Preoperative management in hematologic disorders

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IN THE NAME OF GOD

Anemia

- Anemia is a very common preoperative hematologic disorder with multifactorial etiology. It is strictly defined as a reduced number of circulating red blood cells (RBCs), however, more commonly it is defined based on the value of reduced hemoglobin concentration or reduced hematocrit.
- the World Health Organization defines anemia as a hemoglobin level less than 130 g/L in adult men and less than 120 g/L in adult women.
- Anemia can be classified based on the underlying mechanisms as being related to **decreased RBC production** (e.g., bone marrow disorders, nutritional deficiencies), **increased RBC destruction** (e.g., hemolytic anemia, intravascular hemolysis), and **blood loss** (e.g., gastrointestinal blood loss).

ANEMIA CAUSES

vector icons set

IRON DEFICIENCY

B12 DEFICIENCY

FOLATE DEFICIENCY

DECREASED BLOOD CELLS PRODUCTION

BLOOD LOSS

RED BLOOD CELLS DESTRUCTION

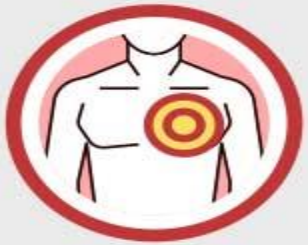
ANEMIA SYMPTOMS

FATIGUE

HEADACHE

YELLOWISH SKIN

IRREGULAR HEARTBEATS



CHEST PAIN

COLD HANDS

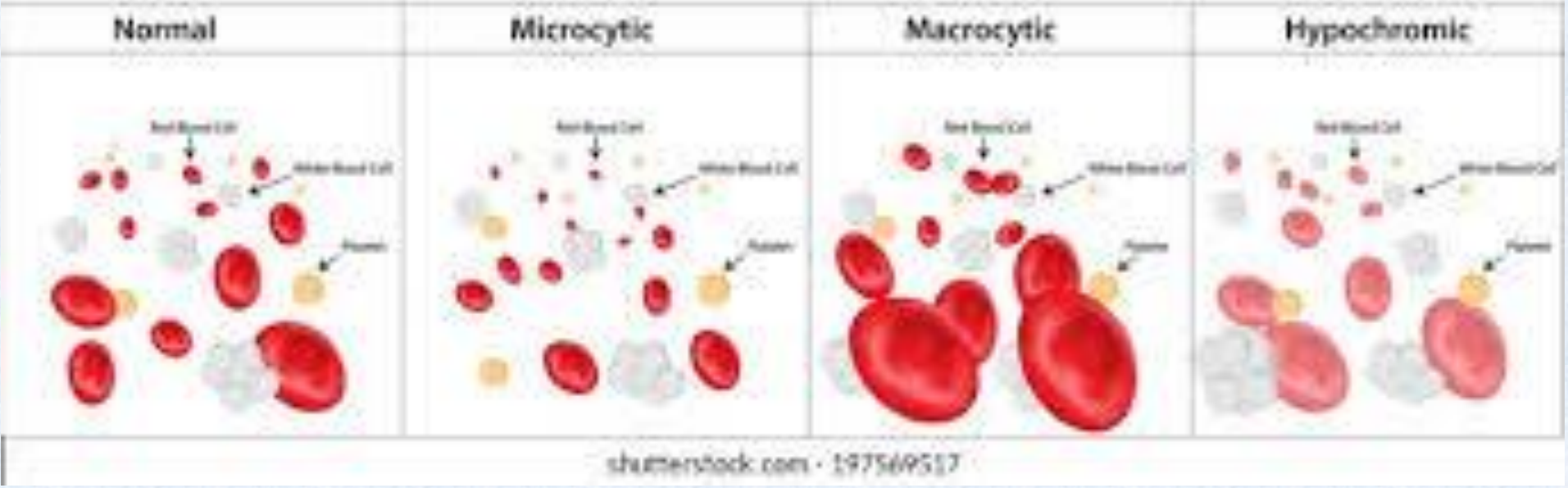
DIZZINESS

LEG CRAMPS

INSOMNIA

- Anemia may also be classified morphologically based on the associated RBC size, which is itself characterized by the mean corpuscular volume (MCV). Based on this approach, anemia can be classified as **microcytic** (MCV < 80 femtoliter [fL]), **macrocytic** (MCV > 100 fL), or **normocytic** (MCV between 80 and 100 fL).
- Common causes of **microcytic anemia** are iron deficiency (including chronic blood loss), thalassemia minor, and anemia associated with inflammatory disease. Common causes of **macrocytic anemia** include alcoholism, liver disease, hypothyroidism, and vitamin B12 deficiency. Common causes of **normocytic anemia** are CKD, heart failure, and cancer.
- Preexisting anemia is a consistently recognized risk factor for postoperative death and complications, including AKI, stroke, and infections. Furthermore, this risk is proportional to the degree of anemia and independent of the patient's other comorbidities .

Anemia


Normal
Microcytic
Macrocytic
Hypochromic
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- there are some important caveats for consideration: **First**, it remains unclear whether anemia is the causal mechanism for these complications, or instead simply a marker of a high-risk patient. The limited available perioperative data generally suggest that anemia treatment strategies (e.g., erythropoiesis-stimulating agents) can improve hemoglobin concentrations and reduce transfusion requirements, but without convincing evidence for the prevention of death or complications. These perioperative data are also generally consistent with findings in nonsurgical populations, such as patients with heart failure. **Second**, there is no consistent hemoglobin concentration threshold that defines elevated perioperative risk. While data from noncardiac surgery performed in Jehovah's Witness patients suggest that risk increases substantially once preoperative hemoglobin concentrations fall below 100 g/L (especially in the presence of concomitant IHD), simply increasing hemoglobin concentrations to this threshold with RBC transfusion is not consistently beneficial. Importantly, transfusion itself has also been associated with poor outcomes in observational studies.

- During the preoperative evaluation of known or suspected anemia, the overarching goals are to determine its **etiology**, **duration**, **stability**, **related symptoms**, and **therapy**. Thus, it is important to inquire about any history of anemia (including family history of anemia), colon cancer, gastrointestinal bleeding, genitourinary bleeding, menorrhagia, chronic infections, inflammatory diseases, nutritional deficiencies, and prior weight reduction procedures (e.g., bariatric surgery).
- The anesthesiologist should also consider the type of surgical procedure, anticipated blood loss, and comorbid conditions that may either affect oxygen delivery or be affected by decreased oxygen delivery (i.e., pulmonary, renal, hepatic, cerebrovascular, cardiovascular disease). In addition, an accurate determination of the patient's medications is helpful, especially because anemia has implications for the risk-to-benefit profile of some perioperative medications, such as β-adrenergic blockers.

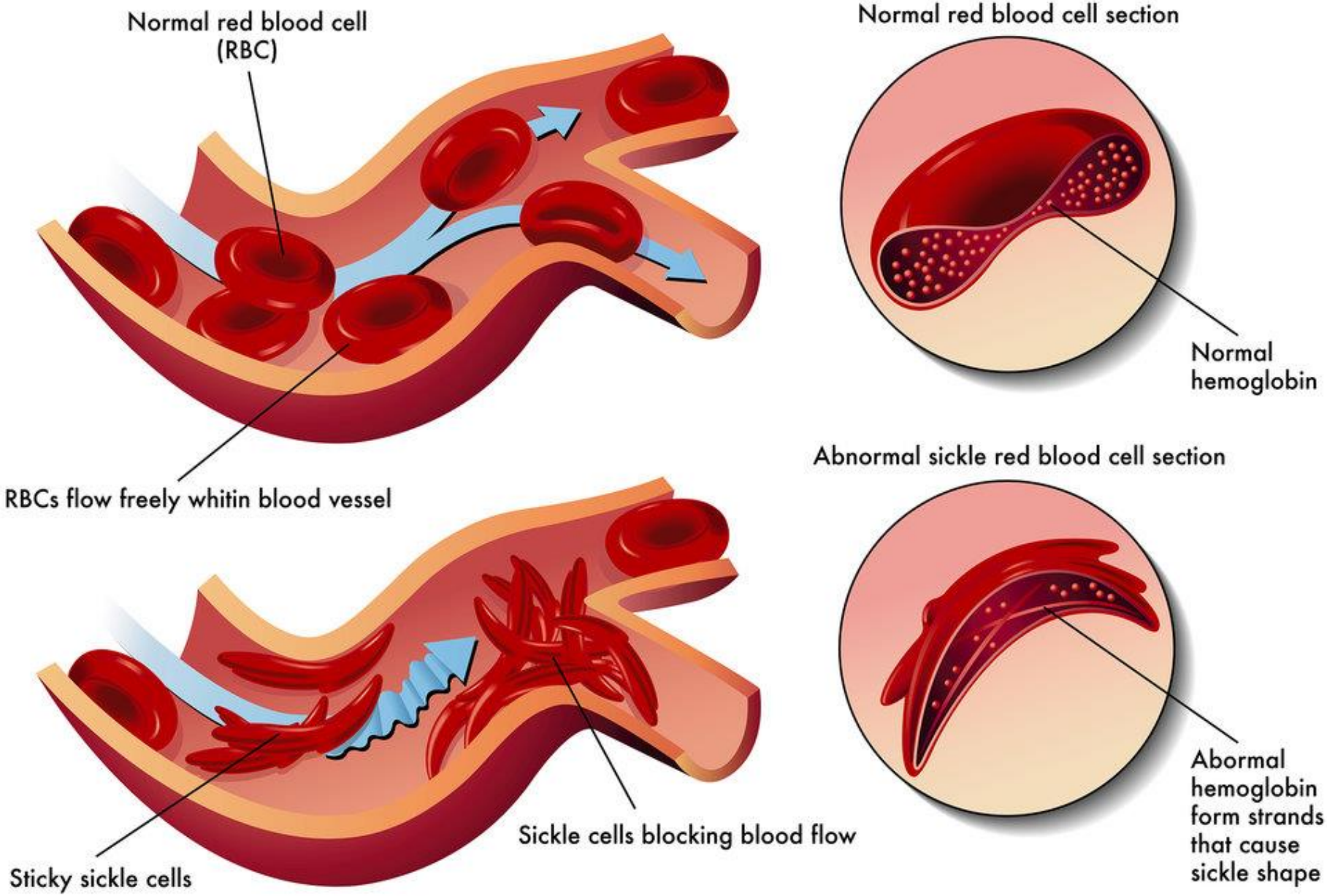
- Patients with anemia or suspected anemia must have a **CBC**. In general, collaboration with a primary care physician or hematologist is helpful for further evaluation of newly diagnosed anemia. Usual initial studies include **peripheral smear** and **MCV**; subsequent studies, such as **iron studies** (i.e., ferritin, transferrin saturation), **vitamin B12**, or **folate levels**, are guided by findings on the smear and the MCV.
- The MCV is high and the vitamin B12 or folate levels are low in **macrocytic anemia** associated with these deficiencies. Low values in MCV, ferritin (<30 g/µL), and transferrin saturation (<20%) are indicative of **iron deficiency anemia**. In some cases of iron deficiency anemia, transferrin saturation may still be low (<20%) but ferritin concentrations are in an indeterminate zone (i.e., 30-100 g/µL). Conversely, ferritin and transferrin saturation are normal or high in **anemia associated with chronic disease.**

- **Blood type and screening** may be necessary based on the level of preoperative anemia and anticipated degree of surgical blood loss.
- Elective procedures should be postponed in patients with significant anemia, regardless of the anticipated surgical blood loss. This delay allows for evaluation of the underlying cause, such as occult blood loss, vitamin deficiency, or undiagnosed chronic conditions (e.g., CKD). When delay in elective surgery is possible, updated 2015 guidelines from the ASA suggest preoperative treatment with an erythropoiesis-stimulating agent and iron in some patient subgroups (e.g., CKD, anemia of chronic disease, patient's refusal to receive blood transfusions), especially for anemic individuals scheduled for procedures with significant expected blood loss.Similarly, preoperative iron therapy may be considered in patients with known iron deficiency anemia, when time permits.

Sickle Cell Disease

- Sickle cell disease is a **hereditary hemoglobinopathy with associated vasoocclusive episodes** that are responsible for most associated complications. Patients homozygous for hemoglobin S (HbS) have symptomatic disease; they are at risk for major morbidity and have a shortened life expectancy. Patients with SC disease, who have both HbS and HbC, have a much less severe clinical course with moderate anemia. Heterozygous patients (HbS and HbA) have sickle cell trait and rarely have any related consequences.
- Preoperative assessment should focus on evidence of **organ dysfunction** and **recent patterns of acute exacerbations.**

Sickle-Cell Anemia



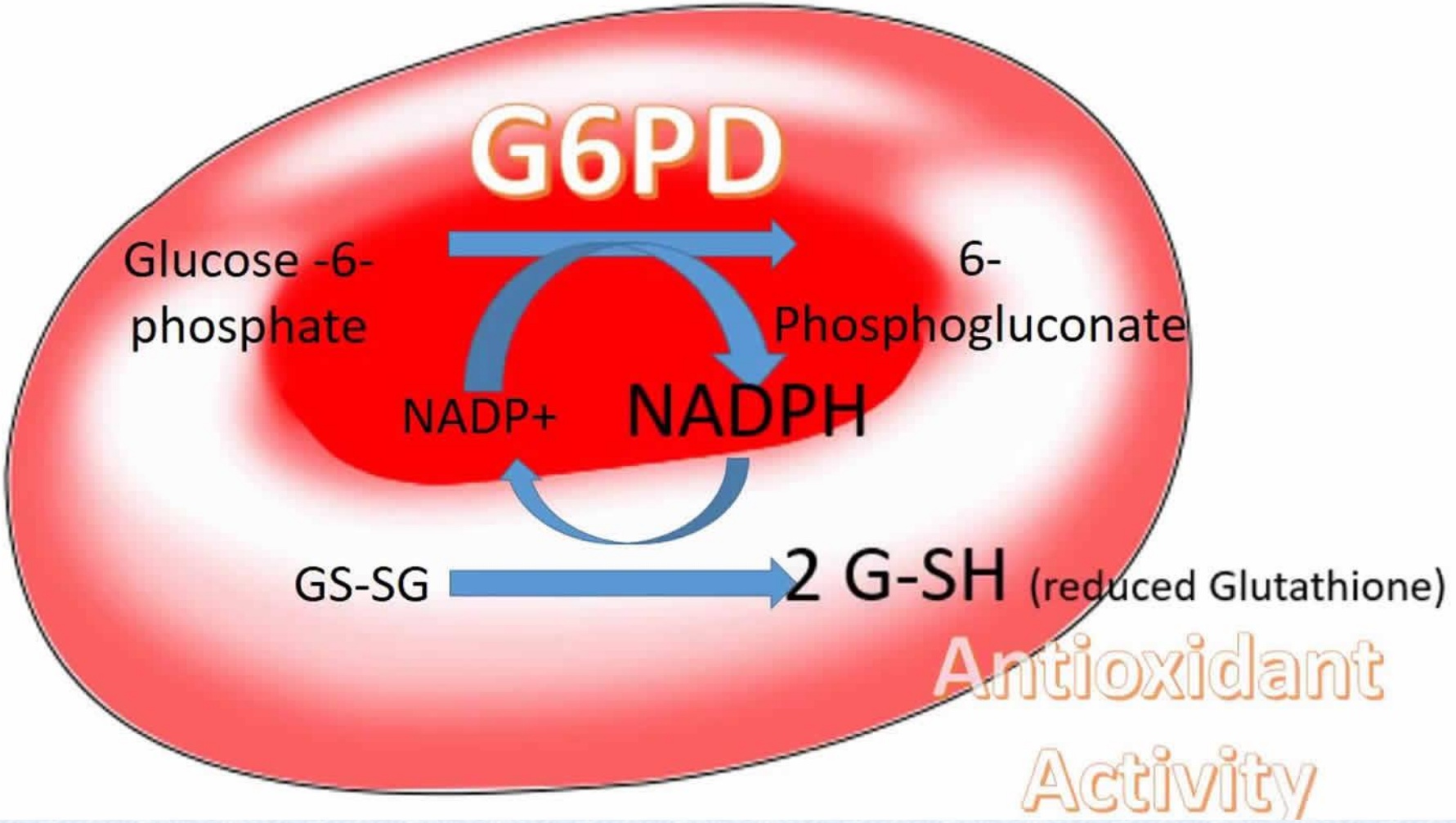
- Patients may have CKD, loss of renal concentration ability (and therefore are prone to dehydration), splenomegaly, pulmonary hypertension, pulmonary infarctions, CVD, and heart failure. They are at risk for infections because of splenic infarctions.
- Predictors of perioperative vasoocclusive complications include recent increases in hospitalizations, advanced age, preexisting infections, and pulmonary disease.
- The **preoperative examination** focuses on the frequency, severity, and pattern of vasoocclusive crises. In addition, the anesthesiologist should evaluate the degree of pulmonary, cardiac, renal, and central nervous system damage.
- Useful tests include an ECG, chest radiograph, and blood sampling for CBC and creatinine concentration. Additional testing (e.g., echocardiogram, arterial blood gases) may be needed.
- Preoperative prophylactic transfusion is increasingly used in patients with sickle cell anemia who are undergoing any surgical procedure—other than short minor procedures (e.g., biopsy, myringotomy).

- The objective of any red cell transfusion is to reduce the proportion of abnormal hemoglobin in the affected patient.
- A prior randomized trial found that prophylactic transfusion to a hemoglobin concentration greater than 100 g/L resulted in fewer adverse events following intermediate-risk surgery. This simpler approach of transfusing to a hemoglobin concentration threshold (>100 g/L) is as effective as a more aggressive approach of transfusing to decrease HbS concentration to under 30% (while also increasing hemoglobin concentration to ≥ 100 g/L) in the setting of intermediate-risk surgery.
- It is likely that a more aggressive strategy (i.e., decreasing HbS concentration to < 30%) is preferable for high-risk surgery such as major cardiovascular or intracranial procedures.

- the decision to transfuse preoperatively should be made only in concert with a hematologist familiar with the disease.
- Additionally, if the person with sickle cell is managed by a specialist sickle cell service, it is best to liaise with this team before surgery.
- The patient’s surgical admission should be planned to minimize preoperative dehydration (e.g., minimize fasting period, schedule procedure as an early morning case).

Glucose-6-Phosphate Dehydrogenase Deficiency

- Glucose-6-phosphate dehydrogenase deficiency is a hereditary Coombs-positive hemolytic anemia. Since it is an X-linked hereditary condition, affected individuals are typically males.
- Hemolysis may be triggered by **drugs** (e.g., antipyretics, nitrates, sulfonamides), **food** (e.g., fava beans), **infection**, **hypoxia**, **hypothermia**, or **blood products.**
- The severity of the hemolysis varies across individuals and the underlying genetic defects.
- **Treatment** involves avoidance of triggers, folic acid supplementation, and management of acute hemolytic episodes (i.e., hydration, red cell transfusion for severe anemia).
- **The preoperative evaluation** should focus on previous hemolysis episodes, predisposing factors, and current hematocrit.


G6PD
Glucose -6-
phosphate
6-
Phosphogluconate
NADP+
NADPH
GS-SG
2 G-SH (reduced Glutathione)
Antioxidant
Activity

DRUGS TO AVOID IN G6PD DEFICIENCY

DEFINITE RISK OF HAEMOLYSIS

Pharmacological Class	Drugs*
Anthelmintics	• ß-Naphthol • Niridazole • Stibophen
Antibiotics	• Nitrofurans - Nitrofurantoin - Nitrofurazone • Quinolones - Ciprofloxacin - Moxifloxacin - Nalidixic acid - Norfloxacin - Ofloxacin • Chloramphenicol • Sulfonamides - Co-trimoxazole (Sulfamethoxazole + Trimethoprim) - Sulfacetamide - Sulfadiazine - Sulfadimidine - Sulfamethoxazole - Sulfanilamide - Sulfapyridine - Sulfasalazine (Salazosulfapyridine) - Sulfisoxazole (Sulfafurazole)
Antimalarials	• Mepacrine • Pamaquine • Pentaquine • Primaquine
Antimethemoglobinaemic Agents	• Methylene blue
Antimycobacterials	• Dapsone • Para-aminosalicylic acid • Sulfones - Aldesulfone sodium (Sulfoxone) - Glucosulfone - Thiazosulfone
Antineoplastic Adjuncts	• Doxorubicin • Rasburicase
Genitourinary Analgesics	• Phenazopyridine (Pyridium)
Others	• Acetylphenylhydrazine • Phenylhydrazine

POSSIBLE RISK OF HAEMOLYSIS

Pharmacological Class	Drugs*
Analgesics	• Acetylsalicylic acid (Aspirin) • Acetanilide • Paracetamol (Acetaminophen) • Aminophenazone (Aminopyrine) • Dipyrone (Metamizole) • Phenacetin • Phenazone (Antipyrine) • Phenylbutazone • Tiaprofenic acid
Antibiotics	• Furazolidone • Streptomycin • Sulfonamides - Sulfacytine - Sulfaguanidine - Sulfamerazine - Sulfamethoxypyridazole
Anticonvulsants	• Phenytoin
Antidiabetics	• Glibenclamide
Antidotes	• Dimercaprol (BAL)
Antihistamines	• Antazoline (Antistine) • Diphenhydramine • Tripelennamine
Antihypertensives	• Hydralazine • Methyldopa
Antimalarials	• Chloroquine & derivatives • Proguanil • Pyrimethamine • Quinidine • Quinine
Antimycobacterials	• Isoniazid
Antiparkinsonism Agents	• Trihexyphenidyl (Benzhexol)
Cardiovascular Drugs	• Dopamine (L-dopa) • Procainamide • Quinidine
Diagnostic Agent for Cancer Detection	• Toluidine blue
Gout Preparations	• Colchicine • Probenecid
Hormonal Contraceptives	• Mestranol
Nitrates	• Isobutyl nitrite
Vitamin K Substance	• Menadiol Na sulfate • Menadione • Menadione Na bisulfite • Phytomenadione
Vitamins	• Ascorbic acid (Vit C) (rare)
Others	• Arsine • Berberine (in *Coptis chinensis*) • Fava beans • Naphthalene (in mothballs) • Para-aminobenzoic acid

*Nomenclature based on INN (International non-proprietary name)


Thanks for
your
attention