Department of Anesthesia Techniques
Title of the lecture:- Anemia

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Anemia / by MSc. ALI FADHIL

Red blood cells comprise almost 50% of blood volume in the average healthy adult. Integral to its vital function of transporting oxygen to and carbon dioxide away from the organs and tissues of the body is the hemoglobin (Hb) contained within its cytoplasm.

The average healthy adult hemoglobin level measures between 140–180 g/L in males and 130–160 g/L in females.

WHO set the criteria of anemia as less 130 g/L for men and less 12 g/L for women .

in the ICU, anemia is considered important when hemoglobin less than or equal to 100 g/L .

Anemia in adult intensive care units

Anemia is extremely common amongst critically ill patients As many as 30% of critically ill patients have been anemic at some point during their admission . Many factors are involved in the etiology of anemia in the critically ill and include:

1- Surgical and traumatic blood loss

2- A blunted erythropoietin (EPO) response in critical illness [7], which is further reduced in the context of renal failure

3- Diagnostic blood sampling.

4- Gastrointestinal blood loss; either as the admission diagnosis or occurring as a complication of critical illness

5- Spillage during vascular cannulation

6- Renal failure, Coagulopathy , hemolysis and malnutrition

7- Other factors (e.g. iron, B12 and folate availability).

Physiologic effects of anemia

Under normal physiologic circumstances, a partial pressure of oxygen of 27 mmHg results in 50% oxygen saturation of Hb.

A right shift of the curve, or decreased oxygen affinity, is observed with increased temperature, CO2, increased 2,3-DPG levels or a decreased pH.

A left shift, or increased oxygen affinity, is observed with lower temperature, lower CO2, decreased 2,3-DPG levels or a higher pH.

A rightward shift in the oxyhemoglobin dissociation curve (ODC) is seen, which increases the O2 unloading by Hb at the tissues for a given blood PO2 – thus increasing oxygen availability to the tissues. The primary reason for this rightward shift is the increased red cell 2,3-diphosphoglycerate (DPG) synthesis seen during anemia.

Conversely, old transfused blood may have reduced DPG levels, shifting the oxyhemoglobin dissociation curve to the left, increasing the affinity of Hb for

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oxygen and potentially reducing oxygen availability to the tissues.

Given a normal cardiac output and high oxygen saturation, the variable most easily manipulated to increase oxygen delivery is hemoglobin concentration. It is on this premise that RBCs are often transfused.

With acute blood loss, There is no doubt that hypovolemia is less well tolerated than anemia. Thus, where hypovolemia is present, restoration of blood volume and cardiac output is the first priority.

Management and Prevention of anemia in the critically ill

1-Blood-loss reduction associated with diagnostic testing (e.g. use of microanalyzer systems for blood testing and, indwelling continuous oximetry and pH sensors).

2-improved removal of erythropoiesis inhibitors and endotoxins, improved iron utilization and erythropoietin response.

3- The routine use of non invasive rather than invasive eg: pulse oximetry (reducing the need for arterial blood gas sampling).

4- Preservation of gut mucosal integrity, and well nutrition

Transfusion in critically ill patients

Based on examination of practice, the most common reason for administering an RBC transfusion to an ICU patient, aside from an acute bleed, is to improve oxygen delivery

Harmful effects of blood transfusion

Massive blood transfusion imparts its own set of important potential complications, including hyperkalemia, hypocalcemia, metabolic acidosis, hypothermia, dilutional coagulopathy and citrate toxicity. This will not be discussed further in this text. Risks otherwise associated with RBC transfusion are best considered under the categories of “infectious” and “noninfectious.”

A- Infectious complications of RBC transfusion

Infectious complications of RBC transfusion Fortunately, due to significant advances in the screening and testing of blood donors and products, respectively, infectious complications of RBC transfusion are rare : (HIV/AIDS , Hepatitis A , Hepatitis B , Hepatitis C , Sepsis , Bacterial contamination ,Parasitic infection , Prions.)

B-Noninfectious complications of RBC transfusion

Urticarial Reaction , Febrile nonhemolytic reaction , Transfusion-associated cardiac overload (TACO) , Transfusion-related acute lung injury (TRALI) , Delayed hemolytic transfusion reaction , Acute hemolytic transfusion reaction , Anaphylactic reaction , Post-transfusion purpura.

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practical approach to RBC transfusion

Recommendations by the ASA Task Force on Blood Component Therapy state, and remain valid today, that transfusion is:
"rarely required above an Hb of 100 g/L,"
"almost always indicated when Hb is less 60 g/L
Current evidence supports a restrictive strategy (Hb less 70 g/L . For transfusion in most ICU settings. More definitive data is still required for certain specific patient populations, including patients with cardiovascular diseases and acute neurologic injuries. Until such time, a higher transfusion trigger (Hb 80–90 g/L) is clinically acceptable in the context of critical illness.