Hämolysis

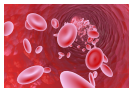
Thrombo-Guide
vom Labor zur Diagnose

Description and Clinical Significance:

- In hemolysis, erythrocytes are destroyed, releasing intraerythrocytic substances (hemoglobin, LDH, potassium, etc.).
- Free hemoglobin discolors the plasma brown as soon as free Hb rises above >250 mg/L. At values exceeding >1000 mg/L, Hb passes into the urine, turning it brown. This can also cause kidney damage. Sclerae and skin turn yellow (jaundice/icterus).
- Haptoglobin is consumed (binds free Hb).
- Compensatorily, erythropoiesis is stimulated (increased reticulocyte count), except in cases of concurrent iron, vitamin B12, or folic acid deficiency, or disorders of hematopoiesis in the bone marrow.

Laboratory Values in Hemolysis

- **LDH:** (normal 150–350 G/L): Significantly increased
- **Bilirubin:** Elevated in extravascular hemolysis
- **Haptoglobin:** Consumed (<12 mg/dL)
- **Reticulocyte Count:** Increased (>100 G/L)

	Decreased Parameters	**Elevated Parameters**
Intravascular Hemolysis 	Hb Haptoglobin	**LDH** **free Hb** Urine-Hb Retikulocyte counts (Bilirubin)
Extravascular Hemolysis 	Hb Haptoglobin	**Bilirubin** Retikulocyte counts (LDH, free Hb)

Causes of Hemolysis:

Immunological	**Complement- Mediated**	**Mechanical**	**Other**
Autoimmune hemolytic anemia (AIHA)	Paroxysmal nocturnal hemoglobinuria (PNH)	Extracorporeal circuits (HF, ECMO, VAD, etc.)	Burns
Transfusion mismatches, acute hemolytic transfusion reactions	Hemolytic uremic syndrome (HUS)	Defective mechanical valves, paravalvular leaks, thrombosis	Polytrauma
Alloimmunization following polytransfusion	Cold agglutinin disease	Intravascular foreign bodies (pulmonary artery catheters, IABP, Impella, etc.)	Infections (malaria, babesiosis, hemorrhagic fever viruses, etc.)

Drug-induced immune hemolytic anemias		Thrombotic microangiopathies (TMA), thrombotic thrombocytopenic purpura (TTP)	Drugs, toxins
Paroxysmal cold hemoglobinuria		Large hemangiomas	Hypersplenism
		Large thrombi / pulmonary embolism	Acute liver failure, Wilson's disease
		Mechanical overstrain: Exertional (march) hemoglobinuria, drummer's hemoglobinuria	Congenital hemoglobinopathies (sickle cell disease, thalassemia)
		DIC	Congenital enzyme defects (G6PDD, PK deficiency, etc.)
			Congenital membrane defects (spherocytosis, elliptocytosis)

Therapeutic Options

- Identification and elimination of the underlying cause.
- Immunosuppression in immune hemolysis (steroids, rituximab).
- Therapy of any underlying hematologic diseases.
- Complement inhibition if indicated (e.g., eculizumab, ravulizumab, sutimlimab, etc.).
- Splenectomy

Pre-analytics

Attention must be paid to precise blood collection, avoidance of contamination, correct filling of the tubes, and thorough mixing with the EDTA. Artificial (in vitro) hemolysis can occur due to difficulties during venipuncture or improper collection technique

References

Thomas L, Labor und Diagnose, 2023, Release 5: https://www.labor-und-diagnose.de/index.html
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