



HEMOLYSIS AND FRAGILITY OF RED BLOOD CELLS

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ABSTRACT:

Hemolysis means the destruction of blood cells especially red blood cells (RBCs) and the liberation of hemoglobin (Fig. 1). Fragility is nothing but the susceptibility of erythrocytes to hemolysis or tendency to break very freely is termed as fragility.

Two types of fragility is seen in RBCs such as osmotic fragility and mechanical fragility.

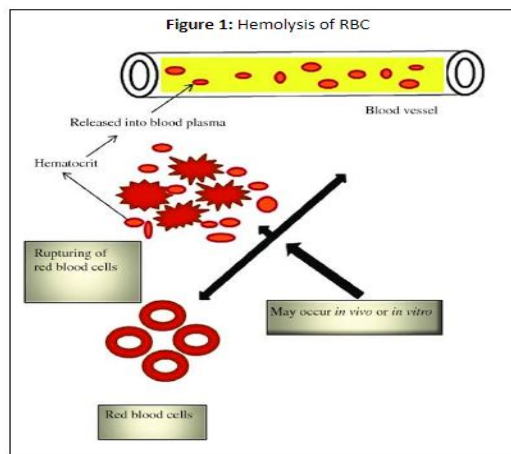
1. Osmotic fragility happens due to exposure to hypotonic saline
2. Mechanical fragility takes place due to wound or injury.

Generally the destruction of only old erythrocytes takes place in the reticulo endothelial system (RES).

Abnormal hemolysis is the process by which the destruction of even younger erythrocytes takes place in large number with the help of hemolysins or hemolytic agents like acid, alcohol, benzene, coal tar, chloroform, ether, hypotonic saline, saponins, snake poisons.

❖ METHADODOLOGY OF HEMOLYSIS:

Generally, osmotic equilibrium of blood is regulated by plasma and erythrocytes. The cells are affected because of disturbance in osmotic equilibrium . For example, if the erythrocytes are kept in hypotonic



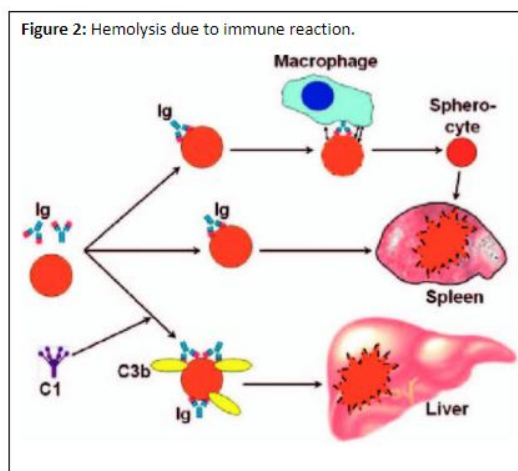
saline, the cells are swollen and rupture by bursting because of endosmosis. The release of hemoglobin occurs especially from the ruptured erythrocytes.

❖ FRAGILITY TEST:

It measures the resistance of RBCs particularly in hypotonic saline solution. This test is performed with the help of sodium chloride at concentrations from 1.2% to 0.2%. The solutions at different concentrations are measured in series of Cohn's tubes. Then one drop of blood is added to each tube for testing. The sodium chloride solution and the blood in each tube are combined well and kept for sometime without disturbance. The results can be obtained by visualising the tubes directly or by centrifuging the tubes after 15 minutes.

Direct Results:

1. Hemolysis is absent – Turbid type of fluid is seen.
2. Commencement of Hemolysis – Turbidity is reduced
3. Completion of hemolysis – Clear fluid is seen.



Results after Centrifugation

- Hemolysis is absent – The Sedimentation of cells occur at the bottom with clear colorless fluid on the top of the tube.
- Commencement of hemolysis –The sedimentation of the cells occurs at slow rate and the fluid is turned slightly into reddish colour because of the release of small amount of hemoglobin from particularly few hemolyzed erythrocytes.
- Completion of hemolysis – The Fluid is turned into more reddish in the absence of sedimentation because of the release of more amount of hemoglobin from all the hemolyzed cells.

❖ Index for Fragility

- After 20 minutes of observation:
- Absence of hemolysis = up to 0.6%
- Onset of hemolysis = around 0.45%
- Completion of hemolysis = around 0.35%

At 0.45%, only the destruction of the older cells takes place due to fragility of their membrane. So, these cells cannot become strong with this hypotonicity. Whereas, particularly younger cells are not affected. At 0.35%, the destruction of even younger cells also takes place.

HEMOLYSIS OCCURS IN THE FOLLOWING CONDITIONS:

1. Hemolytic jaundice
2. Antigen-antibody reactions (Fig. 2)
3. Chemicals or toxins
4. While using heart-lung machine during cardiac surgery (rare occasions) or artificial kidney for hemodialysis.

> HEMOLYSINS

Hemolytic agents or hemolysins are the substances which lead to the destruction of erythrocytes. There are two types of hemolysins, as follows:

A. Chemical substances

1. Acids
2. Alcohols
3. Alkalis
4. Benzene
5. Bile salts
6. Chemical poisons
7. Arsenical preparations
8. Carbolic acid
9. Nitrobenzene
10. Resin.
11. Chloroform
12. Ether
13. Saponin

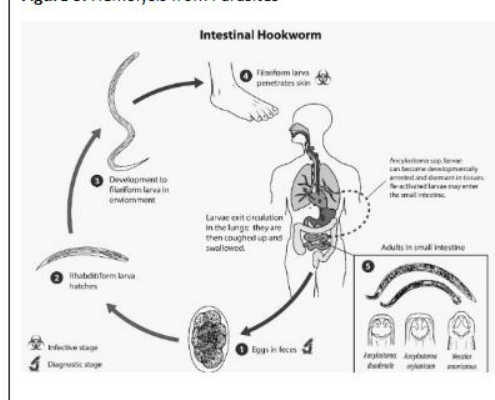
B. Substance of bacterial origin or substance observed in body.

1. Hemolysis from parasitic infections
2. Hemolysis from normal tissues
3. Toxic substances or toxins from bacteria such as staphylococcus, and Tetanus bacillus etc.
4. Snake venom, e.g. Cobra.

Hemolysis from Parasitic Infections :

The major parasites responsible for creating blood loss in men and result in occurrence of direct iron-deficiency anemia are hookworm infection such as *Ancylostoma duodenale* and *Nectar Americans*, *schistosomiasis*, *s. hematobium*. Normally hookworm infection in men, particularly in children, are responsible for causing iron-deficiency anemia and leading to intestinal capillary blood loss following the feeding activities of fourth stage (L4) larva and adult worms. Some parasitic infections particularly soil-transmitted helminths and protozoan parasite shows higher prevalence among school children. Parasites feed on the blood of the host tissue leading to anemia. The most serious effects of hookworm infection are the appearance of anemia as well as protein deficiency occurred by blood loss at the site of the intestinal attachment of the adult worms. Round worm enters the skin and make their way through lungs to small intestine. There roundworms hatch and grow into adults, laying more eggs. Roundworms feed off the blood of the infected person, which cause anemia. Children's are particularly probe to this kind of infection. Infectious disease, especially parasitic diseases also result in the occurrence of both extra corporeal iron loss as well as anemia of the inflammation which reduces bioavailability of iron to host tissues. Parasitic agents like *Diphyllothrrium latum*, *Giardia lamblia* and *Taenia infestation* also are available for causing intestinal vitamin B12 malabsorption. Unexpectedly swallowing or breathing in pinworm eggs leads to the occurrence of pinworm infection. The very small eggs can be carried to your mouth via contaminated food, water or your fingers. After swallowing, the eggs hatch in the intestines and mature into adult worms within a few weeks. Tapeworm cause iron deficiency anemia and it is shown by capsule endoscopy. The presence of an intestinal parasite is based on the symptoms like unexplained constipation, diarrhoea, gasbolting, nausea or other symptoms of Irritable Bowel syndrome (IBS). Coconut is the efficient route to treat intestinal worms. Add table spoon of crushed coconut in your breakfast. Subsequently, take one glass of luke warm milk mix with 2 table spoons of castor oil. Continue this for a week to remove all types of intestinal worms.

Figure 3: Hemolysis from Parasites





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