The Full Blood count

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Structure

- Some key takes homes
- Red cell results
- Platelets
- White cell results

Key take-home messages

- If any of the cell lines are low (anaemia, thrombocytopenia, neutropenia) always check a B12/folate
- If it's acute leukaemia, haematologists/biomedical scientists will tell you before you see the result – mature vs immature cells
- Look at **trends (**not just what is outside 'normal range') **and patterns**
  - **Over how long and which cell lines involved?**

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Red cell elements

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Red cell elements

- Haemoglobin
- Haematocrit
  - Proportion of blood that is red cells
- ~~RBC count~~
  - ~~Not particularly useful on it's own~~
- Mean corpuscular volume (MCV)
  - Average size of a RBC (Haematocrit ÷ RBC)
- Mean corpuscular haemoglobin (MCH)
  - Average mass of haemoglobin per RBC (Haemoblogin ÷ RBC count)
- ~~MCHC~~
  - ~~Not particularly useful~~
- Reticulocyte count
  - Count of the immature red cells

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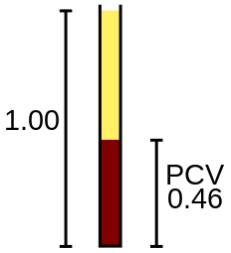
High Haemoglobin

- Is it a true result? Trends are you friend –
  - Haemoconcentration?
  - Either bone marrow is;
    - Too active (myeloproliferative neoplasm) or
    - Responding to hypoxic stimulus (secondary polycythaemia) or rarer things

Months or years

- Other useful elements from FBC
  - Haematocrit



  - If an MPN – often see other myeloid cell increases; Basophilia, eosinophilia, thrombocytosis
  - Any history lung disease, possible sleep apnoea?

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Low haemoglobin approaches

Trends

vs

Red cell size

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Low haemoglobin

Trends

Days or short weeks	Weeks, months or years
Blood loss/dilution Bleeding Haemolysis Dilution	**Reduced production** Haematinic deficiency Toxicities to marrow Bone marrow infiltration/disorders

Days/short weeks - Clues from FBC

Bleeding	**Haemolysis**	**Dilution**
Look for bleeding…	Blood film	Blood film
Blood film	LDH ↑	MCV/MCH might go down
Might see MCV/MCH trending ↓	Haptoglobins ↓	
+- ferritin	DAT	
Reticulocytes ↑	Reticulocytes ↑	

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Low haemoglobin

Trends

Days or short weeks	Weeks, months or years
Blood loss/dilution Bleeding Haemolysis Dilution	**Reduced production** Haematinic deficiency Toxicities to marrow Bone marrow infiltration

Weeks/months/years - Clues from FBC

Haematinic deficiency	**Toxicity to marrow**	**Bone marrow infiltration**
Blood film	Blood film	Blood film
MCV raised	MCV raised - alcohol	Pancytopenia
B12/folate low	Reticulocytes ↓↑	
Reticulocytes ↓		

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Anaemia – by red cell size

Microcytic
Iron deficiency
Alpha/Beta thalassaemia
HbC & HbE
Anaemia of chronic disease

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Iron deficiency
Alpha/Beta thalassaemia
Anaemia of chronic disease

Microcytic anaemia

- Iron deficiency
  - Blood film
    - Rod poikilocytes, hypochromic red cells
  - Raised platelet count
  - Check ferritin
    - Expect to be low (caution with inflammation)

Weeks or months

- Alpha/beta thalassaemia
  - Possibly anaemic
  - Low MCH
  - Med/Middle Eastern/East

Lifelong

- Anaemia of chronic disease
  - Inflammatory markers
  - Renal function

Months or years

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Macrocytic anaemia

B12 and folate deficiency
Myelodysplastic syndrome
Alcohol abuse/Liver disease
Haemolytic disorder
Chemotherapy/hydroxycarbamide

- B12/folate deficiency
  - Blood film for both of above will show megaloblastic features e.g hypersegmented neutrophils

Months

- Drug effects
  - Alcohol, hydroxycarbamide, zidovudine, vitamin C deficiency
  - Blood film shows target cells if liver disease/alcohol

Months or years

- Myelodysplastic syndrome
  - An older patient
    - Blood film; Basophilic stippling, Pappenheimer bodies, Neutrophil disorders e.g Pseudo-Pelger-Huet abnormality

Months or years

- Haemolysis
  - Reticulocyte count, LDH, bilirubin, DAT (Coomb's) test
    - Blood film shows reticulocytosis, polychromasia, spherocytosis

Days/ Weeks

- Myeloma
  - Macrocytic anaemia and abnormal protein investigations

Months/ years

Reticulocytes

- Immature red cells
  - Should increase as a response to blood loss or red cell destruction
  - Will be low if either;
    - The bone marrow does not have sufficient haematinics
    - OR the marrow is infiltrated/abnormal e.g MDS

Platelets

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Platelet count - thrombocytopenia

Days or short weeks

Consumption

Sepsis

Bleeding

Reduced production

Chemotherapy

Destruction

DIC

ITP

HIT

TTP/MAHA

Weeks, months or years

Reduced production

Haematinic deficiency

Toxicities to marrow

Bone marrow infiltration

Consumption

Splenomegaly

Platelet count - thrombocytosis

Days or short weeks	Weeks, months or years
Reactive Infection/inflammation/ post-surgical	**Reactive** Iron deficiency Infection/inflammation/ bleeding Smoking **Myeloproliferative** ET (+- baso/eos) CML (+neuts,baso,eos) Myelofibrosis (+neuts,baso,eos)

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White cells

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White cell count & differential

- White cell count
  - Granulocytes – **mature** cells
    - Neutrophils
    - Eosinophils
    - Basophils
    - Monocytes
  - Lymphocytes

White cell count & differential

- Acute leukaemia
  - Usually pancytopenia
  - Often no leukocytosis
  - We will call you….

Granulocytes

- Neutropenia

Days or short weeks	Weeks, months or years
Reduced production Chemotherapy Bacterial/Viral infection	**Reduced production** Haematinic deficiency Toxicities to marrow Bone marrow infiltration or disorders **Physiological** Ethnic neutropenia

- Neutrophilia

Days or short weeks	Weeks, months or years
Reactive Infection/inflammation/ post-surgical	**Reactive** Infection/inflammation/ post-surgical Smoking **Myeloproliferative** Pattern

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Granulocytes

- Monocytosis

Days or short weeks	Weeks, months or years
Reactive Infection/inflammation/ post-surgical	**Reactive** Infection/inflammation/ post-surgical **Myeloproliferative** CMML Pattern

- Monocytopenia

Rarely clinically significant

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Granulocytes

- Eosinophilia

Days or short weeks
Reactive Infection/inflammation/ post-surgical
Weeks, months or years
Reactive Autoimmune/autoinflammatory Infective Malignant Reactive to malignancy Pattern

- Basophilia

Days or short weeks
Reactive Infection/inflammation/ post-surgical
Weeks, months or years
Almost always myeloproliferative neoplasm Pattern

- Eosinopenia, basopenia (?!)

Rarely clinically significant

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Lymphocytes

- Lymphocytosis

Days or short weeks	Weeks, months or years
Reactive Infection/inflammation/ post-surgical	**Reactive** Infection/inflammation/ post-surgical **Lymphoproliferative** CLL

- Lymphopenia

HIV but otherwise....
Rarely clinically significant

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Patterns

Acute leukaemia		Reactive states	
AML	**ALL**	**Neutropenia**	**Neutrophilia**
Days or weeks	Days or weeks	Days or weeks	Days or weeks
Pancytopenia +- blasts in blood	Pancytopenia +- blasts in blood	Previously normal	No other counts raised

Chronic leukaemia			
CLL	**CML**	**PV**	**ET**
Months/years	Months/(years)	Months/(years)	Months/(years)
Lymphocytosis	Neutrophilia Thrombocytosis Basophilia Eosinhophilia	Polycythaemia +- Neutrophilia Thrombocytosis Basophilia Eosinhophilia	Thrombocytosis +- Neutrophilia Basophilia Eosinhophilia

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Summary

- Patterns
  - Acute or gradual
- One cell line or more involved?
- Which cell line?
  - Myeloid (neuts/baso/eos/platelets/red cells) or lymphoid
- Which pathology?
  - Consumption/destruction or reduced production

Thank you

Any questions?

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