

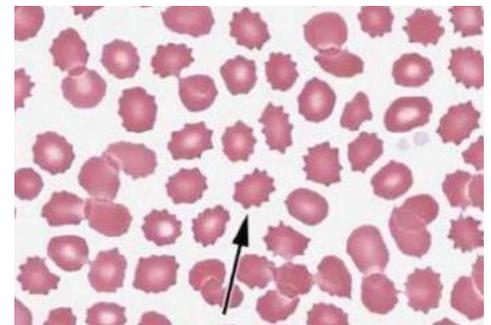
Abnormal Erythrocytes Morphology

There are abnormalities that might happen to the shape of the RBCs, referred to as **Poikilocytosis**, which is the term for abnormally shaped red blood cells in the blood. Poikilocytes may be flat, elongated, teardrop-shaped, crescent-shaped, sickle-shaped, or may have pointy projections, or other abnormal features. It is necessary to know about the different types of poikilocytosis and common causes of early diagnosis and treatment.

In several different disease causes changes in shape and number of RBC, which lead to lose erythrocyte the specific features that important in the vital roles of RBC, it include:

1- Echinocytes:

These are a form of red blood cell that has an abnormal cell membrane characterized by many small, evenly spaced thorny projections. A more common term for these cells is **burr cells**.



Echinocytes

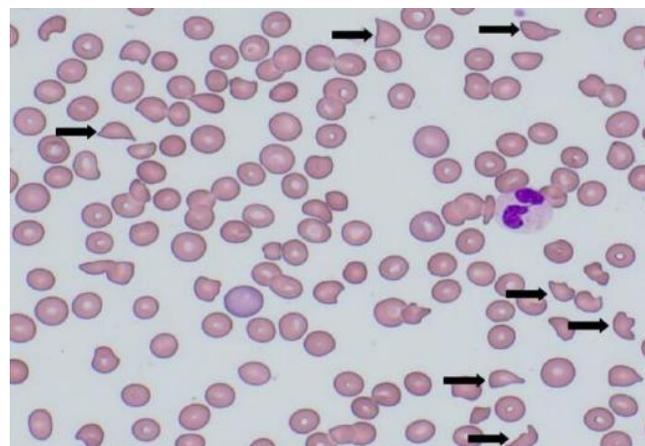
We can see this shape of RBC during

- Uremia and chronic kidney disease
- Liver disease (e.g., cirrhosis)
- pyruvate kinase deficiency
- hypophosphatemia
- hyperlipidemia
- Phosphoglycerate kinase deficiency
- Disseminated malignancy
- Myeloproliferative disorders
- Vitamin E deficiency

2- Schistocytes:

These are typically irregularly shaped, jagged, and have two pointed ends. Several diseases, including disseminated intravascular coagulation and thrombotic microangiopathies, generate fibrin strands that sever red blood cells as they try to move past a thrombus, creating schistocytes, can see it by:

- hemolytic anemia
- artificial heart valves
- hemolytic uremic syndrome
- thrombocytopenic purpura

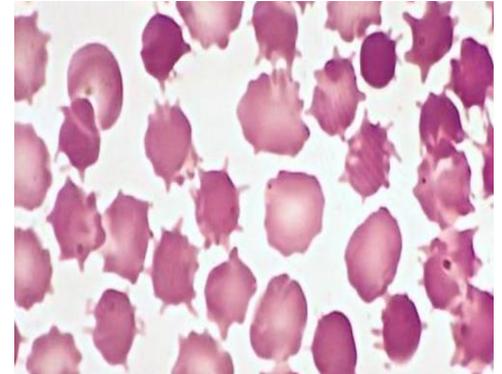


Schistocytes

3- Acanthocytes:

These are abnormal red blood cells with spikes of different lengths and widths unevenly positioned on the cell surface. Acanthocytes are found during the following conditions:

- severe liver disease
- malnutrition
- hypothyroidism
- abetalipoproteinemia (a rare genetic disease involving an inability to absorb some dietary fats)
- Splenectomy (spleen removal)
- Anorexia nervosa



Acanthocytes

4- Degmacyte (Bite cell).

When a red blood cell has circular portions called "bites" resulting from the mechanical removal of denatured hemoglobin during splenic filtration as red cells attempt to migrate through endothelial slits from splenic cords into the splenic sinuses. Bite cells are known to be a result from processes of oxidative hemolysis, such as **Glucose-6-phosphate dehydrogenase deficiency**.

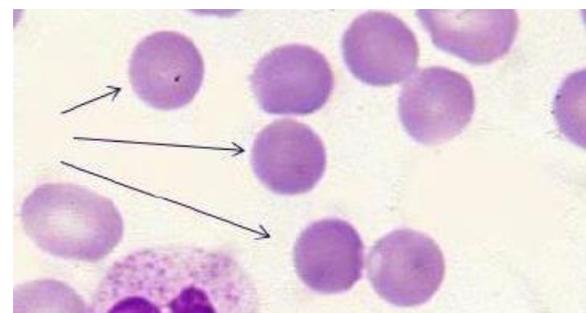


Bite cell

5- Spherocytes:

They are erythrocytes which have assumed the form of a sphere rather than the normal discoid shape and appear pale. They can be seen during:

- 1- Transfused or stored red blood cells
- 2- immune-mediated hemolytic anemia

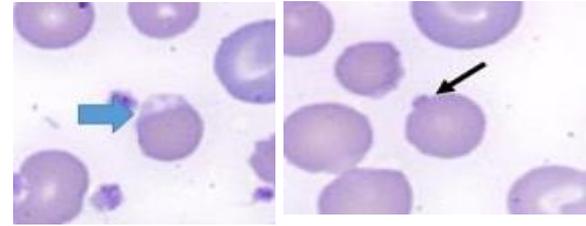


Spherocytes

6- Eccentrocytes (Heinz bodies) are RBCs that appear in a peripheral blood smear to have their hemoglobin shifted to one side of the cell. This is induced by oxidative damage; they are seen in association with Heinz bodies, which provide evidence of an oxidant effect on hemoglobin.

Eccentrocytes are seen in the following conditions:

- Oxidant-induced hemolytic anemia
- Endogenous oxidants
- Inherited enzyme defects



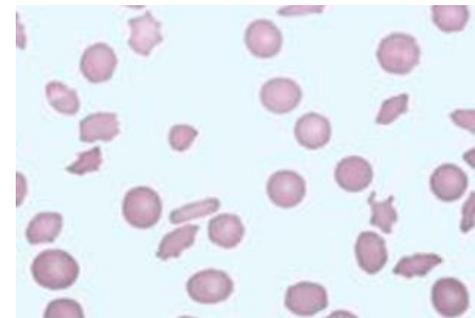
Eccentrocytes (Heinz bodies)

7- Elliptocytes:

That are elongated red blood cells. There are three types: Type I is a slightly oval-shaped cell (used to be called ovalocyte), type II is a more rounded to oval shaped cell and type III is an elongate elliptical cell.

Elliptocytes can indicate underlying diseases, which are listed below:

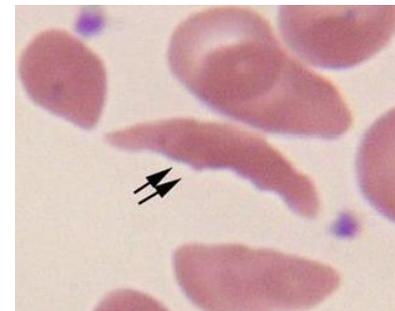
- Liver disease
- Inherited/congenital red blood cell abnormality



Elliptocytes

8- Sickle cell RBCs

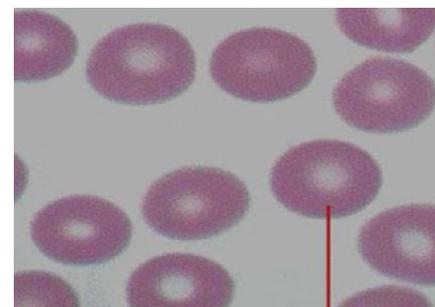
Are red blood cells that shaped like sickles or crescent moons. These rigid, sticky cells can get stuck in small blood vessels, which can slow or block blood flow and oxygen to parts of the body. That appear during Sickle cell disease.



Sickle cell

9- Hyperchromic RBCs:

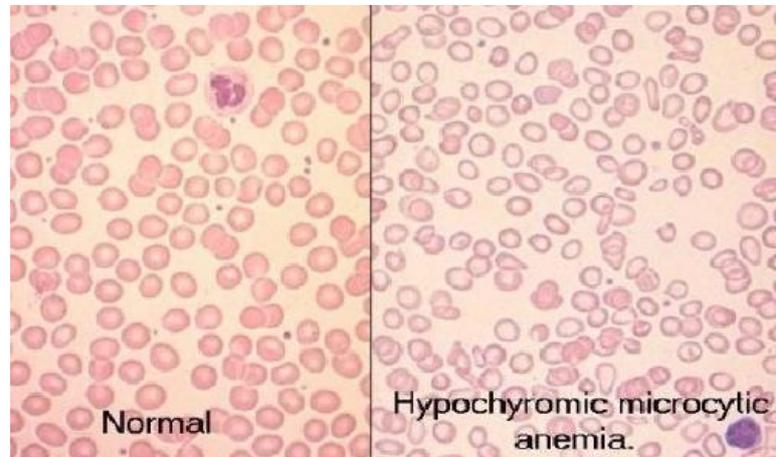
Red blood cells that have more color than normal when examined under a microscope are called hyperchromic RBC, They are also associated with Iron deficiency anemia which may be caused by a genetic condition known as congenital spherocytic anemia



Hyperchromic RBC

10- Hypochromic RBCs:

Red blood cells that have less color than normal when examined under a microscope are called hypochromic RBCs. This usually occurs when there is not enough of the pigment that carries oxygen (hemoglobin) in the red blood cells.

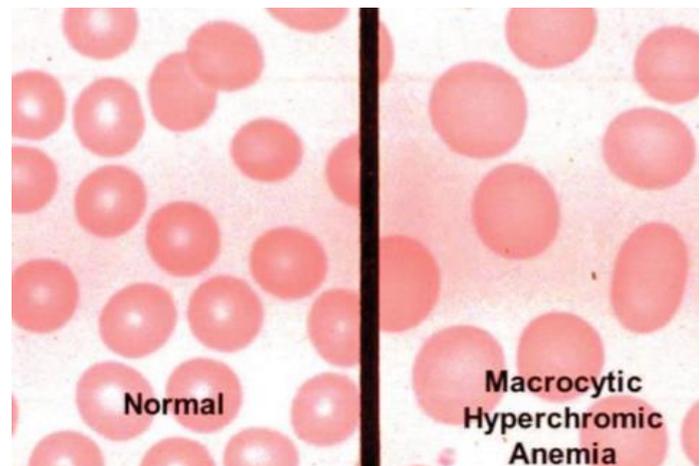


11- Macrocytic RBCs:

Red blood cells that are larger than the normal ones are called **macrocytes which are defined by a mean corpuscular volume (MCV) of greater than 100 femtolitres, they are also called megalocytes which means (big cell)**

They are associated with the following conditions:

- Megaloblastosis (vitamin B 12 deficiency)
- Hypothyroidism
- Chronic obstructive pulmonary disease (COPD)
- Liver disease
- Pregnancy (most common, and requires no treatment as the person affected will return to normal post-partum).

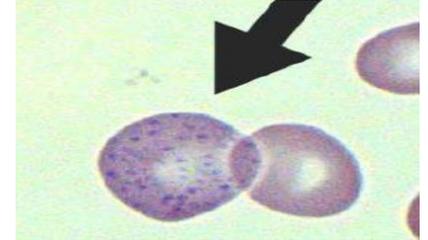


12- Basophilic stippling:

also known as **punctate basophilia**, is the presence of numerous basophilic granules that are dispersed through the cytoplasm of **erythrocytes** in a peripheral blood smear. They can be demonstrated to be RNA, They are seen in the following conditions:

- Thalassemia

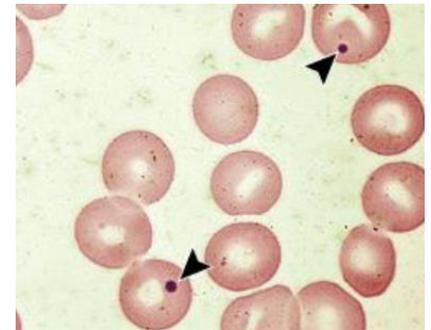
- Severe megaloblastic anemia
- Heavy metal poisoning
- Sickle-cell anemia
- Alcoholism
- Leukemia
- Hemorrhage, e.g. from gastrointestinal tract



Basophilic stippling

13- Howell jolly bodies:

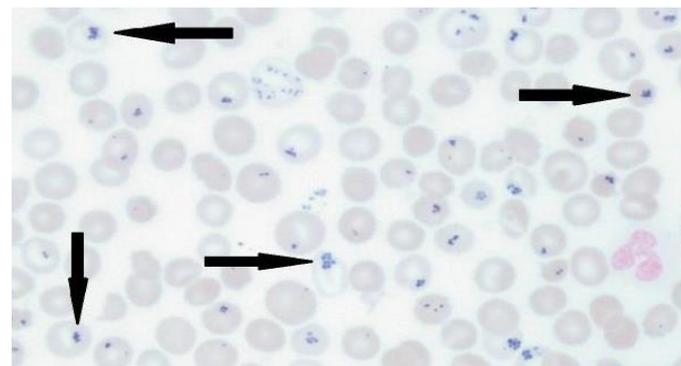
It is a cytopathological finding of basophilic nuclear remnants (clusters of DNA) in circulating erythrocytes, during maturation in the bone marrow. Its presence usually signifies a damaged or absent spleen, because a healthy spleen would normally filter this type of red blood cell, the bodies can also be seen in premature infants.



Howell jolly bodies

14- Pappenheimer bodies

Erythrocytes which contain no hemoglobin iron granules. They appear as dense blue, irregular granules which are unevenly distributed in Wright stained RBCs. Pappenheimer bodies can be increased in **hemolytic anemia, infections and post-splenectomy.**



Pappenheimer bodies

References:

- 1- Dacie and Lewis Practical Haematology" (Twelfth Edition) 2017, Pages 61-92
- 2- Muhammad M. D., Gaib B. A., Dawood, H. A., Emad. A. A., Abnormal Red Blood Cell Shapes In Different Diseases (2022). A Graduation Report Project in AL-KITAB University.

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