Normocytic Anemia: Pyruvate Kinase Deficiency

In this article, the rare disease pyruvate kinase deficiency is presented, emphasizing on their etiology and clinic.

Definition and Etiology of Pyruvate Kinase Deficiency

The pyruvate kinase defect is an *autosomal-recessively inherited disease*. Due to a decreased production of ATP, the erythrocytes lose their physiological flexibility and become rigid.

Etiology of Pyruvate Kinase Deficiency

It is caused by gene mutations that decrease the activity of pyruvate kinase, the last enzyme in glycolysis.
Clinic and Diagnosis of Pyruvate Kinase Deficiency

Usually, the symptoms are less distinctly present; besides jaundice and gallstones, skeleton deformations can occur (frontal bumps). In the blood smear, poikilocytes can be seen.

The RBC has only glycolysis to generate energy (no mitochondria). In PK deficiency, therefore, there is a little ATP or NADH production. ATP deficiency affects the Na⁺/K⁺ ATPase, leading to osmotic instability and misshapen RBCs that are cleared in the spleen (extravascular hemolysis).

NADH deficiency decreases the reducing power required to convert methemoglobin (Hb-Fe³⁺) to hemoglobin (Fe²⁺). Because of the distal block, 2,3-BPG is increased. 2,3-BPG binds to hemoglobin and alters its confirmation (allosteric inhibition), shifting the oxygen saturation curve to the right.

A safe diagnosis is made via enzyme deficiency proof.

Pyruvate kinase defect is usually diagnosed in childhood as chronic hemolytic anemia. The serum methemoglobin is elevated. Although most common of the errors in glycolysis, it is still a very rare disease.

Therapy of Pyruvate Kinase Deficiency

Splenectomy can be considered, which often brings relief, but no cure.

References


