

**ASK A SPECIALIST****Ask a Hematologist  
Iron Studies in the Hospitalized Patient**Jiyuan Sun<sup>1</sup>, Sindhu Singh<sup>1</sup><sup>1</sup>Division of Hematology and Medical Oncology, Department of Medicine, University of Missouri

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*Am J Hosp Med* 2018 Apr;2(2):2018.012 <https://doi.org/10.24150/ajhm/2018.012>**Question:** How to order and interpret iron studies for a hospitalized patient with anemia?

**Answer:** Anemia is defined as a hemoglobin <13.5 g/dL in men and <12.0 g/dL in women. Iron deficiency anemia (IDA) has been historically considered as a hemodynamically stable anemia that could be referred to outpatient clinics; therefore, it is often underdiagnosed in an inpatient setting. Sometimes, it is also missed even when iron studies were checked.

Currently, there is no single test or a battery of tests to accurately diagnose IDA. Each test has its limitation. The cutoff for diagnosis often depends on a patient's comorbidities. Physicians need to use their best knowledge to make a diagnosis.

The most common iron studies are iron level, iron saturation, total iron-binding capacity (TIBC) and serum ferritin. The diagnosis of IDA is accepted based on the following: iron <11 umol/L, transferrin saturation (%Sat) <0.20, total iron-binding capacity (TIBC) >45 umol/L, and ferritin <13 ug/L for females and <25 ug/L for males.<sup>1</sup> Using these criteria, one study reported iron deficiency was correctly diagnosed by serum iron in 41%, %Sat in 50%, TIBC in 84%, and ferritin in 90% of the patients.<sup>1</sup> The sensitivity and specificity for each test were as follows: iron level (77.5%, 35.6%), %Sat (76.5%, 45.6%),

TIBC (55.9%, 87.3%), ferritin (52.5%, 95%)<sup>1</sup>. Therefore, serum ferritin could be the most useful, especially in uncomplicated patients. However, it is less sensitive. The diagnosis of iron deficiency can usually be made based on serum ferritin  $\leq 15$  ug/L alone or serum ferritin along with the rest of iron studies for higher sensitivity. On the contrary, a low serum iron cannot be used to diagnose iron deficiency because iron may also be low in anemia of chronic disease.

Ferritin is often nonspecifically elevated by inflammation, liver disease, heart failure, and malignancy regardless of iron stores. The cutoff value for serum ferritin should be increased in patients with comorbidities. In some specific populations, such as veterans with concomitant medical problems, a serum ferritin level  $\leq 100$  ug/L was optimal for determining iron deficiency.<sup>2</sup> A ferritin level of  $\leq 50$  ug/L would be used as evidence of iron deficiency in patients with inflammation or malignancy.<sup>2</sup> C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and erythropoietin (EPO) could also be ordered in patients with comorbidities.

IDA is also predicted by low mean corpuscular volume (MCV)<sup>3</sup>, wide red cell distribution width (RDW), low reticulocyte

count, and reactive thrombocytosis.<sup>4</sup> Low MCV sometimes might be overlapped with macrocytic anemia resulting in a normal MCV<sup>3</sup>. Reactive thrombocytosis is a good predictor. It appears in 31% of patients with IDA and resolves in 66% of patients 28 days after treatment.<sup>4</sup> Additionally, a peripheral blood smear could also be ordered and a pathology review would be requested.

Importantly, iron studies should always be performed before blood transfusion. A typical blood transfusion has been shown to raise serum iron level and %Sat during the first 24 hours, which persisted at a marginally significant level up to 36 hours.<sup>5</sup> However, no significant changes of TIBC and ferritin levels have been noted.<sup>5-6</sup>

When confronting inconclusive initial testing or comorbidities, physicians should consult a hematologist while the patient is in the hospital. The most reliable means of diagnosing IDA is to evaluate iron storage in the bone marrow.<sup>1</sup> It is sensitive and specific. However, it is invasive, uncomfortable, and expensive; hence, it should always be determined by a hematologist and it is usually used as an approach to diagnose hematologic diseases other than IDA.

#### Notes

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