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# IRON DEFICIENCY ANEMIA IN CLINICAL PRACTICE

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**Abstract:** Iron deficiency anemia (IDA) is the most common nutritional and hematologic disorder encountered in clinical practice and remains an important cause of fatigue, impaired physical performance, cognitive dysfunction, reduced quality of life, and adverse maternal and pediatric outcomes. Despite the apparent simplicity of the diagnosis, clinically relevant errors continue to occur because hemoglobin alone does not define iron status, ferritin may be misleading in inflammatory states, and treatment without identification of the underlying cause can delay the diagnosis of gastrointestinal bleeding, gynecologic disease, malabsorption, or chronic inflammatory disorders. The aim of this review was to summarize contemporary principles for recognition, etiologic evaluation, treatment, and follow-up of IDA in routine clinical practice, while integrating evidence from international recommendations and recent studies from Uzbekistan. A focused narrative review of guidelines, expert reviews, randomized trials, and regional publications was performed. Current evidence supports a diagnostic strategy based on complete blood count indices, serum ferritin, transferrin saturation, and clinical assessment of inflammation. Oral ferrous preparations remain first-line therapy for many stable patients, whereas intravenous iron is appropriate when oral treatment is not tolerated, ineffective, poorly absorbed, or when rapid iron repletion is required. Modern dosing concepts favor once-daily or alternate-day oral administration rather than multiple daily doses in selected patients. The clinical objective is not only normalization of hemoglobin but also restoration of iron stores and correction of the source of iron loss. A structured, cause-oriented approach can improve therapeutic response, reduce recurrence, and prevent missed serious disease.

**Keywords:** iron deficiency anemia, ferritin, transferrin saturation, hemoglobin, oral iron, intravenous iron, clinical practice.

## INTRODUCTION

Iron deficiency is the most prevalent micronutrient deficiency worldwide, and iron deficiency anemia represents its most clinically visible stage. The disorder occurs when available iron is insufficient to sustain normal hemoglobin synthesis and tissue iron requirements. Because iron participates in oxygen transport, mitochondrial metabolism, myoglobin function, and numerous enzymatic reactions, deficiency can produce symptoms even before anemia becomes severe. In daily practice, patients commonly present with fatigue, exercise intolerance, reduced concentration, dizziness, headache, palpitations, exertional dyspnea, restless legs, pica, or nonspecific weakness. Physical findings may include pallor, tachycardia, brittle nails, angular cheilitis, glossitis, or, in advanced cases, cardiovascular strain. The absence of dramatic symptoms does not exclude

clinically important deficiency, especially when the process develops gradually (Camaschella, 2015; Cappellini et al., 2020).

The contemporary approach to IDA has shifted from a narrow focus on hemoglobin correction toward a broader evaluation of iron biology and the cause of deficiency. Iron loss, insufficient intake, impaired absorption, and increased physiologic requirements may act alone or in combination. Menstrual blood loss and pregnancy are common causes in women of reproductive age, whereas occult gastrointestinal bleeding becomes increasingly important in men and postmenopausal women. Other contributors include peptic ulcer disease, colorectal neoplasia, inflammatory bowel disease, celiac disease, bariatric surgery, atrophic gastritis, chronic kidney disease, chronic heart failure, repeated blood donation, parasitic disease, and prolonged use of medications that increase bleeding risk or interfere with iron absorption. The British Society of Gastroenterology emphasizes that unexplained IDA in adults at risk of gastrointestinal pathology should trigger etiologic investigation rather than empirical iron therapy alone (Snook et al., 2021).

Diagnostic complexity arises because iron deficiency and anemia are related but not identical conditions. Hemoglobin identifies anemia but does not establish its cause. Mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) often decrease as deficiency progresses, yet early IDA may be normocytic. Serum ferritin is the most useful marker of body iron stores in uncomplicated patients, but ferritin is also an acute-phase reactant and can be normal or elevated in infection, obesity, inflammatory disease, liver disease, and malignancy. For this reason, ferritin should be interpreted with transferrin saturation (TSAT), C-reactive protein when appropriate, and the overall clinical context. Recent recommendations from the European Hematology Association and WHO further support a biomarker-based approach that accounts for age, sex, pregnancy, and inflammation (Iolascon et al., 2024; World Health Organization, 2024).

IDA remains particularly relevant in Uzbekistan, where women, children, and patients with chronic disease continue to represent important risk groups. Recent Uzbek publications have addressed early laboratory recognition in children, ferrokinetic changes in women, and practical selection between oral and intravenous iron therapy. These local observations are clinically valuable because patterns of nutrition, reproductive health, access to laboratory testing, and prevalence of chronic gastrointestinal disorders influence how international recommendations are implemented in real-world care (Zayniddinov et al., 2026; Ruzimatova, 2026). The aim of the present article is therefore to review IDA specifically from the perspective of clinical practice, emphasizing diagnosis, differential diagnosis, etiologic assessment, treatment selection, and follow-up.

## MATERIALS AND METHODS

A focused narrative review was conducted to synthesize clinically applicable evidence on iron deficiency anemia. Publications were selected from peer-reviewed journals, professional society guidance, World Health Organization documents, and accessible Uzbek medical sources. Priority was given to guidelines, expert reviews, randomized clinical studies, and publications addressing diagnostic thresholds, oral and intravenous iron replacement, etiologic evaluation, and special clinical populations. International literature included major sources published between 2015 and 2026, while regional literature from Uzbekistan was included to reflect local clinical observations and practice patterns.

The review considered the following domains: definition of anemia and iron deficiency; interpretation of complete blood count indices and iron biomarkers; differentiation of absolute iron deficiency from functional iron restriction and other microcytic anemias; common sources of blood loss or malabsorption; indications for gastrointestinal and gynecologic evaluation; principles of oral iron dosing; indications for intravenous iron; response monitoring; and causes of treatment failure. Evidence was interpreted qualitatively rather than pooled statistically because the included sources differed in population, clinical setting, diagnostic thresholds, and treatment regimens. The synthesis was organized according to practical decisions faced by clinicians during initial assessment, treatment, and follow-up.

## RESULTS

### Clinical recognition and diagnostic confirmation

The reviewed evidence shows that IDA should be suspected when anemia coexists with low MCV, low MCH, increased red-cell distribution width, or characteristic peripheral smear findings such as hypochromia, microcytosis, anisopoikilocytosis, and elongated pencil cells. However, morphology is neither sufficiently sensitive nor specific to replace iron studies. In early deficiency, hemoglobin and MCV may remain within reference limits while ferritin falls, whereas in mixed disorders the MCV may appear normal. WHO guidance provides population- and patient-specific hemoglobin thresholds, but interpretation in individual clinical care still requires attention to age, sex, pregnancy, altitude, smoking, and comorbidity (Pasricha et al., 2024; World Health Organization, 2024).

Serum ferritin is central to diagnosis because a low ferritin strongly supports depleted iron stores. In adults without inflammation, many contemporary recommendations consider ferritin below approximately 30 micrograms/L compatible with iron deficiency, although laboratory reference intervals vary. In inflammatory conditions, a higher ferritin does not reliably exclude deficiency. TSAT, generally calculated from serum iron and total iron-binding capacity or transferrin, provides complementary information regarding circulating iron available for erythropoiesis. A low TSAT together with a ferritin that is low or inappropriately normal strengthens the diagnosis. Soluble transferrin receptor, reticulocyte hemoglobin content, percentage of hypochromic red cells, and hepcidin may be helpful in selected cases but are not universally available (Iolascon et al., 2024).

The diagnostic process should also determine whether anemia is truly attributable to iron deficiency rather than thalassemia trait, anemia of inflammation, sideroblastic anemia, lead exposure, chronic kidney disease, or combined nutritional deficiency. A markedly low MCV with a relatively preserved red-cell count may suggest thalassemia trait. In anemia of inflammation, ferritin is often normal or elevated and serum iron is low because hepcidin-mediated iron sequestration reduces iron release and intestinal absorption. Mixed IDA and inflammation is common and requires interpretation of ferritin and TSAT together. The practical importance of early laboratory identification is also emphasized in recent Uzbek pediatric work, where combined assessment of ferritin, hemoglobin, and transferrin saturation was considered useful for staging iron deficiency and guiding treatment (Zayniddinov et al., 2026).

**Etiologic evaluation**

Once iron deficiency is demonstrated, identifying the cause becomes the most important clinical task. In women of reproductive age, detailed menstrual and obstetric history is essential. Heavy menstrual bleeding, frequent pregnancies, short interpregnancy intervals, postpartum blood loss, and prolonged lactation may produce progressive depletion. Diet should be reviewed for low intake of heme iron or restrictive eating patterns, but dietary deficiency alone should not be assumed when bleeding or malabsorption is plausible. In men and postmenopausal women, gastrointestinal blood loss requires particular attention. The British guideline notes that a substantial proportion of such patients have underlying gastrointestinal pathology, including malignancy, and therefore investigation may include upper and lower gastrointestinal assessment according to age, symptoms, risk profile, and local protocols (Snook et al., 2021).

Celiac disease, Helicobacter pylori-associated gastritis, inflammatory bowel disease, autoimmune atrophic gastritis, prior gastric or bariatric surgery, and chronic use of proton-pump inhibitors can impair absorption. Patients should also be questioned about nonsteroidal anti-inflammatory drugs, anticoagulants, antiplatelet therapy, recurrent epistaxis, urinary blood loss, and blood donation. Fecal occult blood testing alone should not be used to reassure the clinician when significant IDA remains unexplained. In younger patients with an obvious gynecologic source and no red flags, the sequence of investigations may differ from that used in older adults, but persistence or recurrence after iron replacement should prompt reassessment.

Local clinical reports illustrate that IDA may coexist with findings that can distract from the underlying diagnosis. Abdiyev, Mamatkulova, and Gafarov described IDA associated with thrombocytosis, emphasizing that reactive platelet elevation may accompany chronic iron deficiency and should be interpreted within the complete clinical picture rather than automatically treated as a primary myeloproliferative process (Abdiyev et al., 2023). Such observations reinforce a general principle: atypical laboratory features do not eliminate the need to document iron status and investigate the reason for iron loss.

**Oral iron therapy**

For hemodynamically stable patients with uncomplicated IDA and intact gastrointestinal absorption, oral iron remains the usual first-line treatment because it is inexpensive, accessible, and effective. Ferrous sulfate is widely used and is specifically favored in the 2024 American Gastroenterological Association Clinical Practice Update because no oral formulation has demonstrated universal superiority and ferrous sulfate is cost-effective (DeLoughery et al., 2024). Traditional practice often used two or three divided daily doses, but newer evidence shows that large or frequent doses raise hepcidin and can reduce absorption from subsequent doses while increasing gastrointestinal adverse effects.

Studies of iron-depleted women demonstrated greater fractional absorption when oral iron was given on alternate days compared with consecutive daily dosing, providing a physiologic basis for simplified regimens (Stoffel et al., 2017). A later randomized trial in adults with IDA found no clinically important difference in hemoglobin rise between daily and alternate-day regimens over eight weeks, indicating that both approaches can be effective and that tolerability, adherence, dose, and severity of anemia should guide selection (Pasupathy et al., 2023). Current expert advice

commonly supports administration no more than once daily, with alternate-day treatment as a reasonable option when gastrointestinal side effects or adherence problems occur (DeLoughery et al., 2024).

Oral iron is best taken in a manner that maximizes adherence rather than according to an overly rigid schedule. Food reduces absorption but may improve tolerability. Tea, coffee, calcium supplements, and some antacids can reduce absorption when taken close to the iron dose. Gastrointestinal adverse effects include nausea, epigastric discomfort, constipation, diarrhea, and metallic taste. A patient who stops treatment because of these symptoms should not be labeled noncompliant without adjustment of dose, frequency, formulation, or route. Hemoglobin should begin to rise when the diagnosis is correct and treatment is taken consistently, but the exact speed varies with baseline severity and ongoing losses. Iron therapy should usually continue beyond hemoglobin normalization to restore iron stores and reduce early recurrence (Iolascon et al., 2024).

**Intravenous iron and treatment escalation**

Intravenous iron is appropriate when oral therapy is not tolerated, fails to improve iron indices, is unlikely to be absorbed, or when rapid replacement is clinically important. Common scenarios include active inflammatory bowel disease, significant malabsorption, previous bariatric surgery, chronic kidney disease, some patients with heart failure, ongoing heavy blood loss, and selected pregnant patients after the first trimester when benefits outweigh risks. Modern intravenous formulations can deliver larger amounts of iron in fewer visits than older preparations, but dosing and monitoring should follow the specific product and local protocol. Hypersensitivity reactions are uncommon but require an appropriate infusion environment, and some formulations may cause hypophosphatemia (DeLoughery et al., 2024; Iolascon et al., 2024).

The decision between oral and intravenous therapy should therefore be individualized. Recent Uzbek clinical literature similarly highlights the need to select the route according to severity, speed of required correction, gastrointestinal tolerance, malabsorption, and inflammatory status. Ruzimatova's 2026 review of reproductive-age women concluded that stable mild-to-moderate cases can often be treated with oral ferrous salts, whereas intravenous preparations are preferable when rapid correction is needed or oral treatment is ineffective or poorly tolerated (Ruzimatova, 2026). This approach is consistent with international guidance and is particularly relevant in settings where unnecessary intravenous therapy can increase cost while prolonged ineffective oral therapy can delay recovery.

**Monitoring and causes of inadequate response**

Monitoring should confirm both hematologic response and iron-store repletion. A meaningful rise in hemoglobin over the first several weeks supports the diagnosis and indicates adequate treatment exposure. Failure to respond should trigger a structured review rather than automatic dose escalation. Common explanations include poor adherence, intolerance leading to missed doses, continued bleeding, incorrect diagnosis, celiac disease or other malabsorption, severe inflammation, chronic kidney disease, concurrent vitamin B12 or folate deficiency, and rare disorders such as iron-refractory iron deficiency anemia. Repeat ferritin and TSAT are useful after treatment,

although the timing of post-infusion measurements must account for transient changes after intravenous iron.

Recurrence is clinically important. Patients whose hemoglobin normalizes but whose underlying source of blood loss persists may return with deficiency months later. Therefore, follow-up should be risk-based. Patients with heavy menstrual bleeding need management of the bleeding source in addition to iron replacement. Adults with gastrointestinal blood loss require treatment of the lesion. Nutritional counseling is useful but should not substitute for investigation of unexplained IDA. This cause-oriented strategy is a consistent theme across international reviews and regional publications and represents one of the most important practical lessons in IDA management (Cappellini et al., 2020; Snook et al., 2021).

## DISCUSSION

The principal finding of this review is that successful management of IDA depends on combining three processes: confirmation of iron deficiency, identification of its cause, and appropriate iron replacement. Treating only the low hemoglobin is insufficient. This is especially important because IDA can be the first sign of clinically significant gastrointestinal or gynecologic disease. The diagnostic sequence should begin with a complete blood count and ferritin, followed by TSAT and inflammatory markers when interpretation is uncertain. The clinician must then decide whether the clinical setting suggests chronic blood loss, malabsorption, increased physiologic demand, inadequate intake, or a combination of mechanisms.

A second important point is the changing concept of oral iron dosing. Older regimens were based on the assumption that more frequent dosing would deliver more iron, whereas modern studies of hepcidin physiology show that repeated doses can transiently reduce subsequent absorption. The evidence does not mean that alternate-day therapy is mandatory for every patient. Rather, it supports flexibility. Once-daily low-to-moderate elemental iron can be appropriate for many patients, and alternate-day administration can be particularly useful when gastrointestinal symptoms threaten adherence. The best regimen is one that the patient can take consistently and that produces an objective hematologic response. Stoffel et al. (2017), Pasupathy et al. (2023), and the AGA update (DeLoughery et al., 2024) collectively support this practical shift.

The role of intravenous iron has also expanded, but it should be used for defined indications rather than convenience alone. It offers rapid repletion and bypasses the gastrointestinal tract, making it valuable in malabsorption, active inflammation, ongoing losses, and situations where oral therapy has failed. At the same time, intravenous treatment requires product-specific dosing, infrastructure, cost considerations, and awareness of adverse effects. Clinical judgment should balance severity, symptoms, comorbid conditions, urgency, patient preference, and feasibility.

The Uzbek sources included in this review complement international guidance by demonstrating the continuing clinical relevance of IDA in regional practice. Zayniddinov et al. (2026) emphasize laboratory recognition in children; Abdiyev et al. (2023) illustrate an atypical hematologic presentation with thrombocytosis; and Ruzimatova (2026) addresses individualized oral versus intravenous treatment in reproductive-age women. These publications support the need for context-sensitive implementation of general principles. The burden of iron deficiency is influenced by reproductive patterns, nutrition, access to diagnostic testing, gastrointestinal disease,

and continuity of follow-up. Consequently, locally applicable algorithms should remain consistent with evidence-based thresholds while accounting for available resources.

Several limitations should be acknowledged. This article is a narrative rather than systematic review, so it does not provide pooled effect estimates or formal certainty grading. Diagnostic cutoffs vary among guidelines and according to inflammatory status, age, pregnancy, and comorbidity. Oral iron trials also differ in elemental iron dose, duration, baseline hemoglobin, and adherence measurement. Nevertheless, the major principles are consistent: low ferritin is highly informative, ferritin must be interpreted cautiously in inflammation, unexplained IDA requires etiologic assessment, oral iron is effective for many stable patients, intravenous iron has clear indications, and therapy should continue long enough to restore iron stores rather than merely normalize hemoglobin.

## CONCLUSION

Iron deficiency anemia is common, treatable, and diagnostically important. In clinical practice, the most effective approach is structured and cause-oriented. Diagnosis should combine hemoglobin and red-cell indices with ferritin, TSAT, and assessment of inflammation when necessary. Clinicians should actively search for menstrual, gastrointestinal, nutritional, absorptive, and chronic disease-related causes rather than relying on empirical supplementation alone. Oral ferrous preparations remain first-line treatment for many stable patients, with once-daily or alternate-day schedules providing practical options that may improve tolerability. Intravenous iron should be used when oral therapy is ineffective, not tolerated, poorly absorbed, or when rapid repletion is needed. Response monitoring must include both hematologic recovery and restoration of iron stores. Integrating international recommendations with evidence from Uzbekistan can improve early recognition, individualize treatment, and reduce recurrence of IDA in routine clinical care.

## References:

1. Abdiyev, K. M., Mamatkulova, F. X., & Gafarov, F. E. (2023). Trombotsitoz va anemiya bilan kechadigan temir tanqisligi anemiyasining kam uchraydigan holati [A rare case of iron deficiency anemia accompanied by thrombocytosis]. Problems of Biology and Medicine, 4(146), 210–215.
2. Camaschella, C. (2015). Iron-deficiency anemia. New England Journal of Medicine, 372(19), 1832–1843. https://doi.org/10.1056/NEJMra1401038
3. Cappellini, M. D., Musallam, K. M., & Taher, A. T. (2020). Iron deficiency anaemia revisited. Journal of Internal Medicine, 287(2), 153–170. https://doi.org/10.1111/joim.13004
4. DeLoughery, T. G., Jackson, C. S., Ko, C. W., & Rockey, D. C. (2024). AGA Clinical Practice Update on management of iron deficiency anemia: Expert review. Clinical Gastroenterology and Hepatology. https://doi.org/10.1016/j.cgh.2024.03.046
5. Iolascon, A., Andolfo, I., Russo, R., Sanchez, M., Busti, F., Swinkels, D., Aguilar Martinez, P., Bou-Fakhredin, R., Muckenthaler, M. U., Unal, S., Porto, G., Ganz, T., Kattamis, A., De Franceschi, L., Cappellini, M. D., Munro, M. G., & Taher, A. (2024). Recommendations for diagnosis, treatment, and prevention of iron deficiency and iron deficiency anemia. HemaSphere, 8(7), e108. https://doi.org/10.1002/hem3.108

6. Pasricha, S.-R., Rogers, L., Branca, F., & Garcia-Casal, M.-N. (2024). Measuring haemoglobin concentration to define anaemia: WHO guidelines. The Lancet, 403(10440), 1963–1966. https://doi.org/10.1016/S0140-6736(24)00502-6
7. Pasupathy, E., Kandasamy, R., Thomas, K., et al. (2023). Alternate day versus daily oral iron for treatment of iron deficiency anemia: A randomized controlled trial. Scientific Reports, 13, 1818. https://doi.org/10.1038/s41598-023-29034-9
8. Ruzimatova, G. M. (2026). Reproduktiv yoshdagi temir tanqisligi kamqonligi bo‘lgan ayollarda og‘iz orqali va vena ichiga temir terapiyasini individual tanlash [Individualized selection of oral and intravenous iron therapy in women of reproductive age with iron deficiency anemia]. Zamonaviy tibbiyot jurnali, 14(3), 706–713. https://doi.org/10.67519/nshr.ztj.2026.03.100
9. Snook, J., Bhala, N., Beales, I. L. P., Cannings, D., Kightley, C., Logan, R. P. H., Pritchard, D. M., Sidhu, R., Surgenor, S., Thomas, W., Verma, A. M., & Goddard, A. F. (2021). British Society of Gastroenterology guidelines for the management of iron deficiency anaemia in adults. Gut, 70(11), 2030–2051. https://doi.org/10.1136/gutjnl-2021-325210
10. Stoffel, N. U., Cercamondi, C. I., Brittenham, G., Zeder, C., Geurts-Moespot, A. J., Swinkels, D. W., Moretti, D., & Zimmermann, M. B. (2017). Iron absorption from oral iron supplements given on consecutive versus alternate days and as single morning doses versus twice-daily split dosing in iron-depleted women: Two open-label, randomised controlled trials. The Lancet Haematology, 4(11), e524–e533. https://doi.org/10.1016/S2352-3026(17)30182-5
11. World Health Organization. (2024). Guideline on haemoglobin cutoffs to define anaemia in individuals and populations. World Health Organization.
12. Zayniddinov, A. A. o‘g‘li, Ismoilova, S. Z., & A’zamova, F. A. qizi. (2026). Bolalarda temir tanqisligi anemiyasini erta aniqlashda laborator va klinik belgilarning diagnostik ahamiyati [Diagnostic significance of laboratory and clinical signs in the early detection of iron deficiency anemia in children]. Central Asian Journal of Academic Research, 4(5 Part 2), 62–64. https://doi.org/10.70413/cajar-v04-i05-p2-010