Anemia Fact Sheet

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American Nephrology Nurses' Association

Developed by:
ANNA Hemodialysis Specialty Practice Network

ANNA's Mission Statement

ANNA promotes excellence in and appreciation of nephrology nursing so we can make a positive difference for people with kidney disease.

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I. Overview

Anemia is often the hallmark sign of CKD, and many patients become diagnosed with CKD during a work-up for resistant anemia. Erythropoietin (EPO) is a circulating hormone, 90% of which is produced in the kidneys and the remainder in the liver. Healthy kidneys produce EPO in response to hypoxia. EPO stimulates the division and differentiation of erythroid progenitor cells in the bone marrow; reticulocytes are released from the bone marrow into the blood stream, and they mature into red blood cells (RBCs). When kidneys fail, less EPO is produced, which results in a decreased production of RBCs. The 10% of EPO produced by the liver is enough to trigger the production of about only one-third of the RBCs required by the body, resulting in anemia. In the patient with CKD, anemia is usually the normocytic, hypochromatic type.

The Kidney Disease Improving Global Outcomes (KDIGO) (2012) has highly suggested, based on a moderate quality of evidence, in the Clinical Practice Guidelines, the following principle for anemia levels in CKD 5 patients: ESA therapy should be used to maintain the patients Hgb between 9.0 - 10.0 g/dl. All efforts need to be taken to prevent the Hgb from falling below 9.0 g/dl or rising above 11.5 g/dl.

Causes of anemia in CKD include:

- Inadequate EPO production.
- Shortened RBC survival time (40% to 60% of normal) due to the effects of uremia and other toxins.
- Blood loss from the hemodialysis procedure, frequent lab draws, and gastrointestinal (GI) blood loss.
- Iron deficiency.
- Deficiency of water soluble vitamins.

Symptoms of anemia include pallor, fatigue, shortness of breath, decreased cognition, muscle weakness, decreased exercise tolerance, chest pain, tachycardia, and a decreased quality of life. Anemia contributes to the development of left ventricular hypertrophy (LVH), cardiomyopathy, congestive heart failure (CHF), and ischemic heart disease. Cardiovascular disease and CKD Stage 5 place this population at increased risk of morbidity and mortality.

II. Treatment

Erythropoiesis-stimulating agents (ESAs) are used to treat anemia in CKD and other patients. The FDA has approved epoetin alfa (Epogen®) and darbepoetin alfa (Aranesp®) for use in patients on dialysis. Both agents are dosage-based on the patient's weight. Other ESAs, such as ProCrit®, are approved for use in oncology patients and other patients with anemia.

- Epoetin alfa:
  - Starting dosage: Adults 50-100 U/kg.
  - Administer intravenous or subcutaneous three times weekly.
- Darbepoetin alfa:
  - Starting dosage: Adults with CKD 0.45 mcg/kg.
  - Administer intravenous or subcutaneous weekly, or 0.75 mcg/kg every two weeks.

Most hemodialysis patients will require intravenous iron supplementation while receiving EPO. Iron stores may be used up quickly once treatment with EPO begins. Many dialysis providers use an algorithm to dose EPO and give intravenous iron. An anemia manager, usually a registered nurse, applies the algorithm based on the laboratory values of the individual patient, consulting with the patient's nephrologist as necessary.

III. Laboratory Testing

The following targets are recommended by KDIGO (2012) for CKD stage 5 patients on dialysis:

- Hb target should be in the range of 9.0 to 10.0 g/dL and should not be greater than 11.5 g/dL.
- Transferrin saturation (Tsat) > 20%, no upper limit specified.
- Ferritin lower limits:
  - For CKD patient on dialysis: 200 ng/mL.
  - For CKD patient not on dialysis: 100 ng/mL.
  - 500 ng/ml not routinely recommended.
- Serum B12 and folate levels.

The reticulocyte content (CHr) may also be used to monitor iron status. CHr measures hemoglobin content of the reticulocyte and has been shown to have a high sensitivity and specificity for absence of bone marrow iron stores. Normal values for CHr are 24.5 to 31.8 pg. A CHr value < 26 strongly correlates to functional iron deficiency.

IV. Hyporesponse to EPO

About 90% of persons given EPO will respond with an increase in circulating RBCs. There are a number of reasons why an individual does not respond. Among them are:

- Inadequate EPO dose:
  - Hb below target in absence of causes of hyporesponse.
  - Low Epogen based on body weight, inappropriately missed or held doses, frequent dose changes, non-compliance.
- Iron deficiency – absolute and functional:
  - Absolute iron deficiency may be caused by blood loss and/or not receiving enough iron. Lab values that indicate absolute iron deficiency include Tsat < 20 and ferritin < 200.
  - Functional iron deficiency occurs when iron is mobilized too slowly from the RES to keep up with the demands of ESA-driven erythropoiesis. TIBC is generally normal to elevated. IV iron will correct.
- Infection and inflammation:
  - Inflammatory iron blockade results in iron being blocked from leaving the RES due to the infection or inflammation. TIBC may be reduced. Avoid or use caution with administering IV iron to patients with active systemic infections.
  - Known acute or chronic infections or inflammatory processes, including access infections, AIDS, rheumatologic disorders, surgical inflammation, dental disease, and cancer.
  - Labs indicating this include elevated ferritin and decreased Tsat, elevated white blood cells (WBC), and significantly elevated C-reactive protein, which is also called acute phase reactant.
- Blood loss:
  - Known excessive blood loss from GI bleed, phlebotomy, hemodialysis, or other sources.
- Secondary hyperparathyroidism:
  - Causes marrow fibrosis aggravating anemia.
  - Documented disease, bone changes, iPTH > 300pg/mL[4].

- Aluminum toxicity:
  – Can interfere with iron incorporation into Hb and also disturbs human erythropoiesis.
  – Deposits in bone marrow and may cause microcytic anemia.
- Co-morbid conditions:
  – Malignancies, hematologic disorders, AIDS, pregnancy, chemotherapy.
- Hemolysis:
  – Destruction of RBCs caused by a mechanical problem, medication, or sterilants. Labs will show an acute decrease in Hb.
- Hypoalbuminemia:
  – Detected by lower protein intake than the recommended level. Labs show a decreased serum albumin.
  – Vitamin deficiencies, vitamin B-12 deficiency, or folate deficiency.
  – Pure red cell aplasia (PRCA) or anti-erythropoietin antibody-associated anemia.

If a patient does not respond to EPO administration, evaluate for the above reasons. Iron deficiency is a major cause because iron stores may be depleted quickly once ESA therapy is initiated. Identify and treat the underlying source of hyporesponse; the ESA dosage may need to be adjusted to prevent worsening anemia. Once the cause of hyporesponse is resolved, adjust the ESA to prevent Hb from exceeding recommended range.

Advanced Practice Nursing Care (Gomez, 2011) (in addition to the items outlined above):
- Assessment:
  – Interpret results of any diagnostic tests, studies, or laboratory values.
  – Initiate anemia work-up per current evidence-based research, guidelines or per facility protocol.
  – Monitor patient's ability to follow and his/her response to treatment plan.
  – Monitor BP and adjust any therapy as needed.
  – Monitor for any potential causes for hyporesponse to anemia management.
- Intervention:
  – Treat anemia based on the most current evidence.
  – Initiate any further anemia work-up and order laboratory and/or diagnostic tests as appropriate.
  – Adjust medication based on patient's response.
  – Evaluate patient for any co-morbid conditions (i.e., pulmonary disease, angina, congestive heart failure, cerebrovascular disease) and collaborate with physician as appropriate.
  – Consult hematology/oncology if cause of hyporesponse is not evident.

Reference

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Additional Readings

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Other Questions:
For questions and/or concerns please contact us at 1-888-600-2662

For more information about nephrology nursing, dialysis, transplantation or other renal disorders check out the American Nephrology Nurses' Association (ANNA) Web site at www.annanurse.org.

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2/13