs, and the child becomes particularly lethargic, bacteria may be responsible. The condition may be very distressing to both child and parents, but is rarely serious.

Affected children have a seal-like barking cough, difficulty with taking a breath in, and excessive chest movement with breathing. There is usually only a slight fever, and minimal throat pain. Very rarely, the child may develop severe swelling in the throat that totally obstructs breathing, which is a critical emergency.

Medications and steam will ease the symptoms. Nurse the child in a warm, moist, steamy environment (eg. use a vaporiser). Paracetamol is given for fever or discomfort, and lots of fluid to prevent dehydration. In more serious cases, prednisone is prescribed and a steam and oxygen tent may be used in hospital to assist breathing. The vast majority of children recover spontaneously within a day or two.

There are many other causes of croup including epiglottitis, glandular fever (infectious mononucleosis), diphtheria, foreign bodies (eg. peanut, small toy), polyps, cysts, tumours, bruising, an abscess and other growths in the larynx or throat, and laryngomalacia (rare condition of children in which the cartilage of the larynx is softened, and collapses when the patient breathes in heavily with exercise).

CYTOMEGALOVIRUS INFECTION

A cytomegalovirus (CMV) infection is an extremely common viral infection affecting between 10% and 25% of the entire population at any one time. Infection rate may be in excess of 80% in homosexual men. It may be a serious illness in patients who have reduced immunity due to treatment with cytotoxic drugs, have suffered other serious illnesses, are anaemic, suffering from AIDS or other immune affecting diseases, or who are extremely run-down from stress or overwork.

The virus passes from one person to another in saliva or as droplets in the breath, but may also spread through blood transfusions or sexual contact. In all but a tiny percentage of infected people, there are absolutely no symptoms, and they appear and feel totally well. Adults with reduced immunity develop a fever, headaches, overwhelming malaise, myalgia and arthralgia, lymphadenopathy and a tender liver. In patients with severely reduced immunity, pneumonia and hepatitis may develop.

If a pregnant woman with reduced immunity acquires a significant CMV infection, her baby may be affected in the womb and be born with liver damage, hepatomegaly and splenomegaly, poor ability to clot blood, bruises, intellectual disability, and one in six are deaf.

The infection can be detected by specific blood tests, and the virus may be found in sputum, saliva, urine and other body fluids.

There is no specific treatment. Aspirin and/or paracetamol are used to control fever and pain, and prolonged rest is required for recovery. It is not necessary to exclude children from school.

An uneventful recovery is expected in normal patients. In immune compromised patients, pneumonia and hepatitis may be fatal.

HAND FOOT MOUTH DISEASE

Hand foot mouth disease is an infection that virtually every child will eventually catch caused by a *Coxsackie* virus. The infection is usually so mild that it causes no symptoms, but in severe cases a child will develop blisters on the soles and palms, and mouth ulcers. It may be accompanied by a mild intermittent fever, headache and irritability. Paracetamol is the only treatment necessary. The rash persists for three to five days before settling without any problems.

See also COXSACKIE VIRUS INFECTION

LATEROTHORACIC EXANTHEM

Laterothoracic exanthem (asymmetric periflexural exanthem of childhood or APEC) is an uncommon rash that affects children (mainly girls) between the ages of one and five years in winter and spring. It is probably a viral infection.

The disease is characterised by a rash of tiny red or pink raised spots that are itchy and may be surrounded by a pale halo, that slowly enlarge, and becomes flat and scaly before fading to a dull grey. The patches may merge into a web like pattern. The rash starts in the armpit or groin and slowly extends across one side only of the trunk. It may spread to the genitals, hands and feet and form blood blisters. Some children have an accompanying fever and sore throat with lymphadenopathy in the axilla and groin.

No treatment is necessary. The itching may be relieved by soothing or mild steroid creams, or in severe cases antihistamine mixtures. The condition lasts for one to three months before settling spontaneously.

MOLLUSCUM CONTAGIOSUM

Molluscum contagiosum is a mild contagious viral skin infection spread from one person to another by close contact. It is most common in childhood. If the blisters occur in an adult on the genitals, it has probably been caught by sexual contact. Multiple small (2-4 mm.), dome-shaped, white blisters with a central dimple appear on scattered parts of their body. The abdomen, chest and face are the most commonly affected areas.

No treatment is normally required. Unsightly or persistent blisters can be removed by a doctor scraping out their contents, or heating them with an electrical cautery needle. Secondary bacterial infection of a scratched blister can occur. The rash disappears spontaneously after three to twelve months. It is not necessary to exclude a child from school.

PARVOVIRUS

See ROSEOLA INFECTIOSUM

RESPIRATORY SYNCITIAL VIRUS

See BRONCHIOLITIS

ROSEOLA INFECTIOSUM

Fifth disease (erythema infectiosum) is a common childhood viral disease caused by the *Parvovirus* that last from two to five days, but occasionally may persist for weeks. It occurs in epidemics every few years, and virtually every child will eventually develop the infection before their teenage years.

The infection is characterised by red flushed cheeks (slapped cheeks appearance), paleness around the mouth and a red patchy rash on the arms and legs. Many children will have very mild symptoms that may be overlooked, or confused with rubella. Rarely joints may become sore and inflamed. Complete recovery is normal and no treatment is necessary.

ROSEOLA INFANTUM

Roseola infantum (baby measles, sixth disease or exanthema subitum) is a contagious viral infection that is caught by virtually every child in the first two or three years of life. It has an incubation period from 7 to 17 days, and most children will have such a mild attack that it will be passed off as a slight cold. Those with a severe attack will develop a fever and a measles-like rash on the trunk and neck, which usually appears after the fever has gone. No treatment is necessary other than paracetamol for the fever, and the child recovers completely within two or three days.

OTHER COMMON CHILHOOD BACTERIAL DISEASES

PARAPERTUSSIS

Parapertussis is a bacterial infection of the nose, throat and lungs that resembles, but is far milder than, pertussis (whooping cough). It is caused by the bacteria *Bordetella parapertussis*, and the symptoms include fever, episodic cough and a sore throat. It is treated in the same way as whooping cough.

TONSILLITIS

Tonsillitis is infection of the tonsils, which are modified lymph nodes that sit on either side of the throat at the back of the mouth. They intercept and destroy bacteria and viruses that enter the body, but if a tonsil is overwhelmed by these organisms tonsillitis occurs. Infection may occur at any age, but is far more common amongst children. The cause may be bacteria (eg. *Streptococci, Staphylococci, Haemophilus*) or viruses (eg. glandular fever) that enter through the mouth or nose.

The tonsil(s) becomes enlarged, red and covered in pus, and the patient develops a sudden high fever, headache, throat pain, has offensive breath and finds it difficult to swallow or speak. It can easily spread to the other tonsil and to lymph nodes below the jaw and around the ear. The Eustachian tube that drains fluid from, and allows air to enter into the middle ear, opens into the back of the throat between the tonsils and adenoids. As a result infection may spread from the tonsils to the ear. Uncontrolled bacterial infection may cause an abscess (quinsy) or septicaemia.

Tonsillitis is infectious, and may be passed to another person who is in close contact with the patient.

The types of bacteria can be differentiated by a throat swab, and blood tests can detect glandular fever and the likelihood of other viral infections.

Bacterial infections are readily treated by bed rest, fluid diet, aspirin or paracetamol, antiseptic mouth washes and antibiotics (eg. penicillin, erythromycin, tetracycline). No cure is available for viral infections, and painkilling tablets and gargles are used to give relief, while prolonged rest allows recovery. Recurrent attacks may lead to surgical removal of the tonsils (tonsillectomy).

CURIOSITY

VIRAL EXANTHEMA

A viral exanthema is any rash caused by a viral infection. These are much more common in children than adults and common examples include measles, roseola infantum (baby measles), chickenpox and German measles (rubella), but a wide range of other viral infections may be responsible.

The rashes that may occur are extremely variable in their appearance. Usually there is a red or maroon, flat, widely scattered, slightly itchy rash in a child with a mild fever who is vaguely unwell, but the rash may also be a raised, crusting and highly itchy as in chickenpox.

No tests are normally necessary, but blood tests and swabs of sores may be necessary to make definite diagnosis.

The rash settles spontaneously within hours or days without treatment. Paracetamol and medication for the itch may be necessary.

TOTALLY, COMPLETELY AND UTTERLY USELESS MEDICAL INFORMATION

Historically, six diseases that caused a rash were known by numbers. They were first disease (measles), second disease (scarlet fever), third disease (German measles - rubella), fourth disease (Duke's disease - Coxsackie virus infection), fifth disease (erythema infectiosum or slapped cheek syndrome) and sixth disease (exanthema subitum - roseola infantum). Only the fifth disease nomenclature is commonly used today.

Assoc. Prof. Warwick Carter

THE MANAGEMENT OF DIABETES MELLITUS

Year 1

Diabetes Mellitus Type Two

(Maturity Onset Diabetes; Non-insulin Dependent Diabetes Mellitus; NIDDM)

DESCRIPTION:

Excessive levels of glucose in the blood. Glucose is used as fuel by every cell in the body. When glucose is eaten, it is absorbed into the blood from the small intestine. Once it reaches a cell, it must cross the fine membrane that forms its outer skin. This is normally impermeable to all substances, but insulin has the ability to combine with glucose and transport it across the membrane from the blood into the interior of the cell. Insulin is made by cells in the Islets of Langerhans in the pancreas, which sits in the centre of the abdomen.

There are two totally different types of diabetes - type one diabetes (juvenile or insulin dependent diabetes mellitus - IDDM) and type two diabetes (maturity onset or non-insulin dependent diabetes mellitus - NIDDM). Diabetes affects approximately 2% of the population, with 90% of diabetics suffering from the maturity onset form. The cause and treatment of the two types is quite different.

CAUSE:

Multifactorial. Far more common in obese patients.

- inadequate insulin production by the pancreas
- insulin resistance and cells fail to respond to insulin, so glucose cannot enter the cell.
- glucose overproduction by the liver

SYMPTOMS:

Excessive tiredness, thirst, excess passing of urine, visual problems, skin infections and sensory nerve problems. Many patients are totally without symptoms when the diagnosis is discovered on a routine blood or urine test.

INVESTIGATIONS

(see Additional Information section of these notes for more details):

Blood and urine glucose levels are high in untreated or inadequately treated patients. A blood glucose tolerance test (GTT) is performed to determine the severity of diabetes. After fasting for 12 hours, a blood sample is taken, then a sweet drink is swallowed, and further blood samples are taken at regular intervals for two or three hours. The pattern of absorption and elimination of blood glucose will give the diagnosis.

By measuring the amount of glucose in certain blood cells, the average blood glucose level over the past three months can also be determined.

Regular blood testing of glucose levels is also necessary, but normally on a weekly rather than daily basis. Urine tests are often inaccurate in the elderly, as their kidney function may be reduced to the point where glucose cannot enter the urine.

The glycosylated haemoglobin (HbA1c) is measured every three to six months to manage diabetes as this gives an average reading of glucose over the preceding two or three months.

COMPLICATIONS:

An increased risk of both bacterial and fungal skin and vaginal infections, the premature development of cataracts in the eye, microscopic haemorrhages and exudates that destroy the retina at the back of the eye, damage to the kidneys that prevents them from filtering blood effectively, poor circulation to the extremities (hands and feet) that may cause chronic ulcers and even gangrene to the feet, the development of brown skin spots on the shins, and sensory nerve damage (diabetic neuropathy) that alters the patient's perception of vibration, pain and temperature. High blood pressure is more common than in the average person of their age.

There are also complications associated with treatment such as a 'hypo' in which too much medication is taken, excess exercise performed or not enough food is eaten, and blood glucose levels drop (hypoglycaemia) to an unacceptably low level. The patient becomes light-headed, sweats, develops a rapid heart beat and tremor, becomes hungry, then nauseated before finally collapsing unconscious. Glucose drinks or sweets given before collapse can reverse the process, but after collapse, an injection of glucose is essential. Diabetic ketoacidosis (see separate entry) is the most severe complication.

PROGNOSIS:

With the correct treatment and careful control, patients should live a near-normal life, with a near-normal life span.

TREATMENT OF NIDDM:

1. LIFESTYLE CHANGES

DIET

(see Additional Information section of these notes for more details):

Education of patients with diabetes is very important, so that they understand what they can and cannot eat and drink.

Diet is essential because the amount of glucose eaten is not normally constant, but the medication levels do not normally vary from day to day. The diet must restrict the number of kilojoules (calories) being eaten, and sugar in all its forms should be eaten only with great caution. Fat should not account for more than a third of the total calories, and cholesterol intake should be restricted. Protein should be obtained more from poultry and fish than red meats. Carbohydrates other than sugar can be consumed freely. Grains and cereals with a high fibre content should be the main part of the diet. Artificial sweeteners such as aspartame (NutraSweet) can be used to flavour food and drinks.

Two systems of dietary management, KISS and Glycaemic index.

KISS (keep it simple stupid) is simply the rule :-

NO SUGAR, MINIMAL FAT

Glycaemic Index involves learning the GI of every type of food and applying that to diet. The GI values of foods are not intuitive, for example Mars bars have a lower GI than baked potatoes.

Unless patients are very dedicated and interested, the KISS principle works quite well.

Alcohol should be reduced, particularly beer and cider, while a glass of wine a day is reasonable.

EXERCISE

Patients should exercise as much as possible, because the fitter they are, the better the diabetes will be controlled, and they are also more likely to lose weight, which again will help the diabetes. Walking briskly 30 minutes a day is adequate, but more is better. There is no limitation on vigorous sports such as squash, swimming or cycling.

SMOKING

No diabetic should smoke as it dramatically increases the risk of peripheral vascular complications.

WEIGHT LOSS

Fat cells can react abnormally to insulin very easily, and so overweight diabetics must lose weight.

Weight loss in an obese patient may mean that they no longer have NIDDM, or they may be able to avoid or reduce their medication. Every kilo of weight loss counts, but it must be kept off. Yo-yo dieting is often worse than not dieting at all as they often reach a higher than initial weight on the rebound. Most patients with NIDDM are overweight.

Weight loss is a combination of diet and exercise.

Ideal BMI is 22 to 25.

2. MEDICATION

MONOTHERAPY

Metformin is normal initiating medication UNLESS patient is thin or metformin not tolerated or contraindicated (eg. heart failure, liver disease) when a sulfonylurea class medication (eg. chlorpropamide, glipizide, tolbutamide, glibenclamide) can be used as a single agent.

These medications make the cell membrane respond to insulin again.

Start low and go slow, gradually increasing dose of single agent every week or two until blood glucose levels (ideally done fasting on waking) are stable in desired range (usually 5 to 7 mmol/L). Patient should have a glucometer and home test every morning on waking and before evening meal.

COMBINED ORAL THERAPY

IF NIDDM not controlled by monotherpay, ADD another agent.

IF on metformin, ADD a sulfonylurea.

IF on a sulfonylurea class medication, ADD a glitazone (eg. rosiglitazone, pioglitazone) OR acarbose.

Again start low and increase dose slowly until control of blood glucose achieved.

IF metformin AND sulfonylurea combined do not control NIDDM,

THEN either:-

- STOP sulfonylurea and
- ADD a glitazone (eg. Avandia, Actos, Juvena) OR acarbose OR glimepride
- Better option is to add insulin

INSULIN

IF NIDDM still not controlled, ADD insulin to a single oral agent (metformin OR sulfonylurea).

Start by adding a single daily dose of a long duration type insulin (eg. insulin glargine – Lantus)

If morning blood glucose high, give insulin in evening.

If evening blood glucose high, give insulin in morning.

Increase insulin dose and frequency as necessary while maintaining oral hypoglycaemic at average level.

3. ONGOING MANAGEMENT

HbA1c

(see Additional Information section of these notes for more details):

The glycated haemoglobin (HbA1c) is a fascinating test that has only been available since the early 1990s and has revolutionised the management of all forms of diabetes mellitus.

It measures the amount of glucose in the membrane of red blood cells (erythrocytes) which have a half life of about three months. As a result the HbA1c gives an average blood sugar reading over a period approaching three months. Spot readings may be high or low, but if the HbA1c is below 7, the patient is well controlled.

This test should be performed every three months initially, but once patient is stable, may be reduced to six monthly.

The HbA1c is NOT designed to be used to diagnose diabetes.

ILLNESSES

A variety of illnesses from infections to hyperthyroidism (overactive thyroid gland) and malignancies can alter blood sugar levels and cause NIDDM to be difficult to control.

Further investigations are necessary in any diabetic whose control is variable or difficult and lifestyle causes have been excluded.

EYES

Diabetics should have an eye check by an optometrist or ophthalmologist every two years to exclude any retinal damage or the premature development of cataracts.

FEET

The feet of diabetics (especially smokers) have poor circulation and are more likely to be damaged, ulcerate, have nail damage (eg. onychogryphosis), develop neuropathy (nerve damage) and develop fungal or bacterial infections. Annual checks by a GP or podiatrist are necessary.

MICROALBUMINURIA

The presence of tiny amounts of the protein albumin in urine, at a level normally undetectable by simple dipstick tests, is called microalbuminuria, and is an early sign of kidney damage in conditions such as diabetes mellitus. This should be checked annually.

OTHER MEDICATIONS

Hypoglycaemics can interact with other medications to increase or decrease their effect. Examples include the oral contraceptive pill, menopausal hormone replacement therapy,

steroids, thiazide diuretics, anti-epileptic medications (eg. phenytoin), antipsychotics and antivirals.

If the other medication is taken regularly, the dose can be appropriately adjusted, but intermittent medication use may make control of glucose levels difficult.

Diabetes Mellitus Type One

(Insulin Dependent Diabetes Mellitus; IDDM; Juvenile Diabetes; Sugar Diabetes)

DESCRIPTION:

Type one diabetes (juvenile or insulin dependent diabetes mellitus - IDDM) is due to a lack of insulin production by the Islet of Langerhans cells in the pancreas. Most people develop this type as a child or in early adult life. It is probably an autoimmune disease.

SYMPTOMS:

These are identical to NIDDM, but have a far more rapid onset in children or young adults. They include excessive tiredness, thirst, excess passing of urine, weight loss despite a large food intake, itchy rashes, recurrent vaginal thrush infections, pins and needles and blurred vision. Patients become steadily weaker because their muscles and other organs cannot work properly. Coma (diabetic ketoacidosis) is a very common presenting symptom.

INVESTIGATIONS:

The investigation and diagnosis of IDDM is the same as NIDDM. The two are distinguished by age group (IDDM <25y, NIDDM> 40y) or more sophisticated investigations (eg. glutamic acid decarboxylase, islet cell antigen antibodies).

COMPLICATIONS AND PROGNOSIS:

These are similar to NIDDM, but because of the earlier onset and more difficult control of IDDM, the complications are more common, more serious and the prognosis is more guarded.

TREATMENT OF IDDM:

Diet, exercise, not smoking and avoiding obesity are all essential in IDDM, but most of these patients are not obese at the time of diagnosis.

IDDM patients should use the glycaemic index diet rather than the KISS principle in order to better regulate their carbohydrate intake and energy release.

When first diagnosed, patients are often quite ill, and most are hospitalised for a few days to stabilise their condition. Insulin injections must be given regularly several times a day for the rest of their life. Initially derived from pigs and cattle, human insulin has now been produced by genetic engineering techniques. Insulin cannot be taken by mouth as it is destroyed by acid in the stomach, but can be injected into any part of the body covered by loose skin, although the same site should not be used repeatedly. The newer pen-style delivery systems enable diabetics to easily dial the required dose and inject as necessary with minimal inconvenience. There are many different types of insulin that vary in their speed of onset and duration of action.

Insulin is given in one to three or more daily injections of one or more of the different types, eg. soluble (peak 4h, duration 8h, isophane (peak 10h, duration 24h), protamine zinc (peak 16h,

duration 36h), lente zinc suspension (peak 8h, duration 24h), semilente zinc suspension (peak 4h, duration 12h), biphasic (peak 2h, duration 24h).

There is a tendency to use frequent doses of soluble insulin in young newly diagnosed diabetics who may check their blood sugar many times a day and adjust their insulin dosage accordingly.

Implanted and external insulin pumps are now becoming available, and experiments with Islet of Langerhans cell implants are looking promising as a cure for IDDM.

Those with IDDM need the same ongoing care (eg. regular HbA1c, eye checks) as those with NIDDM, but because of the long term nature of the condition and the age of the patients, many take more responsibility for their care than those with NIDDM.

Diabetes Mellitus Type 1.5

(Latent Autoimmune Diabetes in Adults)

Also known as diabetes mellitus type 1.5, latent autoimmune diabetes in adults (LADA) is effectively type one diabetes mellitus that has a delayed onset in mid-life rather than in childhood. Because it has an unusual age of onset and symptoms which are not necessarily typical of diabetes, and does not respond to oral hypoglycaemics, it is often diagnosed only after many investigations.

Patients are usually between 35 and 55 years of age, and unlike type two diabetics, they are not overweight. The symptoms are the same as any other form of diabetes with thirst, hunger, excessive tiredness, excess passing of urine, and weight loss despite a large food intake.

The diagnosis of diabetes is made by finding high levels of glucose in the blood, but the specific type of diabetes can be confirmed by specific tests such as the glutamic acid decarboxylase (GAD) antibody levels and the anti-tyrosine phosphatase antibody (also known as the insulinoma associated 2 antibodies).

There is a strong association between this type of diabetes and autoimmune thyroid disease.

It is successfully treated in the same way as type one diabetes mellitus, with regular insulin injections.

Diabetic Ketoacidosis

Ketoacidosis is a severe complication or initial presentation of diabetes mellitus. It is due to a build-up of waste products and glucose in the bloodstream because of untreated or under-treated diabetes. Patients who are careless about their treatment, diet and self-testing may be affected. Almost invariably, it is the juvenile insulin dependent diabetics that develop this complication.

The symptoms include mental stupor, nausea, vomiting, shortness of breath and eventually coma. Blood sugar levels are very high and other blood and urine tests are abnormal.

Treatment involves the emergency injections of insulin, but urgent hospital treatment is necessary to control the situation adequately. If left untreated, death will occur due to kidney, heart or brain damage.

The prognosis is good with prompt medical care, but permanent organ damage may occur if treatment is delayed.

Diabetic Ketoacidosis Treatment

1. Establish diagnosis and severity by appropriate laboratory investigations.
2. Nasogastric tube if unconscious.
3. Oxygen.
4. Fluid replacement with isotonic saline to correct electrolyte imbalance and shock.
5. Soluble insulin by intravenous infusion.
6. Potassium supplements.
7. Bicarbonate if pH low (<7).
8. IM insulin once stabilised.
9. Antibiotics to prevent secondary infection.
10. Heparin to prevent thrombosis in elderly, unconscious or hyperosmolar patients.

Prec: Fluid and electrolyte balance critical; monitor all relevant biochemical levels constantly.

ADDITIONAL INFORMATION

INVESTIGATIONS

RI = Reference interval (normal values) Ind = Indication for performing test
Int = Interpretation of test Phys = Physiology of test

Glucose, Blood

RI: 3.5 - 6 mmol/L (60 - 100 mg/100 mL)
(Fasting whole blood specimen)

Ind: Diabetes

Int: HIGH - Diabetes mellitus [>7.0 fasting diagnostic] (GTT?), infection (WCC?), hyperthyroidism (ETR?), hyperpituitarism, adrenal cortical excess, hepatic disease (LFT?), acromegaly, phaeochromocytoma, Leschke syn., Prader-Willi syn., Reaven syn., Turner syn., polyglandular autoimmune syn., hypokalaemia, burns, steroid therapy, recent meal
LOW - Vomiting, diarrhoea, insulinoma, hyperinsulinism, adrenal insufficiency, hypopituitarism, Addison's disease, hypothyroidism (ETR?), severe hepatic disease (LFT?), hepatoma, alcoholism (GGT?), post-gastrectomy, von Gierke syndrome, Hers syndrome, Reye syndrome, unpreserved blood specimen, drugs [eg. insulin, laxatives, hypoglycaemic agents, diuretics]

Phys: Glucose in adequate levels is essential for normal body functions. Its level is controlled by the insulin released by the Islets of Langerhan in the pancreas. No food for 12 hours before test

Glucose Tolerance Test [GTT]

RI: 75 g of glucose is given orally. The blood sugar level should not exceed 8 mmol/L (140 mg/100 mL) after 30 minutes, and should return to normal within 2 hours. No sugar should appear in the urine

Ind: Diabetes

Int:

	FASTING mmol/L	TWO HOURS mmol/L
Normal	<6.1	<7.8
Impaired glucose tolerance	<7.0	7.8-11.0
Impaired fasting glycaemia	6.1-6.9	<7.8
Diabetes mellitus	>7.0	>11.1

Phys: Diabetic (and potential diabetic) patients do not produce adequate insulin to clear glucose from serum rapidly. Test may be impaired by diuretics, steroids, lithium, phenytoin, phenothiazines

Glycosylated Haemoglobin, Blood [GHb or HbA_{1c}]

RI: <6% of Hb as HbA1c - not diabetic
6 to 7% of Hb as HbA1c - good non-insulin dependent diabetic control
6 to 8% of Hb as HbA1c - good insulin dependent diabetic control

>9% of Hb as HbA1c - poor diabetic control

Ind: Diabetic management

Int: HIGH - Above average normal glucose level (ie. diabetes, poorly controlled diabetic, noncompliance with therapy)
FALSE HIGH - Uraemia, beta thalassaemia
FALSE LOW - Haemolytic anaemia, blood loss

Phys: Glucose reacts with and attaches to Hb nonenzymatically. Index of compliance and efficacy of treatment as life cycle of erythrocyte is about 3 months. Should not be used in under this time for change of therapy. Inaccurate in conditions of shortened RBC lifespan (eg. haemolytic disease, blood loss). Not to be used for diagnosis of diabetes.

Glutamic Acid Decarboxylase Antibodies, Serum [GAD]

RI: <0.9 U/mL

Ind: Diabetes

Int: HIGH - Type one diabetes mellitus, potential to develop type one diabetes mellitus, latent autoimmune diabetes in adults, autoimmune thyroid disease

Phys: Present in 70% of type one diabetics, and frequently in first degree relatives of patients, and others at risk of developing the disease. More commonly raised in early stages of disease

Anti-Tyrosine Autoantibodies, Serum [IA-2]

(Insulinoma Associated 2 Antibodies, Serum)

RI: <0.8 U/mL

Ind: Diabetes

Int: HIGH - Type one diabetes mellitus, latent autoimmune diabetes in adults, potential to develop type one diabetes

Phys: Definitive diagnostic marker for type one diabetes.

DIABETES KISS DIET

FOODS TO AVOID

Sugar and fat.
Full cream milk, butter, ice cream, yoghurt, custard, cream, soft cheese.
Fatty meats such as sausages, hamburgers, chops, chicken skin and roasts.
Pastries, cakes, puddings, filled and sweet biscuits, milk chocolate.
Fried foods, chips, pies, pasties, sausage rolls, cream based sauces and soups.
Cereals with added sugar (eg. Nutri-Grain, Coco-Pops).
Fried and scrambled eggs, omelettes.
Soft drinks and cordials.

FOODS ALLOWED

All fresh fruit and vegetables.
Bread (particularly whole grain and high fibre).
Crispbreads and crackers.
Pasta (spaghetti, macaroni etc.).
Cereals that have no added sugar (eg. Weet-Bix).
Seafood, chicken breast, lean meats.
Boiled or poached eggs.
Polyunsaturated margarines, canola and olive oil.
Tofu and soy products.
Low fat milk, diet yoghurt and ice cream, soy milk.
Diet soft drinks (eg. Diet Coke) with artificial sweeteners (eg. Nutra-Sweet).
Nuts, dark chocolate (in limited quantities).
Herbs, spices, garlic, vinegar.
Tea, coffee, soda and mineral water.

Alcohol (wine and spirits preferable to beer and sherry) up to two drinks a day.
Grill, microwave, dry roast and stir-fry foods.

GLYCAEMIC INDEX

The glycaemic index (GI) is a measure of how much a food affects the blood sugar level. This is very important for diabetics who need to keep their blood sugar level within specific limits. Diabetics can determine their diet by referring to the GI of foods they eat.

Different foods have different effects on the blood sugar level, and a GI level between 0 (no effect) and 100 (serious effect) has been given to most foods, and comprehensive lists of these are available from doctors, dieticians and diabetic educators. A limited number of foods and their GI are listed below.

FOOD	GI
All bran cereal	30
Apple, fresh	38
Apple juice	40
Apricot	57
Apricot, dried	31
Baguette	95
Baked beans in tomato sauce	48
Banana	55
Beetroot	64
Biscuit, plain digestive	59
Bread, high fibre white	80
Bread, white, one slice	70
Bread, wholemeal	77
Cake, sponge, plain	46
Carrots, boiled	49
Cherries	22
Chocolate, dark	49
Chocolate, milk	45
Coca-Cola	58
Coco-Pops	70
Corn Flakes	84
Crumpet	69
Fettucini	32
Fish fingers	38
Flour, white	70
French fries	75
Fruit loaf	47
Grapefruit	25
Grapes	46
Ice cream, full cream	60
Ice cream, low fat	50
Jatz crackers	55
Jelly beans	78
Just Right	60
Lamingtons	87
Macaroni cheese	64
Marmalade	33
Mango	51
Mars bar	65
Milk, full cream	31
Milk, skim	32
Muesli bar with fruit	61
Noodles, two minute	46
Nutri Grain	66
Orange	44
Orange juice, unsweetened	53
Paw paw	57
Peach	42
Peaches, canned, unsweetened	38
Pear	39
Peas, boiled	45
Pineapple, raw	66
Pineapple juice, unsweetened	46
Porridge	42
Potato crisps, plain	63
Potatoes, baked	85
Potatoes, boiled	50
Pumpkin, boiled	70
Raisins	65
Ravioli	39
Rice Bubbles	83
Rice, boiled brown	77
Rice, boiled white	56
Sausages, fried	28
Scones, plain	92
Soft drink (eg. lemonade)	63
Soy milk	44
Spaghetti	41
Strawberries, fresh	40
Sweet corn, fresh cooked	52
Watermelon	72
Yoghurt	36
Yoghurt, diet	27