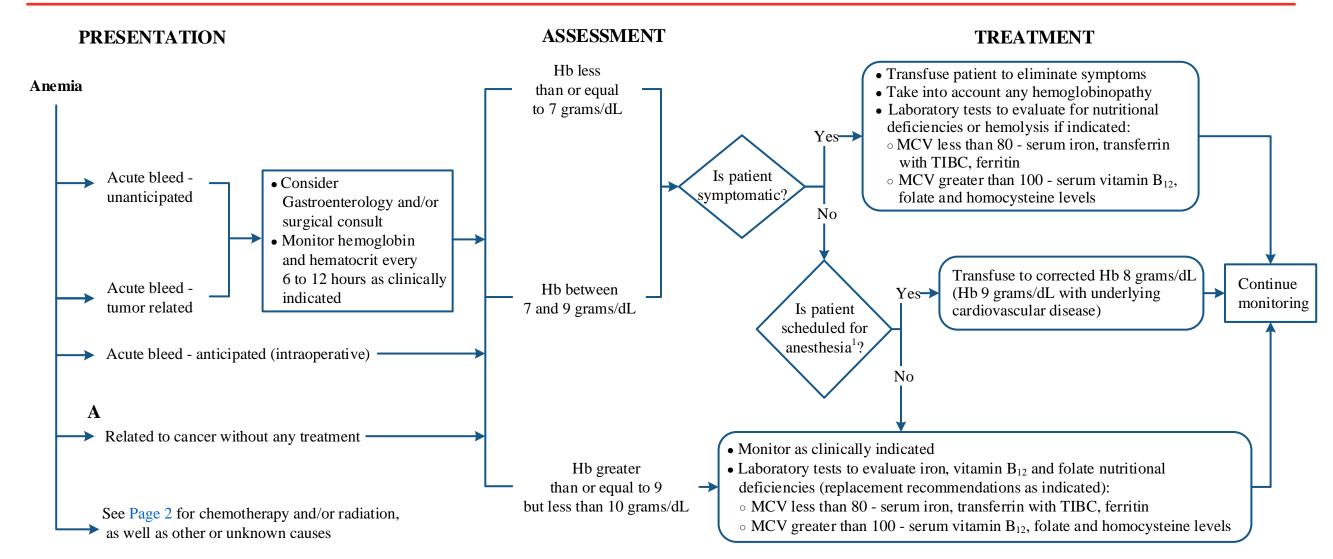
Disclaimer: This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson's specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient's care. This algorithm should not be used to treat pregnant women.



Hb = Hemoglobin

MCV = mean corpuscular volume

TIBC = total iron binding capacity

<sup>1</sup>Considerations and associated risks in patients with anemia that receive anesthesia care:

- Under anesthesia, patients often experience systemic vasodilation and are at risk of significant hypotension, resulting in hypoperfusion and decreased tissue oxygenation
- Use of vasopressors or IV fluid boluses to maintain adequate blood pressure invariably results in hemodilution and further decrease in Hb concentration (e.g. if baseline Hb 7 grams/dL, hemodilution will decrease Hb to below 7 grams/dL and increase risks for periprocedural complications)



## **Anemia Assessment and Management**

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#### **PRESENTATION TREATMENT** • Transfuse patient to eliminate symptoms Hemoglobin less • Take into account any hemoglobinopathy • Laboratory tests to evaluate for nutritional deficiencies or hemolysis if indicated 1 than or equal o MCV less than 80 - serum iron, transferrin with TIBC, ferritin to 7 grams/dL Anemia o MCV greater than 100 - serum vitamin B<sub>12</sub>, folate and homocysteine levels The use of ESA are Yes contraindicated<sup>2</sup> Related to Yes chemotherapy. Continue Hemoglobin Yes and/or Curative Radiation Is patient laboratory between radiation myelosuppressive No treatment mptomatic? monitoring 7 and 9 grams/dL chemotherapy? alone? No Use institutional ESA ordering tools (darbepoetin alfa, epoetin alfa) • Monitor as clincally indicated Hemoglobin greater • Laboratory tests to evaluate for nutritional deficiencies or hemolysis if indicated<sup>1</sup>: than or equal to Continue monitoring 9 and less than o MCV less than 80 - serum iron, transferrin with TIBC, ferritin o MCV greater than 100 - serum vitamin B<sub>12</sub>, folate and homocysteine levels 10 grams/dL Recommended evaluation: Other or • Stool guaiac – obtain Gastroenterology consult if positive Follow care path "A" (on Page 1) unknown depending on hemoglobin level • Nutritional deficiencies – consider Nutrition consult cause • Hemolysis, premalignancy, or other suspected etiologies – obtain Hematology consult

ESA = erythropoietin stimulating agents

<sup>&</sup>lt;sup>1</sup> ESAs may be considered for patients who refuse blood transfusions after discussing the risks

<sup>&</sup>lt;sup>2</sup> See FDA approved indications and CMS guidelines



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### **SUGGESTED READINGS**

- Beattie, W. S., Karkouti, K., Wijeysundera, D. N., & Tait, G.(2009). Risk Associated with Preoperative Anemia in Noncardiac Surgery: A Single-center Cohort Study. *Anesthesiology*, 110, 574–581. doi:10.1097/ALN.0b013e31819878d3
- Cable, C. A., Razavi, S. A., Roback, J. D., & Murphy, D. J. (2019). RBC Transfusion Strategies in the ICU: A Concise Review. *Critical Care Medicine*. doi:10.1097/CCM.000000000003985
- Centers for Medicare and Medicaid Services. (2019). *Medicare National Coverage Determinations Manual*. Retrieved from: https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/downloads/ncd103c1\_Part2.pdf
- Hébert, P. C., Wells, G., Blajchman, M. A., Marshall, J., Martin, C., Pagliarello, G., ... Transfusion Requirements in Critical Care Investigators for Canadian Critical Care Trials Groups. (1999). A Multicenter, Randomized, Controlled Clinical Trial of Transfusion Requirements in Critical Care. *New England Journal of Medicine*, 340(6), 409-417. doi:10.1056/NEJM1999 02113400601
- Johannes, T., Mik, E. G., Nohé, B., Unertl, K. E., & Ince, C. (2007). Acute decrease in renal microvascular PO2 during acute normovolemic hemodilution. *American Journal of Physiology*. *Renal Physiology*, 292(2), F796–F803. doi:10.1152/ajprenal.00206.2006
- Kuriyan, M., & Carson, J. L. (2005). Anemia and clinical outcomes. Anesthesiology Clinics of North America, 23(2), 315-vii. doi:10.1016/j.atc.2005.01.005
- Mueller, M. M., Van Remoortel, H., Meybohm, P., Aranko, K., Aubron, C., Burger, R., ... Fergusson, D. (2019). Patient blood management: Recommendations from the 2018 Frankfurt Consensus Conference. *Jama*, 321(10), 983-997. doi:10.1001/jama.2019.0554
- National Comprehensive Cancer Network. (2022). *Hematopoietic Growth Factors* (NCCN Guideline Version 1.2022). Retrieved from https://www.nccn.org/professionals/physician\_gls/pdf/growthfactors.pdf
- National Comprehensive Cancer Network. (2018). Cancer-and Chemotherapy-Induced Anemia. (NCCN Guideline Version 3.2018). Retrieved from https://www.nccn.org/professionals/physician\_gls/pdf/anemia.pdf
- Rizzo, J. D., Somerfield, M. R., Hagerty, K. L., Seidenfeld, J., Bohlius, J., Bennett, C. L., ... Rarick, M. U. (2008). Use of epoetin and darbepoetin in patients with cancer: 2007 American Society of Clinical Oncology/American Society of Hematology clinical practice guideline update. *Journal of Clinical Oncology*, 26(1), 132-149. doi:10.1200/JCO.2007.14.3396
- Society for the Advancement of Blood Management. (2014). *Anemia in the pre-surgical patient*. Retrieved from: https://www.sabm.org/wp-content/uploads/2018/08/Anemia-in-the-Pre-Surgical-Patient.pdf

# **Anemia Assessment and Management**

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### **DEVELOPMENT CREDITS**

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