

# WHAT DO THE TEST RESULTS TELL YOU?

## **Quest Laboratories Pte Ltd**

Core Lab/Administration:

67 Ubi Ave 1  
North Wing #07-09  
Starhub Green  
Singapore 408942  
Phone: 62755501  
Fax : 62770220

Satellite Lab:  
290 Orchard Road  
#16-09,  
The Paragon  
Singapore 238859  
Phone: 67372788  
Fax : 68873249

# What does your health screen report tell you?

This pamphlet serves as a guide to provide brief but useful information about your lab test results reported on your health screen. Please consult your physician for an in depth explanation and interpretation of your results.

***Please note the following points when reading this pamphlet:***

1. Your health screen report may not comprise all the lab tests mentioned in this pamphlet. Your doctor will have tailored the health screen based on your medical history and health condition.
2. The majority (about 95%) of a normal population test results will fall within the normal range. About 5% of the normal population test results may be slightly above or below the normal level.
3. It is an acceptable fact that a normal person's test results may fluctuate at different times although still within the normal range. This occurrence may be due to diet or other factors.
4. Health conditions are not conclusive based solely on laboratory test results. Lab results should correlate with your medical history and other clinical findings.

# INTRODUCTION

## Blood

### What is blood?

Blood, the dark red (venous blood) or bright red (arterial blood) fluid that flows through the human body is the transportation medium carrying all the essential components required for living e.g. oxygen, food, vitamins, etc. to all the organs of the human body.

Blood comprises three major components; Red blood cells which are produced by the bone marrow, white blood cells which are also produced by the bone marrow and certain lymphoid tissue and platelets which are produced by the fragmentation of giant cells in the bone marrow. All these components can be found floating in a liquid base known as plasma.

Plasma comprises mainly of water (about 90%), proteins (about 7%) and very small amounts of sugar, fats and mineral salts. Plasma proteins account for the stickiness of blood and are necessary for maintaining normal blood pressure. Many of the plasma proteins such as blood clotting factors, antibodies and enzymes have specialized functions.

### What are some of the major functions of blood?

1. Blood is the transport medium that carries oxygen from the lungs to the cells and carbon dioxide from the cells back to the lungs where it is expelled through normal breathing.
2. Blood also transports nourishment (in the form of glucose) obtained from food broken down in the intestines to the cells. Waste products are transported from the cells to excretory organs like kidneys where they are removed from the body.
3. Blood also serves as a temperature regulator as it can distribute heat produced by the working muscle throughout the body.
4. Blood by the action of white blood cells, antibodies and certain complex chemical substances serves as a constant bodyguard against infections and other diseases.
5. Blood by the action of platelets and proteins forms a clot and plugs up openings in the blood vessels thus stopping bleeding.

## What is Urine?

Urine is the fluid formed and excreted by the excretory system consisting of the kidney, ureter, bladder and urethra. When blood flows through the kidney, waste products, salt and excess fluids are filtered. Water and certain substances from the filtrate are reabsorbed and those portions not reabsorbed forms the urine.

Urine passes out of the kidney, through a tube called the ureter into the bladder. The bladder is used for temporary storage of the urine until it is passed out of the body through a tube called urethra.

The volume of urine excreted daily and its composition depends on the condition of the blood, kidneys, the diet and the metabolic activity of the body's cells. Urine examination is useful in the diagnosis, management and treatment of diseases.

## What is Stool?

Stool (or faeces) is the solid waste product of the digestive system. The food that we eat is digested in the stomach and then the intestines. The nutrients from food are absorbed into the body. The undigested material is stored in the large intestine and excreted from the body as stool. Stool analysis is useful in the diagnosis of intestinal tract complications and common parasitic infections.

<b>A Typical Health Screen Report</b>	
<b>Haematology</b> <ol style="list-style-type: none"><li>1. Total White Cell Count</li><li>2. Differential Count</li><li>3. Haemoglobin</li><li>4. Packed Cell Volume</li><li>5. Total Red Cell Count</li><li>6. Red Blood Cell Indices (MCV,MCH,MCHC)</li><li>7. Platelet Count</li><li>8. Peripheral Blood Film</li><li>9. ESR</li><li>10.ABO Blood Group</li></ol>	<b>Lipid Panel</b> <ol style="list-style-type: none"><li>30. Cholesterol - Total</li><li>31. Cholesterol - HDL</li><li>32. Cholesterol - LDL</li><li>33. Cholesterol/HDL Ratio</li><li>34. Triglycerides</li></ol>
<b>Renal Panel</b> <ol style="list-style-type: none"><li>11. Sodium</li><li>12. Potassium</li><li>13. Chloride</li><li>14. Glucose</li><li>15. Urea</li><li>16. Creatinine</li><li>17. Microalbumin</li></ol>	<b>Thyroid Panel</b> <ol style="list-style-type: none"><li>35. TSH</li><li>36. Free T4</li><li>37. Free T3</li></ol>
<b>Bone/joint Function</b> <ol style="list-style-type: none"><li>18. Calcium</li><li>19. Phosphate</li><li>20. Uric Acid</li></ol>	<b>Hepatitis Panel</b> <ol style="list-style-type: none"><li>38. Hepatitis Bs Antigen</li><li>39. Hepatitis Bs Antibody</li><li>40. Hepatitis A IgG Antibody</li></ol>
<b>Liver Panel</b> <ol style="list-style-type: none"><li>21. Bilirubin</li><li>22. Protein</li><li>23. Albumin</li><li>24. Globulin</li><li>25. A/G Ratio</li><li>26 . AST/SGOT</li><li>27. ALT/SGPT</li><li>28. Alkaline Phosphatase</li><li>29. GGT</li></ol>	<b>Tumour Markers</b> <ol style="list-style-type: none"><li>41. AFP</li><li>42. CEA</li><li>43. CA19.9</li><li>44. CA 125 (Female)</li><li>45. CA15.3</li><li>46. PSA (Male)</li><li>47. EBV EA IgA</li></ol>
	<b>Immunology</b> <ol style="list-style-type: none"><li>48. Rubella IgG</li></ol>
	<b>Auto-Antibody Profile</b> <ol style="list-style-type: none"><li>49. Rheumatoid Factor (RF)</li></ol>
	<b>STD Screen</b> <ol style="list-style-type: none"><li>50. VDRL (titre if reactive)</li><li>51. TPHA (ifVDRL is reactive)</li><li>52. Anti HIV</li></ol>
	<b>Urine FEME</b> <ol style="list-style-type: none"><li>53. Urine FEME</li></ol>

## **A BRIEF EXPLANATION**

### **Haematology**

#### **Total White Cell Count**

White blood cells are present in normal blood in a smaller number than red cells; the normal adult range being between 4,000 and 11,000 per  $\text{mm}^3$  of blood. White cells are capable of "eating up" bacteria and other harmful particles found in the blood, thus its main function is to act as one of the body's defenses. Some white cells are also connected with making antibodies which play an important role in providing immunity and resistance to infection. In certain conditions, the white blood cell count may be higher or lower than the normal range. The five main types of white cells present in the blood are the neutrophils, lymphocytes, monocytes, eosinophils and basophiles.

#### **Differential Count**

The differential count presents the five main types of white cells; neutrophils, lymphocytes, monocytes, eosinophils and basophiles as a percentage. Each type of white cell has its own unique function.

- Neutrophils are usually increased in acute bacterial infection
- Lymphocytes are usually increased in viral disease
- Monocytes are usually increased in some bacterial infections and monocytic leukaemias.
- Eosinophils are usually increased in allergic conditions and when intestinal parasites are present.
- Basophiles are usually increased in association with hypersensitivity and allergic responses.

#### **Haemoglobin (Hb)**

The red blood cell contains a protein called haemoglobin (Hb). Hb consists of an iron-containing red pigment (haem) combined with a protein substance (globin). Hb gives the red cells their colour and their ability to take up oxygen from the lungs which is then delivered to the tissues where it is needed. Iron is the key raw material required by the body to keep the production of Hb up to the normal rate. A good source of iron is from food (meat, liver, eggs, wholemeal bread and green vegetables).

A person is considered anaemic if the Hb falls below the normal range. Severe anaemia can lead to many conditions including heart failure. Anaemia can be caused by: a) loss of blood through bleeding, b) deficiency of iron from food, c) decreased production of red blood cells and d) hereditary disease such as thalassaemia.

#### **PCV (Packed Cell Volume)**

PCV measures the amount of red cells to the volume of the whole blood sample. It is a useful test for the evaluation of haematological disorders such as anaemia and other conditions.

## **Total Red Cell Count**

Red blood cells transport oxygen from the lungs to various tissues of the body. These cells also carry back carbon dioxide to the lungs to be exhaled. The total red cell count gives an approximation of the number of red cells circulating in the blood. A reduction in their number results in decreased oxygen carrying capacity and this condition is called anaemia. A significant increase in red blood cell count is related to a disease called polycythemia.

## **Red Blood Cell Indices**

### **MCV (Mean Corpuscular Volume)**

MCV measures the average volume of a red cell in an individual's blood. It is an index calculated from the PCV and total red cell count. It is useful as an aid in classifying anaemias.

### **MCH (Mean Corpuscular Haemoglobin)**

MCH is an index that measures the weight of haemoglobin in a red cell of an individual sample. It is useful as an aid in classifying anaemias.

### **MCHC (Mean Corpuscular Hb Cone.)**

MCHC is an index that expresses the amount of haemoglobin in the red cells relative to the size of the cells. It is useful as an aid in classifying anaemias.

### **Red Cell Distribution Width (RDW)**

The red cell distribution width is a useful indicator of erythrocyte population ratio in peripheral blood; for instance, it helps to evaluate the therapeutic effect of transfusion therapy for anaemia and to discriminate between thalassemia and iron deficiency anaemia

## **Platelet Count**

Platelet is another cellular component of blood. Platelets are fragments of the cytoplasm from a large cell called megakaryocyte found in the bone marrow. Platelets play an important role in the clotting of blood and prevention of bleeding. They help stop bleeding by forming a sticky plug to seal vessel walls and also help initiate a series of enzymatic reactions which result in the formation of the blood clot. Platelet count is an important test used to investigate bleeding disorders to assess clotting ability or to monitor drug treatments. An increase in the platelet count may occur in conditions such as polycythemia or after splenectomy. A decrease in the platelet count below normal level is seen in patients with dengue haemorrhagic fever and may occur in leukaemia, some anaemia and certain blood disorders or following chemotherapy and radiation therapy.

## **Peripheral Blood Film (PBF)**

Peripheral blood film is a thin smear of blood made on a glass slide and stained with special dyes to be examined by a medical technologist using the microscope. It allows visual estimation of Hb and the overall picture of blood cells. Changes in size, shape and structure of individual RBCs and WBCs can be identified. These changes may have diagnostic significance in certain diseases. Immature forms of blood cells which are especially significant in cases of leukemia can also be identified. Overall, the PBF provides useful information on hematological blood disorders such as anaemia and leukaemia.

## **ESR (Erythrocyte Sedimentation Rate)**

As blood is made up of cells suspended in a liquid called plasma, the ESR measures the distance the cells will fall (sedimentation) in a fine tube held vertically for one hour. ESR is influenced by two main factors:

1. **Properties of the Red Blood Cells:** Changes in the size, shape and number of red cells due to certain disease will affect the sedimentation rate.
2. **Properties of the Plasma:** The amount and type of plasma protein present in a blood sample may affect the ESR. If protein levels are raised, the sedimentation rate may be increased.

ESR is not a specific test for any particular disease. It is used as a screening test for general indication of inflammation. ESR may be helpful in confirming or following the course of inflammatory or other diseases. As a high ESR reading is indicative of an inflammatory process, further investigations may be required to confirm a diagnosis. However it is not uncommon for pregnant women to have elevated ESR readings.

## **Blood Group**

There are two commonly used blood group systems:

### **The ABO and Rhesus Group.**

Under the **ABO Group** there are four main groups of blood: **A**, **B**, **AB** and **O**. Every human being belongs to one of these groups. In Singapore, approximately 45% of the population belongs to group **O**. 25% group **A**, 25% group **B** and 5% group **AB**. The **Rhesus (Rh)** blood group is the second most important human blood group system. The major antigen (active part) in the Rhesus system is called the D antigen. Red blood cells that possess the D antigen are called **Rh (D) Positive** and those lacking the D antigen are called **Rh (D) Negative**.

## **Hb Electrophoresis**

Haemoglobin electrophoresis is a test that measures the different types of the oxygen-carrying substance (haemoglobin) in the blood.

### **Why is the test performed?**

You may have this test performed if your healthcare provider suspects that you have a disorder caused by abnormal forms of haemoglobin (hemoglobinopathy).

Many different types of haemoglobin (Hb) exist. The most common ones are HbA, HbA<sub>2</sub>, HbF, HbS, HbC, HbH, and HbM. Healthy adults only have significant levels of HbA and HbA<sub>2</sub>.

Some people may also have small amounts of HbF (which is the main type of haemoglobin in foetus). Certain diseases are associated with high HbF levels (when HbF is more than 2% of the total haemoglobin).

HbS is an abnormal form of haemoglobin associated with sickle cell anaemia. In people with this condition, the red blood cells are crescent or sickle in shape. These malformed cells then break down and block small blood vessels.

HbC is an abnormal form of haemoglobin associated with haemolytic anaemia. The symptoms are much milder than in sickle cell anaemia.

## **Renal Panel**

### **Sodium**

Sodium is an electrolyte that regulates the body's volume of water and is conserved in the kidneys. Increased sodium levels can be seen in dehydration, diabetes insipidus and other conditions. Decreased levels can be seen in severe diarrhoea, kidney disease, uncontrolled diabetes and other conditions.

### **Potassium**

Potassium is also one of the electrolytes excreted by the kidney. Increased levels of potassium can cause a decrease in muscle function and this may occur in circulatory failure such as shock and kidney failure. Decreased levels of potassium may be due to low intake of potassium, vomiting, diarrhoea or use of diuretics. Abnormally high or low levels of potassium outside of normal limits can be dangerous as it can affect muscle function, particularly heart function.

### **Chloride**

Chloride is an electrolyte that usually mirrors levels of sodium in blood. The level of chloride will increase in dehydration or in loss of carbon dioxide by over breathing (hyperventilating). Low levels of chloride may be seen in uncontrolled diabetes, excessive vomiting and in kidney disease.

### **Glucose**

Glucose is the main carbohydrate in the blood used for energy by the body's cells. The level of blood glucose is influenced by food intake. Glucose in adequate levels is essential for normal body functions. Its level is controlled by the action of a hormone known as insulin, is produced by the pancreas. A high level of glucose above the normal range is indicative of diabetes. Another test, Glucose Tolerance Test (GTT) is usually performed to help confirm diagnosis of diabetes.

### **Urea**

Urea is the main end product of protein metabolism in the body and is excreted by the kidneys. Concentration of urea is influenced by the amount of protein digested, diet, hormones and kidney function. Increased levels of urea may be due to kidney disease or after administration of steroids. Slightly increased levels may be due to a high protein diet. Low levels may be seen in normal pregnancy or due to decreased intake of protein.

### **Creatinine**

Creatinine is a waste product of creatine phosphate, a substance stored in the muscle and used for energy. Creatinine is excreted by the kidneys and is not affected by diet or hormones. An increase in creatinine level is often associated with kidney disease.

### **Microalbumin**

Kidney function may be assessed through measurement of albumin levels in the urine. Kidney malfunction occurs when the capillaries in the kidney become blocked, causing waste products to remain in the blood and important proteins are lost from the blood into the urine. Kidney deterioration is progressive and begins with small amounts of albumin leaking into the urine. This is known as microalbuminuria and indicates early signs of nephropathy. The term 'micro' refers to low concentrations of urinary albumin. Progression of kidney disease will lead to larger amounts of albumin leaking into the urine which may develop further to end stage renal disease. Kidney disease is a major concern in diabetes patients and early detection and treatment may slow the onset and progression of the condition.



## **Bone / Joints Function**

### **Calcium**

Calcium is an important mineral necessary for good health. Calcium is essential for proper bone and teeth formation. It is necessary for proper blood clotting as well as muscle contraction. Calcium balance is influenced by Vitamin D, parathyroid hormone and calcitonin. These hormones control the dietary absorption of calcium as well as its excretion by the kidneys and its movement in and out of the bone. One of the common causes of high calcium level is bone diseases as well as excessive presence of Vitamin D. Low levels of calcium may be due to Vitamin D deficiency, poor absorption due to malnutrition and kidney disease.

### **Phosphate**

Phosphate is also an important mineral necessary for good health. A high level of phosphate is associated with bone disease. Children have higher levels than adults because their bones are growing at a faster pace and they have higher levels of growth hormone which influence the level of phosphate. Poor diet and alcoholism can lower the level of phosphate.

### **Uric Acid**

Uric acid is formed from the breakdown of nucleic acids and is excreted by the kidneys. It has low solubility and tends to precipitate as uric acid crystals. High level of uric acid will lead to gout, a disease where uric acid crystals are deposited in tissues and joints causing pain. High uric acid levels can also lead to kidney disease and formation of urinary stones. High protein diet and alcohol intake are known to increase the level of uric acid.

## **Liver Panel**

### **Total Bilirubin**

Bilirubin is a waste product from the breakdown of haemoglobin. It is formed in the liver and excreted in the bile. High levels of bilirubin in the blood will cause jaundice resulting in a yellowness of the skin and the white part of the eyes. High levels are associated with liver disease and haemolytic anaemias.

### **Total Protein (TP)**

Total protein is comprised of albumin and globulin, produced mainly by the liver. Common causes of high total protein level include chronic liver disease, dehydration, chronic infection and alcoholism. Low levels may be caused by severe liver disease, malnutrition and chronic renal failure.

### **Albumin**

Albumin acts as a transport protein for some drugs and a few other substances. Decreased levels may occur in liver disease, starvation and protein loss.

### **Globulin**

Globulin forms the main transport system for various substances as well as a constituent of the antibody system that fights infections. High levels could be due to liver disease, infections, chronic illness and sometimes multiple myeloma. Low levels are usually linked to malnutrition.

### **A/G Ratio (Albumin/Globulin)**

This ratio is used to evaluate the state of liver as well as the kidney. A low ratio is indicative of liver damage.

### **SGOT (AST)**

SGOT is an enzyme present in the cells of many organs such as the liver, heart, skeletal muscle and blood cells. High levels of SGOT in the blood are often associated with episodes of cell destruction in organs such as acute myocardial infarction (heart attack) and hepatitis.

### **SGPT (ALT)**

SGPT is an enzyme usually found in the liver. Damage to liver cells causes large amounts of the enzyme to be released into the blood stream.

### **Alkaline Phosphatase (ALP)**

ALP is an enzyme present in the bone and liver. High concentrations are found in children with growing bones. In adults, high levels are often seen in bone disease and liver disorders.

### **Gamma GT (GGT)**

This enzyme is present in the liver as well as other tissues. Damage to liver cells causes large amounts of the enzyme to be released into the blood stream. Very high levels are seen in alcoholic cirrhosis and other serious liver disorders.

## **Lipid Panel**

### **Total Cholesterol**

Cholesterol is an important component in the blood used by the body for several essential functions. The level of cholesterol is influenced by the person's diet and increased production by the liver. Excessive intake of cholesterol rich food, such as animal fat and egg yolk, may result in increased levels of cholesterol, leading to a condition known as atherosclerosis. When atherosclerosis occurs, the fats are deposited on the inner walls of blood vessels causing blood vessels to narrow. These deposits may cause a blood clot which might block blood supply to vital organs resulting in a stroke or heart attack. High cholesterol is seen in hypercholesterolemia, kidney disease, hypothyroidism, primary biliary cirrhosis and diabetes. Very low levels of cholesterol may not be beneficial suggesting other medical conditions. Two important fractions of cholesterol known as HDL and LDL cholesterol are described below.

### **HDL (High Density Lipoprotein)**

#### **Cholesterol**

HDL Cholesterol is known to be the 'good' cholesterol as it helps remove cholesterol from the tissue and transport it to the liver for harmless excretion. A high level of HDL cholesterol lowers the risk of atherosclerosis. A low level increases the risk of atherosclerosis and coronary artery disease.

### **LDL (Low Density Lipoprotein)**

#### **Cholesterol**

This is the 'bad' cholesterol as it transports cholesterol to be deposited as fat on the walls of blood vessels. An increase in LDL cholesterol is associated with increased risk of coronary artery disease.

### **Cholesterol/ HDL Ratio**

This ratio is derived from the Total Cholesterol value divided by the HDL Cholesterol value. It is a useful indicator to assess the risk factor of heart attack. Higher ratio (above normal range) indicate a higher risk of heart attack while lower ratios mean lower risk.

## **Triglycerides**

Triglycerides are a type of fat found in the fat tissue of the body. They are converted from excess calories and stored in fat tissue providing a major source of energy for the body. Consumption of food rich in animal fat and alcohol are known to elevate the triglyceride level. Very high levels are associated with obesity and coronary risk. Moderately elevated triglyceride levels are found in pregnancy and in some women taking certain hormones and contraceptives.

## **Diabetes Panel**

### **HbA1c**

HaemoglobinA1c(HbA1c), a diabetes marker, can be used for monitoring the long term care of persons with diabetes.

The level of HbA1c is proportional to the level of glucose in the blood and has been widely accepted as an indicator of the mean daily blood glucose concentration over the preceding two months. Recent studies have shown that the regular measurement of HbA1c leads to changes in diabetes treatment and improvement of metabolic control is indicated by lowering of HbA1c values.

## **Thyroid Panel**

### **TSH (Thyroid Stimulating Hormone)**

TSH is produced by the pituitary gland and controls the activity of the thyroid gland. Being the reverse of other indicators, a high level is seen in hypothyroidism and low level is seen in hyperthyroidism.

### **Free T4**

Free T4 is a hormone produced by the thyroid glands. Thyroid gland dysfunction will affect the levels of Free T4. It plays an important role in regulating the metabolic processes of the body. High levels are seen in a condition known as hyperthyroidism with associated tremors, tiredness, weight loss, sweating and anxiety. Low levels, due to reduced production of Free T4 will lead to a condition known as hypothyroidism with features such as slow mental activity, mood depression, lethargic appearance, physical slowness and weight gain.

### **Free T3**

Free T3 is a hormone produced by the thyroid glands. Thyroid gland dysfunction affects the Free T3 levels. It plays an important role in regulating the metabolic processes of the body. High levels are seen in a condition known as hyperthyroidism with associated tremors, tiredness, weight loss, sweating and anxiety. Low levels, due to reduced production of Free T3, will lead to a condition known as hypothyroidism with features such as slow mental activity, mood depression, lethargic appearance, physical slowness and weight gain.

## **Hepatitis Panel**

### **Hepatitis B Surface Antigen - HBsAg**

When a person is exposed to Hepatitis B viral infection, the HBsAg will appear after about three weeks. This antigen will remain in the blood for about 4 to 5 months where it will disappear (return to negative) after recovery takes place. In certain cases HBsAg will persist for very long periods (6 months to years) before it disappears. People in this group are known as suffering from chronic Hepatitis B if the liver enzymes continue to remain high. However, there are cases where there is no recovery at all even though the liver enzymes return to normal. Such groups are known as carriers of hepatitis B and the HbsAg will always be positive. Both groups are known to have a higher risk of contracting liver cancer.

### **Hepatitis B Surface Antibody - HBsAb**

When HBsAb is positive, it indicates that a person has fully recovered from exposure to a Hepatitis B viral infection. A positive result could be due to successful immunisation against the virus. Even after immunization, the level of HBsAb will drop over a period of time and if the level falls below 10mIU/ml, a booster dose is highly recommended to ensure protection against the virus.

### **Hepatitis A IgG Antibody - HAV IgG Ab**

A positive test indicates either a recent or past infection. The test does not differentiate between the two. The cause of Hepatitis A infection is due to consumption of food or drinks contaminated with faecal matter from people infected with the virus. Generally, Hepatitis A infection is less serious than Hepatitis B and almost everyone will recover from the infection. Those who recover will have positive HAV IgG Ab and will be immune against the virus.

## **Tumour markers**

### **Alpha Fetoprotein - AFP**

AFP is an oncofetal protein formed in the foetal liver and the yolk sac. In normal adults the level is very low or negligible. High levels are seen in liver cancer and germ cell tumours of the testes and ovary. Not all cases of liver disease will show high levels of AFP. It is normal and common to see high levels of AFP in pregnant women as the level will vary with the advancement of pregnancy. The AFP test is also performed on pregnant women to screen for congenital defects.

### **Carcinoembryonic Antigen - CEA**

CEA is an oncofetal protein that is found in abundance in foetal life but normally absent or present in very low amount in adults. It is non-tissue specific as it is produced by a variety of cancers including cancers of the gastrointestinal tract, pancreas, lung, breast, ovary and cervix. If the level is high the test should be repeated. Raised serum levels may however be present in benign diseases including inflammatory bowel disease, cirrhosis, pneumonia, pancreatitis and smokers. This index of suspicion is also useful for the early detection of tumour recurrence and spreading.

### **CA 19-9 (Cancer Antigen 19-9)**

Serum CA 19-9 levels are raised in up to 80% of patients with pancreatic cancer, in 54-89% with stomach cancers and 64% with colorectal cancers. Occasionally, serum levels may be raised in benign diseases like acute and chronic pancreatitis, cystic fibrosis, inflammatory bowel disease and hepatobiliary tract disease. However, in benign diseases, CA19.9 does not usually exceed 100 U/ml.

### **CA 125 (Cancer Antigen 125)**

CA 125 is a glyco protein that is produced by many ovarian cancers. CA 125 levels above 35 ng/ml are detected in 20-40% of patients with Stage I & II ovarian cancers and 96% of patients with Stage III and IV of the disease. Less commonly, levels may be raised in patients with cancers of the gastrointestinal tract, breast, cervix, endometrium and fallopian tube. Raised levels may be present in benign conditions like endometriosis and peritoneal inflammation. CA 125 is also useful for monitoring patients for response to treatment and for tumour recurrence.

### **CA 15.3 (Cancer Antigen 15.3)**

CA 15.3 when used in conjunction with other clinical and diagnostic procedures is useful for monitoring the course of disease and therapy in metastatic breast cancer.

### **Prostate Specific Antigen - PSA**

PSA is produced in the prostate gland and useful in the diagnosis for prostate cancer as well as for monitoring patients for tumour recurrence and spreading. Normally, very little PSA is found in the blood. An increase in PSA levels may be due to benign prostatic hypertrophy, prostatitis and/or prostate cancer.

### **EBV EA IgA**

The EBV test is specifically designed for differentiating nasopharyngeal carcinoma (NPC) patients from normal patients. The test consists of 4 highly NPC-specific polypeptides to aid the determination of human immunological response to NPC. The specificity and sensitivity are both above 95%. It should be noted that for diagnostic purpose, the positive result obtained must be correlated with other clinical and laboratory findings. Absence of antibodies does not exclude the possibility of NPC.

## **Immunology**

### **Rubella IgG**

Rubella is a member of the togaviridae family. Primary infections are generally mild with symptoms such as a mild rash, low-grade fever and lymphadenopathy. In contrast, primary infections during pregnancy can pass transplacentally to the foetus and can lead to fetal death or congenital rubella syndrome (CRS); the risk of foetal infection is greatest during the first trimester of pregnancy. Babies born with CRS typically exhibit low birth weight, deafness, eye disease, mental retardation and cardiac abnormalities.

## **Auto-Antibody Profile**

### **Rheumatoid Factor (RF)**

Arthritis is an inflammation of the joints and can occur in several diseases. Common among these are gout, rheumatic fever and rheumatoid arthritis. Rheumatoid arthritis is an inflammatory disease affecting mainly the joints of the hands and feet. About 80% of adults with rheumatoid arthritis have high levels of RA Factor and will show a positive result. Weak positive or false-negative results may be due to early or chronic stages of the disease.

## **STD (Sexually Transmitted Disease) Screen**

### **VDRL**

The VDRL test is performed to detect a syphilis infection and will only be reactive from 2 to 4 weeks (or longer in certain cases) after initial infection. The VDRL test is not a specific test for syphilis as other conditions such as viral or bacterial infections, malaria, rheumatoid disease, yaws and autoimmune diseases are also known to give false positive reactions. If the VDRL test is reactive (positive) a confirmatory test, TPHA must be performed to confirm syphilis infection.

### **TPHA**

TPHA test is done only when a VDRL test is positive and is a test performed to confirm a syphilis infection. A diagnosis of syphilis can only be confirmed when both the TPHA and VDRL tests are positive.

### **HIV Antibody**

There is an interval of about 2 to 5 weeks (sometimes longer) after the initial exposure before the HIV Antibody becomes detectable. A positive HIV screening test must be confirmed by a more specific test called HIV by Western Blot. The presence of the HIV antibody indicates exposure to a HIV virus infection and the antibody is not protective against the disease. A person with positive HIV antibody can remain well for many years before the onset of the disease AIDS.

## **URINALYSIS**

### **Urine Chemistry**

#### **Specific Gravity**

The specific gravity of the urine indicates the amount of dissolved solids in the fluid. The specific gravity is a convenient way of measuring the concentrating and diluting function of the kidney.

#### **Nitrite**

The presence of nitrite on the dipstick indicates that large amounts of bacteria are present in the urine.

#### **pH**

The urinary pH is a measure of the amount of free hydrogen ions excreted by the body. Changes in pH depend largely on the acid-base composition of the blood. A pH below 7.0 indicates acidic urine, and a pH above 7.0 indicates alkaline urine. The pH of urine may change with diet, medication, kidney disease and metabolic diseases such as diabetes mellitus.

#### **Protein**

The presence of protein in the urine in quantities sufficient to be detected by most screening tests is an indicator of renal disorders (kidney disease). Protein is usually not present in normal urine, but small amounts may be present after strenuous exercise or severe emotional stress. A trace of protein is also quite common in women's urine.

#### **Glucose (Sugar)**

Routine screening of urine samples for the presence of glucose is included in the basic examination for any patient for the primary purpose of detecting diabetes mellitus. However, glucose in the urine may also be found in other causes such as recent ingestion of large amounts of carbohydrates or impaired renal tubular activity eg. ability of the renal tubule to reabsorb glucose is decreased.

### **Ketones**

When the liver metabolises fats incompletely, ketones are excreted in the urine. Any condition which increases metabolic demand and is accompanied by reduced carbohydrate intake can produce ketones in the urine. Ketones may be present in diabetes, acute starvation or fasting.

### **Urobilinogen**

Urobilinogen is one of the substances produced by the breakdown of bilirubin. Urobilinogen appears in the urine in increased amounts in individuals with haemolytic disease or liver problems. Urobilinogen levels in the urine are used as a sensitive gauge of liver damage and provide assistance in the differential diagnosis of the cause of jaundice.

### **Bilirubin**

The presence of bilirubin in the urine is just as significant as jaundice in the detection of liver disorders. Bilirubin may appear in the urine before jaundice becomes visible. It may also be found in the urine in liver disorders that do not produce recognizable jaundice. Screening is useful as increased bilirubin does not occur with haemolytic jaundice but usually accompanies obstructive or hepatic jaundice.

### **Blood**

Blood is detected in the urine in the form of free haemoglobin. When extensive or rapid destruction of red cells takes place in the circulation, the body cannot metabolize or store the excessive amounts of haemoglobin released, it finally appears in the urine when the concentration exceeds the kidney threshold. However be wary of contamination from menstruation.

### **Urine Microscopy**

#### **White Blood Cell -WBC**

Normal urine may contain up to 4-5 WBCs on microscopic examination. Increased numbers of WBC in the urine indicates an acute infection at some point in the urinary tract. Infection can be diagnosed by doing a urine culture test.

#### **Red Blood Cell - RBC**

Normal urine may contain up to 2-3 RBCs on microscopic examination. Presence of a large amount of RBCs indicates urinary tract and renal disease or trauma. Strenuous exercise can also result in a high RBC count.

#### **Epithelial Cells (EC)**

The few epithelial cells routinely found in normal urine represent the sloughing off of aging tissue. Most frequently, these are squamous cells originating from the superficial layers of the urinary tract or vagina and have no pathologic significance. The presence of renal cells from the lining of the kidney, ureters or bladder indicates pathologic or inflammatory conditions in the upper urinary tract. Large numbers of renal ECs strongly suggest active degeneration of the kidney tubules. High counts in urine from women may be due to contamination from vaginal discharge.

#### **Casts**

Casts are formed when protein accumulates and precipitates in the kidney tubules and is washed into the urine. The presence of increased numbers of any type of cast in the urine usually accompanies an increase in protein and indicates renal disease. Presence of a few casts may be seen in the urine of a normal person after exercise.

## **Crystals**

Crystals in the urine are usually not present at time of voiding but form as the specimen stands and cools. The formation of crystals is influenced by the pH and temperature of the urine. Although most crystals have no health significance, there are some rare crystals which appear because of certain amino acid metabolic disorders and in patients taking sulfa drugs or other medications that are not very soluble. Presence of crystals in large amounts and for prolonged periods may lead to formation of kidney stone.

## **Bacteria**

Bacteria in a urine specimen may or may not be significant depending on how the urine was collected and how soon after collection it was examined. The presence of large numbers of bacteria in fresh urine is definitely abnormal. Significant numbers of bacteria reported upon microscopic examination suggest the presence of infection.

## **Mucus Threads**

Mucus threads are usually present in small numbers. Increased numbers are indicative of chronic inflammation of the urethra and bladder.

## **Yeast**

Yeast can occur as a common contaminant from skin and air. *Candida albicans* is a common urinary finding in patients with diabetes mellitus.

## **Stool Analysis**

### **Stool FEME (Microscopy)**

Stool FEME is useful for the detection and identification of some parasites eg. protozoa, eggs, larvae and worms. A positive result indicates the presence of the parasite but does not necessarily indicate that it is the cause of any symptoms. Some strains of protozoa are nonpathogenic and cause little or no illness. Cautions: Examination of a minimum of three specimens is required for the detection of >90% of some protozoal infections especially giardiasis.

### **Stool OB (Occult Blood)**

Stool occult blood is used for the detection of blood in the stool from whatever cause whether benign or malignant. The presence of occult blood indicates bleeding from the guts, however, certain foods such as red meat, turnip and cauliflower are known to cause a false positive result. Patients should be advised not to eat red meat for 3 days before collecting specimens. Piles (haemorrhoids) may also give a false positive result.



## **PAP Smear / Thinprep**

Women conscientiously care for their families' health but don't always take time to look after themselves.

**A simple smear test performed regularly could save your life!**

### **What is a Pap smear?**

It is a simple test done in doctor's surgery, in which cells are removed from the neck of the womb or cervix. The cells are examined under a microscope to check for any changes or abnormalities which could lead to cancer.

### **How often should a PAP smear be done?**

Routinely every 1 to 2 years following onset of sexual activity until the age of 70 years but more frequently on your doctor's advise or recommendation.

### **Does it hurt?**

No. There may be slight discomfort if you feel tensed up but it is not painful.

### **At what age should a woman start having smear?**

All females who are sexually active.

### **Is there room for improvement for the Pap smear?**

Yes. The smearing action causes uneven layering, crowding and overlapping of cells, making it difficult to see all the cells. In addition, studies have demonstrated that majority of cell material may not transfer to the slide and may be discarded with the sampling device.

### **How is the Thinprep PAP test different?**

The cells are still collected in the same way; there is no additional discomfort. Instead of smearing the cells on a glass slide, the doctor will rinse the cells into a vial filled with a preservative solution. This method ensures that the cells are completely released into the liquid, capturing virtually all the cells.

### **Is there proof the Thinprep PAP test is more effective?**

The Thinprep PAP test was developed to address many of the inherent pitfalls associated with the PAP smear. Studies around the world have proven the Thinprep Test to be more accurate than the conventional cervical smear.

### **What if it is an Abnormal smear?**

Mild and most abnormalities do not indicate a serious problem, so do not be afraid to have the test. **Early stage cancer is potentially curable when treated promptly and appropriately.**

### **Reporting System**

We use the BETHESDA classification which is recommended by WHO.