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IMPA NEWS

THE OFFICIAL NEWS LETTER OF THE INDEPENDENT MEDICAL PRACTITIONERS ASSOCIATION

FROM THE PEN OF THE PRESIDENT. . .

Dear All,

We had our much awaited 90th AGM on February 7th. I thank our executive council and the membership for electing me for the 3rd consecutive year for the presidency. I will execute the affairs of the IMPA to the best of my ability to make it a viable and sustainable institute in the modern world.

In this context while I do not plan to list and gloat over the past year I will focus on my work for the current year. Perhaps the single most important event I will focus on other than the usual CPD activity is the website and the SLDI 2020. With the help and the advice of our senior most members in the ex-co I have finally now laid down an independent plan for these affairs in the current year. As endorsed in the secretary's minutes we will undertake financially viable options for the maintenance of the website and the SLDI 2020. I plan to discuss this matter in deapth at the next council meeting planned for the 28th of February.

Dr. Ananda Perera
President IMPA

INTERPRETING A FULL BLOOD COUNT (FBC)

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Introduction

The full blood count (FBC) is the most common investigation performed in patients. It is inexpensive readily available and gives early results. When interpreted correctly specially with the patients' clinical history in mind it can give a wealth of information. The FBC is used as an initial test and will direct the physician to which tests to order next in order to prove or disprove a diagnosis. Full blood counts are also used to follow up patients to ascertain disease progression and decide on adequacy or inadequacy of treatment.

Sample collection

FBC is done on a venous sample collected into Ethylene diaminetetra acetic acid (EDTA) anticoagulant. Two ml sample of blood is adequate and no prior patient preparation is needed. Smaller volumes of blood (1ml) can be used in neonates and children. Samples can be collected with

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tourniquet application, however for the assessment of polycythemia (increased Hb) non tourniquet sample after adequate hydration of the patient is needed. FBC can be done on fasting samples if the patient is giving blood for lipid profile or blood sugar estimation at the same time.

Test method and turn around time

Previously Hb estimation and counts were done manually and the parameters given separately. However, with the use of automated analysers FBC reports are generated by automated methods by just feeding the sample into the machine. A report can be generated within 15- 20 minutes of receiving it to the laboratory in an urgent instance. Exceptions would be if there are errors or abnormalities that need to be confirmed by other methods such as manual platelet counts, blood picture examination etc. In this instance it will take longer for the laboratory to release the report. However if it is urgent the request must be made, otherwise the sample will be processed as a routine sample and the turnaround time in most laboratories is about 4 hours.

A blood picture if requested can be made from the same EDTA sample. A blood picture is usually reported by a consultant haematologist and will take 1-2 days on routine reporting depending on the policy of the laboratory. Blood pictures too can be requested urgently and can be issued within the day depending on the availability of the consultant haematologist.

Parameters in the FBC and normal ranges

The FBC will include

- Haemoglobin, red cell count, haematocrit or packed cell vlume, the red cell indices - mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH) mean corpuscular haemoglobin concentration (MCHC) and red cell distribution width (RDW)
- Total white cell count, white cell differential counts (neutrophils, lymphocytes, eosinophils, basophils, monocytes)
- Platelet count and platelet distribution width

The white cell and platelet counts will be in 10 9 /L or mm3 depending on the format of the reporting laboratory.

For example 15 x 10^9 /L total white cell count will be presented as 15 ,000/ mm^3 or 40 x 10^9 /L platelet count will be the same as 40 ,000/ mm^3 of platelets.

Normal values

	Males	Females	Males and females
Haemoglobin	13.5 - 17.5 g/dL	11.5 - 15.5 gldL	
Red cells (erythrocytes)	4.5 - 6.5 x 10^{12}IL	3.9 - 5.6 x 10^{12}IL	
PCV (haematocrit)	40 - 52%	36 - 48%	
MCV			80 - 95fL
MCH			27 - 34pg
MCHC			20 - 35 g/dL
White cells (leucocytes)			
Total			4.0 - 11.0 x $10^9/L$
Neutrophils			2.5 - 7.5 x $10^9/L$
Lymphocytes			1.5 - 3.5 x $10^9/L$
Mnonocytes			0.2 - 0.8 x $10^9/L$
Eosinophils			0.04 - 0.44 x $10^9/L$
Basophils			0.01 - 0.1 x $10^9/L$
Platelets			150 - 400 x $10^9/L$

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Interpreting individual parameters

Haemoglobin

Normal haemoglobin ranges consistent with the laboratory will be given on the report. Anaemia is defined as a low haemoglobin level for that age and sex. WHO defines a level of <12g/dl for females and < 13 g/dl for males. Depending on the Hb, anaemia can be classified as mild (9-12g/dl), moderate (6-9 g/dl) or severe (< 6 g/dl). If a patient has anaemia look at the red cell indices (MCV, MCH, MCHC) next to ascertain the morphological type. Morphological types of anaemia include hypochromic microcytic anaemia where MCV and MCH are reduced, Normocytic normochromic anaemia where MCV and MCH are normal and macrocytic anaemia where MCV is high . Causes for hypochromic microcytic anaemias include Iron deficiency anemia, Thalassaemias and thalassaemia traits ,Anaemia chronic disease, Lead poisoning and Sideroblastic anaemia. Of these the first three are the most commonly seen in routine General practice as lead poisoning and sideroblastic anaemia are rare.

Causes for normocytic normochromic anaemia are haemolytic anaemia and some cases of anaemia of chronic disease. Common causes for macrocytosis are Vitamin B12 deficiency, folate deficiency, alcoholism, hypothyroidism, myeloma and myelodysplastic syndrome. Therefore examining the red cell indices will direct you to what investigations you need to request next.

Iron deficiency on a FBC

When suspecting iron deficiency the first tests to do would be a Full Blood Count and blood picture. A FBC will show low Hb and reduced red cell indices MCV, MCH and MCHC. The red cell count will also be low and there is a proportionate reduction in RBC count and Haemoglobin. The Hb will be approximately 3 times the red cell count . For example if the red cell count is 3 x 10 12 /l the Hb is about 9 g/dl. This proportionate reduction is not seen in haemoglobinopathies (thalassemia traits) who are another common group with low MCV and MCH. Also the MCV and MCH are much lower in the thalassemia traits in comparison to iron deficiency. The red cell distribution width (RDW), a measure of variation of red cell size is increased, especially in the initial phases of iron deficiency when newly produced small hypochromic red cells coexist with normal ones. The RDW is also increased after iron therapy with production of young red cells (reticulocytes). RDWs is not affected in anaemia of chronic disease.

Recognizing Thalassemia indices on a FBC

Alpha or beta thalassemia traits can be suspected on FBC. Normal or reduced Hb will be seen with high RBC count in relation to the anemia. very low MCV and MCH and usually normal MCHC and RDW if there is no concurrent iron deficiency.

If the above indices are seen it is better to request a blood picture as well as serum ferritin and inquire of any family history of thalassemia.

Polycythemia

Polycythaemia (erythrocytosis) is defined as an increase in the haemoglobin concentration above the upper limit of normal for the patient's age and sex. There are many causes for polycythemia. Primary polycythemia or polycythemia (rubra) vera refers to a clonal proliferation of red cells and is associated with underlying genetic defects such as JAK2 V617F and Exon 12 gene mutations. The causes for secondary polycythemia are many and include smoking, alcohol consumption, chronic lung disease, cardiac disorders that cause hypoxia, renal disease, inappropriate erythropoietin secretion by tumours, familial and many more. Increased Hb will result in and increased PCV/ HCT and this can be identified on the FBC too. Due to the increased viscosity the patients will experience hyperviscocity symptoms and are at risk for arterial and venous thrombosis. Therefore it is necessary to identify polycythemia on FBC and refer for further investigation for a cause and possible venesection if the PCV is very high. , Prolonged tourniquet use can spuriously increase the PCV as will dehydration. Therefore a repeat FBC on a non tourniquet sample after adequate hydration of the patient will help confirm polycythemia.

PCV /HCT

Packed cell volume is the volume of packed cells (red cells ,white cells and platelets) as a percentage of plasma volume. It is increased in polycythemia , dehydration and plasma extravasation (as in dengue when vessel wall permeability is increased). PCV is reduced in anaemia.

The total white cell count

The total WBC gives an idea of all the white cells. Leucocytosis and leucopenia must prompt the physician to look for clue to the cause. The differential count is given as percentages of total white cell count and also as absolute counts. . If only the percentage of WBC differential count is given the absolute counts have to be determined as they have a place in clinical decision making. For example if the total WBC is 3 x 10 9/L and the neutrophil percentage is 50 % then the absolute neutrophil count is 1.5 x 10 9/L (in the mild neutropenic range).

Neutrophilia

Neutrophilia (neutrophils above 7.5 x 10 9/L) is seen commonly as a reactive increase in Bacterial infections (Resp.tract infections / UTI /

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sepsis), Inflammatory reactions (ulcerative colitis/ SLE/inflammatory arthritis), Necrotic, ulcerative processes (Appendicitis /Myocardial infarctions), Neoplastic process (as a reaction to non haemopoeitic malignancies), Acute haemolysis and haemorrhage. Other common causes of neutrophilia are Physiological increase in pregnancy, Increase with steroid treatment, smoking and increase in uremia. A CLONAL increase in neutrophils is seen in myeloproliferative disorders – Chronic myeloid leukemia, hypercelluler phase of myelofibrosis and sometimes in polycythemia vera .

Neutropenia
A neutrophil count of less than 1500/mm^3 classifies as neutropenia. It is further graded as follows according to the severity of the neutropenia. Mild neutropenia (1000 <= ANC < 1500): Moderate neutropenia (500 <= ANC < 1000): Severe neutropenia (ANC < 500):

Causes of neutropenia are include viral infections ,drugs, bone marrow infiltrative pathology ,chemotherapy, radiotherapy, hypersplenism, myelodysplasia, liver disease. Congenital neutropenia ,Cyclical neutropenia are rarer causes. Immune mediated causes include – SLE, Felty's syndrome (Neutropenia associated with RA).

The consequences of neutropenia include infections of the mouth, skin, respiratory tract and GU tract. In many patients with drug-induced neutropenia spontaneous recovery occurs within 1-2 weeks after stopping the drug .Infections are mainly bacterial in origin although fungal and viral infections are also possible. The patient has to be isolated (Do not put next to a patient with pneumonia in the General ward !!!!) barrier nursing has to be practiced, all procedures need to be sterile. The visitors need to be restricted, raw food cannot be consumed (Salads, yourgert), flowers are not allowed. If the patient develops a fever in the presence of neutropenia, all cultures must be taken and the patient started on empirical antibiotics .

Lymphocytes
Lymphocytic predominance is seen in children upto about 8 years of age. The most common cause of lymphocytosis includes viral infections : infectious mononucleosis, rubella, pertussis, mumps, hepatitis, cytomegalovirus, HIV, herpes simplex or zoster or chronic bacterial infections (tuberculosis, toxoplasmosis, brucellosis, syphilis) Clonal increase in lymphocytes is seen with chronic lymphoid leukemia and rarely with leukemic phases of Non-Hodgkin's lymphoma.

Sometimes the total count and neutrophil and lymphocyte counts are normal but a lymphocytic predominance can be seen. This is commonly seen with viral infections.

Causes for eosinophilia include Asthma, hypersensitivity reactions, allergies, drugs,parasitic infestations, fungal infections, lymphomas. Clonal – hypereosinophilic syndrome, CML, eosinophilic leukemia.

Basophilia is rarely seen on FBC but of present can be due to ulcerative colitis, hypothyroidism (myxedema) chicken pox , influenza, smallpox, tuberculosis, basophilic leukemia or myeloproliferative neoplasms (CML; polycythemia,myelofibrosis, essential thrombocytosis).

Monocytosis can be a feature in chronic infection with tuberculosis and syphilis, as part of the inflammatory reaction in Crohn's disease and ulcerative colitis and as a response to certain carcinomas. A persistent monocytosis that is unexplained, particularly if associated with anaemia or thrombocytopenia, may be a feature of myelodysplastic and myeloproliferative disorders, so a haematology assessment is advised in these cases.

Thrombocytosis
An increase in platelet count is usually associated with underlying bleeding but is also seen as a reactive increase in infection, inflammatory conditions and malignancy. If reactive causes are ruled out myeloproliferative disorders need to be excluded. (Essential thrombocytosis, Polycythemia vera, proliferative phase of myelofibrosis.

Thrombocytopenia
Low platelet counts are frequently seen on FBC. Usually thrombocytopenia is due to viral infections, drug induced or in association with liver disease. It is important to establish that the thrombocytopenia is real and confirmed on a blood film. Spurious thrombocytopenia can result from in vitro platelet clumping in ethylenediaminetetraacetic acid or due to a clot in the sample.

The two main groups of conditions causing thrombocytopenia are those associated with increased platelet consumption and those due to suppressed production. The causes of consumptive thrombocytopenia are immune mediated thrombocytopenia, hypersplenism, microangipathic haemolytic anemias. Suppressed production is due to primary haematological diseases, bone marrow infiltration, fibrosis marrow , myelodysplastic syndrome. It is important to whether the thrombocytopenia is isolated or part of a pancytopenia.

Pancytopenia
Pancytopenia is a reduction of all three cells lines

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leading to anaemia , leucopenia and thrombocytopenia. A person with pancytopenia needs prompt further investigations. Causes for pancytopenia include drugs that suppress the bone marrow, chemotherapy / radiotherapy, infiltrations of the marrow [by fibrosis (myelofibrosis), leukemia (proliferation of bone marrow blasts) infiltration by solid organ malignancies which have got deposited to the marrow), Vitamin B12 / folate deficiency and myelodysplastic syndrome. Apart from production problems, hypersplenism remains an important cause.

Flags

Sometimes messages denoting presence of abnormal cells, blasts, nucleated red cells , platelet clumps will appear. Usually the laboratory will draw a blood picture prior to releasing these reports. In the presence of circulating blasts of acute leukemia the WBC will be high because the blasts are counted as white cells. However they cannot be differentiated and therefore will appear as asterisks***** in the differential counts. The laboratory is expected to draw slides for blood picture prior to release of these reports too.

Special new parameters

More advanced and recent analyzers give additional parameters which will help physicians interpret the behaviour and production of haemopoetic cells. Outlined below are a few new parameters.

Reticulocyte count: Reticulocytes are the immediate precursors of red cells. The reticulocyte is released by the bone marrow and evolves into the mature red cell when the rNA is removed by the spleen. The reticulocyte count is therefore used to assess bone marrow function and can indicate the rate and production of RBCs. Increased reticulocyte counts are seen in haemorrhage, haemolysis or in response to haematinics. Routinely retic count is done by the manual method by supravital staining and counting but recent automated analyzers will give this parameter as well.

Reticulated Hb (RHE/CHr)

Measuring the haemoglobin content of reticulocytes, also known as reticulocyte haemoglobin (CHr) equivalent, is a way of diagnosing and monitoring iron deficiency anaemia. Changes in the Reiculocyte Hb appear before changes in the classical parameters such as Hb MCV and MCH.

The percentage of hypochromic erythrocytes

The percentage of hypochromic erythrocytes (defined as red blood cells with a hemoglobin concentration of less than 28 g/dl) has been shown to detect insufficient marrow iron supply with a fairly good accuracy.

Immature reticulocyte fraction (IRF)

This parameter shows early haematopoietic recovery post chemotherapy .It is better than the presently used parameter – granulocyte recovery as assessed by the absolute neutrophil count.

IPF(immature platelet fraction) – is a new parameter present in the more advanced analysers. It is anl indicator of the presence of immature platelets in circulation. This is a very good indicator of the marrows ability to produce platelets in patients when presenting with thrombocytopenia and will be increased in patients with immune thrombocytopenia and dengue patients in the recovery stage.

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*vs placebo in acute neck pain † Pain at rest in acute neck pain

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