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No. 469 Iron Deficiency and Iron Deficiency Anemia in Obstetrics and Gynaecology

(En Français : Lignes directrices de pratique clinique No. 469 : Carence en fer et anémie ferriprive en obstétrique et gynécologie).

The English document is the original version.

This clinical practice guideline was prepared by the authors, reviewed by the SOGC Clinical Gynaecology Committee, the SOGC Clinical Obstetrics Committee and approved by the SOGC Guideline Management and Oversight Committee.

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The Society of Obstetricians and Gynaecologists of Canada (SOGC) has a policy of reviewing its clinical practice guidelines at least every five years to ensure they reflect new evidence.

Patients have the right and the responsibility to make informed decisions about their care, in partnership with their health care professional. To facilitate informed decision-making, patients must receive information based on evidence, as well as personalized and culturally appropriate support that enables them to understand the benefits, risks, and potential consequences of their choices, including the impact of refusing recommended care. The values, beliefs, and individual needs of each patient, within the context of their personal circumstances, must be taken into account. The patient is responsible for their informed decision, which must be respected.

This clinical practice guidance document may use either gendered or gender-neutral language and is intended to apply inclusively to all individuals who may benefit from its recommendations. The language chosen reflects efforts to promote inclusivity and acknowledge the diversity of individuals. Health care providers are encouraged to engage in respectful, patient-centred discussions and to apply this guidance with sensitivity to each person's identity, lived experience, circumstances, and specific clinical needs, ensuring care that is respectful, equitable, and responsive.

Weeks Gestation Notation: The authors follow the World Health Organization's notation on gestational age: the first day of the last menstrual period is day 0 (of week 0); therefore, days 0 to 6 correspond to completed week 0, days 7 to 13 correspond to completed week 1, etc.

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Subject Categories: Nutrition, Obstetrics, Gynaecology

Keywords : Anemia; Iron deficiency; pregnancy; peripartum period; uterine hemorrhage; gynecologic surgical procedures

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1. Iron deficiency and iron deficiency anemia should be viewed as systemic, life-course conditions with implications for reproductive health, gynaecologic surgery, and pregnancy worldwide.
2. The early identification of iron deficiency and the early initiation of iron replacement therapy are important strategies for women's health, wellbeing and quality of life.
3. A complete blood count and ferritin are the initial tests for diagnosing iron deficiency and iron deficiency anemia, but a complete blood count alone is inadequate to assess iron deficiency.
4. Oral iron salts are first line therapy for iron replacement, and patients should be provided with strategies to improve tolerance, compliance, and absorption of oral iron salts.
5. Intravenous iron is a safe option for iron replacement in obstetric and gynaecologic patients and should be considered for moderate to severe anemia, intolerance to oral iron, or when rapid correction is required.

ABSTRACT

Objective: The purpose of this guideline is to provide an evidence-based framework for healthcare professionals to recognize, manage, and prevent iron deficiency and iron deficiency anemia across the lifecycle of women, with particular emphasis on time periods of vulnerability, such as pregnancy, menstruation, and perioperatively.

Target Population: This clinical practice guideline seeks to improve the lives of women at all reproductive life stages, from menarche to menopause, with iron deficiency and iron deficiency anemia in the context of obstetrical and gynaecologic care.

Options: This guideline reviews the available options for the prevention, assessment, and treatment of iron deficiency and iron deficiency anemia. While the focus of this guideline pertains to oral and intravenous iron replacement therapy, the importance of reducing menstrual blood loss is also emphasized.

Outcomes: By consolidating the best evidence to date with expert opinion across the disciplines of obstetrics and gynaecology, hematology, and anaesthesiology, we provide recommendations and treatment algorithms to guide the diagnosis and treatment of iron deficiency and iron deficiency anemia for patients within our specialty.

Benefits, Harms, and Costs: The prevention, early identification, and treatment of iron deficiency and iron deficiency anemia is assessed to be a cost-effective strategy to improve the health and well-being of women of reproductive age. This proactive approach to iron deficiency and iron deficiency anemia has also been shown to reduce the need for blood transfusion, along with the associated harms and costs of transfusion. The potential costs of iron infusion therapy must be assessed in the context of the profound adverse impacts on quality of life, reduced work performance and decreased economic productivity of patients with iron deficiency and iron deficiency anemia.

Evidence: Using relevant MeSH headings and keywords (related to concepts of anemia, iron deficiency, blood management, blood conservation, transfusion, obstetrics, pregnancy, postpartum, and gynaecology), published literature was retrieved through searches of PubMed and Cochrane Systematic Reviews from January 2015 to December 2025. Grey literature was identified through searching the

websites of health technology assessment and health technology–related agencies, clinical practice guideline collections, and national and international medical specialty societies.

Validation Methods: This guideline was developed through consensus by a multidisciplinary team of authors with representation from obstetrics, gynaecology, anaesthesiology, and hematology. The content and recommendations were drafted and agreed upon by the authors. The SOGC's Clinical Obstetrics and Gynaecology Committee reviewed the guideline and the Guideline Management and Oversight Committee approved the final draft for publication. The quality of evidence was rated using the criteria described in the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology framework. See online Appendix A (Tables A1 for definitions and A2 for interpretations).

A national panel of patient partners was gathered to provide feedback and perspective on the recommendations and summary statements for this guideline. Community partners were purposefully selected to ensure representation of Canadian geographic regions, lived experience with iron deficiency or iron deficiency anemia, as well as obstetrical or gynaecologic care received.

Intended Audience: Healthcare providers involved in the assessment and management of women with iron deficiency and iron deficiency anemia.

Social Media Abstract: Iron deficiency (ID) and iron deficiency anemia (IDA) have profound impacts on the quality of life in women worldwide. As such, the early identification of ID/IDA and iron replacement therapy is an important strategy for women's health and wellbeing.

SUMMARY STATEMENTS:

General Principles of Diagnosis and Treatment

1. Iron deficiency and iron deficiency anemia present a considerable global health burden, particularly affecting women of reproductive age, with effects that span across the life course. (*high*)
2. Iron deficiency and iron deficiency amenia have a profound impact on the quality of life of women and are a major cause of disability, affecting work performance and economic productivity. (*high*)
3. The early identification of iron deficiency and the early initiation of iron replacement therapy are important strategies for women's health and wellbeing. (*moderate*)

Gynaecology

4. Abnormal uterine bleeding, particularly heavy menstrual bleeding, affects up to half of menstruating individuals and is the leading cause of iron deficiency and iron deficiency anemia in reproductive-aged women. (*high*)
5. Adolescents are at increased risk for iron deficiency and iron deficiency anemia because of higher iron demands after menarche, abnormal uterine bleeding, and insufficient dietary intake. These conditions can adversely affect growth, cognitive performance, and overall development. (*moderate*)
6. Preoperative anemia is common among patients undergoing elective major gynaecologic surgery and is strongly associated with increased surgical risk, including higher transfusion rates, surgical site infection, and other postoperative complications. (*moderate*)

Preconception, pregnancy, and postpartum

7. Iron requirements rise significantly during pregnancy to support fetal and placental development as well as expanded maternal blood volume, often exceeding what can be met through diet alone. (*high*)
8. Maternal iron deficiency and iron deficiency anemia are linked to adverse maternal, fetal, and infant health outcomes, with neurocognitive sequelae in children. (*moderate*)
9. Anemia in pregnancy is defined as a hemoglobin less than 110g/L in all trimesters and in the postpartum period. (*high*)
10. Intravenous iron is safe and effective in the second and third trimesters of pregnancy and in the postpartum period. However, its high cost limits access; each province should develop strategies, particularly in hospital settings, to ensure access for women who do not have the financial means. (*high*)

RECOMMENDATIONS:

General Principles of Diagnosis and Treatment

1. A complete blood count and serum ferritin should be ordered as the initial tests when evaluating for iron deficiency and iron deficiency anemia. A complete blood count alone is insufficient to accurately assess iron deficiency. *(strong, moderate)*
2. When patients do not respond appropriately to iron replacement therapy, additional diagnostic evaluations should be considered. If the cause of anemia cannot be determined, or if an underlying bleeding disorder is suspected, referral to Internal Medicine or Hematology is recommended. *(strong, moderate)*
3. Given the high prevalence of iron deficiency among individuals with heavy menstrual bleeding, periodic universal laboratory screening may be beneficial for women of reproductive age. *(conditional, moderate)*
4. Laboratory screening for iron deficiency and iron deficiency anemia is recommended for all individuals with heavy menstrual bleeding, prior to planned pregnancy, during pregnancy, and pre-operatively for major gynaecologic surgery. (*strong, high*)
5. Oral iron salts are first line therapy for iron replacement due to their efficacy, availability, and low cost. Patients should be provided with strategies to improve tolerance, compliance and absorption of oral iron salts. (*strong, high*)
6. Intravenous iron is a safe and effective iron replacement therapy that can be administered in ambulatory settings and is recommended for patients with moderate to severe anemia, intolerance to oral iron, or when rapid correction of iron deficiency is required. Provincial healthcare systems should establish funding mechanisms to ensure that cost is not a barrier to accessing this treatment when clinically indicated. (*strong, high*)
7. Repeat laboratory testing is required to confirm appropriate treatment response following the initiation of iron replacement therapy. (*conditional, moderate*)
8. Red blood cell transfusion should generally be reserved for patients with hemodynamic compromise, active bleeding, or cardiovascular symptoms (e.g. hypotension, chest pain, syncope). (*conditional, moderate*)

Gynaecology

9. In addition to iron replacement therapy, treatment of heavy menstrual bleeding is recommended as a key component of managing and correcting iron deficiency and iron deficiency anemia. (*strong, high*)
10. All patients undergoing major gynaecologic surgery should be screened for iron deficiency and iron deficiency anemia, ideally at the time of the decision to operate, to allow adequate time for correction. (*strong, high*)
11. Hemoglobin levels should be optimized prior to all major elective surgeries, with a target hemoglobin of $\geq$130 g/L. This practice should be supported by institutional policy. (*strong, high*)
12. For preoperative patients with iron deficiency and iron deficiency anemia with short "lead time" to gynaecologic surgery, there should be a low threshold for the initiation of intravenous iron to allow for rapid optimization. (*strong, moderate*)

13. Intravenous iron is recommended for patients who develop postoperative anemia due to intraoperative blood loss. (*strong, moderate*)

Preconception, pregnancy, and postpartum

14. All individuals of reproductive age who are planning pregnancy should be screened for iron deficiency and iron deficiency anemia. Both hemoglobin levels and iron stores should be optimized prior to conception. (*strong, high*)
15. All pregnant women should be screened for iron deficiency and iron deficiency anemia in the first trimester, with repeat screening at 24–28 weeks' gestation and again prior to delivery. (*strong, high*)
16. In addition to prenatal vitamins, oral iron should be routinely recommended in pregnancy to meet the increased iron demands of pregnancy. (*conditional, moderate)*
17. Routine fetal monitoring during or after intravenous iron administration is not required. In the rare event of anaphylaxis, maternal stabilization should take priority, followed by appropriate fetal assessment. (*conditional, moderate*)
18. Women with postpartum hemorrhage or antenatally identified iron deficiency anemia should have a postpartum complete blood count, with a low threshold for initiating intravenous iron therapy. (*strong, moderate)*

1. BACKGROUND

Global and social impact of iron deficiency

Globally, iron deficiency (ID) is the leading cause of years of life lost in women due to disability.[1] ID is the predominant cause of anemia, accounting for approximately half of all anemia cases among women of reproductive age.[2,3] Anemia, in turn, negatively affects economic productivity and occupational performance,[4,5] further exacerbating the costs to overall health and wellness.[5]

Iron deficiency (ID) and iron deficiency anemia (IDA) in pregnancy are associated with increased risks of preterm birth, low birth weight, impaired fetal growth, and higher maternal morbidity and mortality.[6]

Over the past decade, plant-based diets have become increasingly prevalent, due to potential health benefits, as well as environmental, ethical, and cost considerations. While plant-based diets have potential to reduce the risk of certain chronic diseases, inadequate iron intake continues to be common.[7]

ABBREVIATIONS

AUB	Abnormal uterine bleeding
CARPA	Complement activation related pseudo allergy
CBC	Complete blood count
FIGO	International Federation of Gynaecology and Obstetrics
GI	Gastroenterology
GRADE	Grading of Recommendations Assessment Development and Evaluation
Hb	Hemoglobin
HMB	Heavy menstrual bleeding
ICU	Intensive Care Unit
ID	Iron deficiency
IDA	Iron deficiency anemia
IDWA	Iron deficiency without anemia
IV	Intravenous
NAID	Non-anemic iron deficiency
PBM	Patient Blood Management
RBC	Red blood cell
SOGC	Society of Obstetricians and Gynaecologists of Canada
TIBC	Total iron binding capacity
Tsat	Transferrin saturation
UIBC	Unsaturated iron binding capacity
WHO	World Health Organization

The prevalence of ID/IDA is impacted by social determinants, such as income and geography.[8] Certain groups in Canada, such as First Nations, Inuit and Metis people;[9] racial and ethnically minoritized individuals;[10] and people of immigrant or refugee background,[11] are also disproportionately affected.

Taken together, ID/IDA should be viewed as a systemic, life-course condition with implications for reproductive health, gynaecologic surgery, and pregnancy.

SUMMARY STATEMENTS 1 and 2

Iron as an essential micronutrient

Iron is an essential micronutrient with fundamental roles extending well beyond hemoglobin (Hb) synthesis.[12] Iron plays a central role in mitochondrial function, neurotransmitter synthesis, thyroid hormone metabolism, and immune responses.[13] Iron is also required for myoglobin-mediated oxygen storage in muscle and for proper cognitive and neuromuscular development and function.[13]

Systematic iron homeostasis is tightly regulated by hepcidin, a peptide hormone produced primarily by the liver that serves as the central regulator of iron absorption, distribution, and recycling.[14] When hepcidin levels are elevated, intestinal iron absorption is reduced, limiting iron availability for erythropoiesis and other physiologic processes.[14] Conversely, low hepcidin levels permit increased dietary iron absorption and mobilization of stored iron.[15]

Hepcidin levels are physiologically suppressed in ID and during pregnancy to enhance iron absorption and support increased maternal and fetal requirements.[16] However, inflammation, whether related to chronic disease, infection, or the perioperative state, can elevate hepcidin, impairing iron absorption and functional availability even when total iron body stores are low.[14]

ID exists along a continuum and can exist with or without anemia. This is known as IDWA (iron deficiency without anemia), and in some literature as non-anemic iron deficiency (NAID) or may simply be known as ID (iron deficiency).[12,17–20]

Symptoms of iron deficiency

The symptoms of anemia are well-recognized and include fatigue, chest pain, shortness of breath with or without activity, pallor, palpitations, and syncope or presyncope. However, even in the absence of anemia, patients with ID often exhibit symptoms, including fatigue, impaired

cognition, poor concentration, irritability, reduced exercise tolerance, alopecia, pica, restless legs syndrome, and overall diminished quality of life.[12] Even in the absence of anemia, ID alone is independently associated with increased red blood cell (RBC) transfusion, morbidity, and mortality.[21]

Women who experience chronic, gradual blood loss, such as from menstruation, usually employ physiologic compensatory mechanisms to adapt to levels of anemia that would be poorly tolerated if blood loss occurred rapidly.[22] Unfortunately, the result is reduced cognitive and physical performance, and in pregnancy, an increased risk of maternal and neonatal complications.[23] The broader physiologic importance underscores why ID should be viewed as a systemic condition rather than solely a hematologic abnormality.

High prevalence among women of reproductive age

Although specific data are scarce, ID is disproportionately prevalent among women of reproductive age. In a convenience sample of young women in Switzerland, one in five was iron deficient and one in 30 was anemic due to iron deficiency.[24] In another sample, iron deficiency was identified in 40% of the participants despite normal hemoglobin levels[25], reflecting a combination of biologic iron distribution and sex-specific iron losses. Approximately 70% of total body iron is contained within circulating Hb, making menstrual blood loss represent a recurrent and often underestimated cause of negative iron balance.

Further, pregnancy requires an additional 1000 mg of iron to support expanded maternal erythropoiesis, placental development, and fetal growth. Post-partum blood loss, lactation-associated iron demands, and short interpregnancy intervals may prevent adequate repletion of iron stores, leading to persistent deficiency.[26] Collectively, these factors explain why ID, with or without anemia, remains highly prevalent in menstruating, pregnant, and post-partum women globally (Table 1).

Table 1. Recommended daily intake for iron across the female reproductive life course.[133]

Age Group	Recommended Daily Intake (mg/day)
Adolescent 9-13 years	8mg
Adolescent 14-18 years	15mg
Menstruating individuals 19-50 years	18mg
Pregnancy	27mg
Lactation	9mg
Menopause	8mg

Barriers to the diagnosis and correction of ID/IDA include a lack of awareness and recognition of symptoms, limited access to diagnosis and treatment, and variability in practice regarding oral and intravenous (IV) iron replacement therapies.[27,28] From an economic perspective, each dollar invested in reducing anemia has been estimated to yield a twelve-fold return in productivity by increasing cognitive and physical capacity.[29]

The etiologies and effects of ID and IDA across various stages of a woman's life (Figure 1) emphasize the importance of early identification and proactive management at key periods of vulnerability. The life-course implications of ID/IDA underscore the urgent need for effective prevention, recognition, and treatment strategies to break the intergenerational cycle of ID and its associated morbidities.[30]

SUMMARY STATEMENT 3

Purpose

The purpose of this guideline is to provide an evidence-based framework for healthcare professionals to recognize, manage, and prevent ID/IDA across a woman's lifespan, with particular emphasis on periods of vulnerability, such as pregnancy, menstruation, and around the time of gynaecologic surgery. By consolidating the best evidence to date with expert opinion across the disciplines of obstetrics and gynaecology, hematology, and anaesthesiology, we provide recommendations and treatment algorithms to guide the diagnosis and treatment of ID/IDA for patients within our specialty.

2. DIAGNOSIS OF IRON DEFICIENCY AND IRON DEFICIENCY ANEMIA

Clinical symptoms may serve as the first clue to identifying iron deficiency (ID) and iron deficiency anemia (IDA).

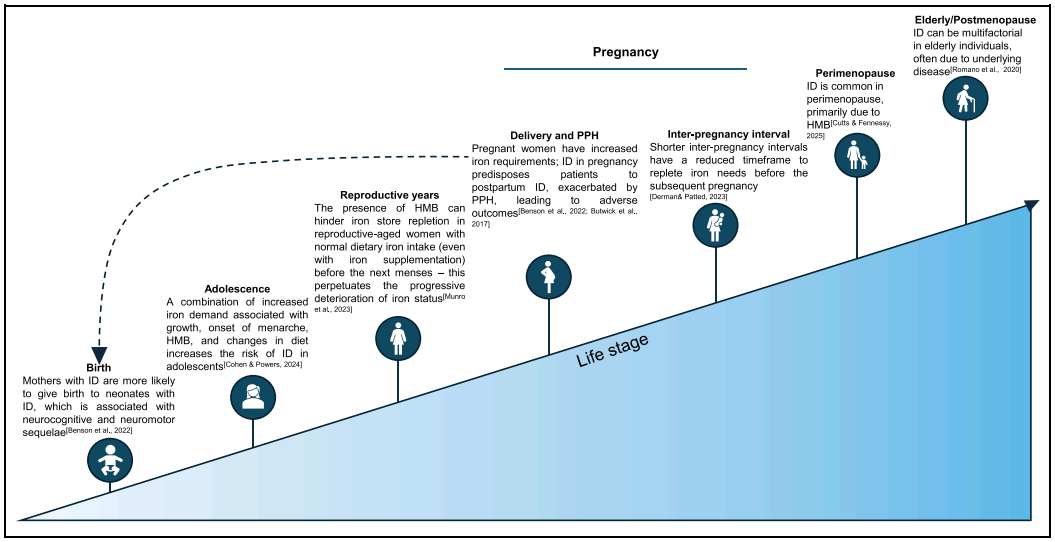
In patients with suspected ID/IDA, initial investigations include a complete blood count (CBC) and serum ferritin.[31]

RECOMMENDATION 1

Hemoglobin

The World Health Organization (WHO) defines anemia in adult non-pregnant women as Hemoglobin (Hb) <120 g/L.[32] While this threshold has been widely adopted, it is based on historical reference ranges that may not be grounded in robust evidence. In obstetrics, the International Federation of Gynecology and Obstetrics (FIGO)

Figure 1. Iron deficiency in women throughout the life course, from birth to perimenopause.



Captions: HMB: heavy menstrual bleeding; HPP: postpartum hemorrhage.

has defined anemia to be a Hb <110 g/L in all trimesters of pregnancy and the postpartum period.[33] Microcytosis is not a sensitive indicator of IDA as it is present in only half of affected patients[34,35] and is even less sensitive during pregnancy.[35]

Serum Ferritin

Serum ferritin is the primary diagnostic test for patients suspected of having ID, particularly those without concurrent inflammatory disease or comorbidities, such as chronic kidney disease, infection, obesity, or the perioperative state.[36,37]

The optimal ferritin threshold for diagnosing ID varies widely across guidelines.[20,38,39] While ID has traditionally been diagnosed with a serum ferritin threshold of <30 μg/L, more recent studies suggest that clinically optimal ferritin levels may lie in the 50 to 100 μg /L range.[20,40] For patients with signs, symptoms, or risk factors associated with ID (heavy menstrual bleeding, pregnancy, upcoming gynaecologic surgery), a more sensitive serum ferritin threshold of <50 μg /mL may be more appropriate for diagnosing ID and guiding decision-making.

A low serum ferritin level (<30-50 μg /L) is highly indicative of *absolute iron deficiency*, rendering additional iron profile tests unnecessary.

Iron studies

Hepcidin levels may be elevated in patients with infection, inflammation, alcohol use, or chronic kidney or liver disease, which in turn results in decreased iron availability for erythropoiesis, leading to functional iron deficiency.[41] In such cases, iron studies (serum iron, unsaturated iron-binding capacity (UIBC), total iron-binding capacity (TIBC), and transferrin saturation (Tsat) can be ordered for a more accurate assessment of ID.[42] A Tsat value less than 20% in the absence of low ferritin is consistent with functional ID.[42]

Other diagnostic considerations

Further testing beyond ferritin and iron studies may be considered in anemic patients, depending on clinical history and risk factors. These include consideration of gastroenterology (GI) studies, hemoglobinopathy assessment, nutritional assessment for B12 and folate deficiency, and assessment for suspected bleeding disorders. In addition to a detailed history of the menstrual and GI systems, clinicians are encouraged to explore a dietary, family, and medication history. If the cause for anemia cannot be ascertained or if an underlying bleeding disorder is suspected, a referral to Internal Medicine or Hematology is recommended.

RECOMMENDATION 2

Universal routine screening

While there is currently limited evidence for routine laboratory screening for ID/IDA in asymptomatic individuals, the high prevalence of ID and heavy menstrual bleeding, as well as the barriers to diagnosis and treatment of ID, suggests that a universal laboratory screening approach may be beneficial for women. Based on expert opinion, regular, universal screening with CBC and ferritin performed approximately every 3 years from menarche would be a reasonable approach.[20,43] Further, an analysis of quality-

adjusted life expectancy found ferritin-based screening with a threshold of 25 μg /L to be cost-effective.[44]

At minimum, all reproductive age women should be screened for risk factors of ID/IDA, such as heavy menstrual bleeding and low dietary iron intake. Further, laboratory screening for ID/IDA is recommended for all individuals with heavy menstrual bleeding, prior to planned pregnancy, during pregnancy, and pre-operatively for major gynaecologic surgery.

RECOMMENDATIONS 3 and 4

3. PREVENTION AND TREATMENT OF IRON DEFICIENCY AND IRON DEFICIENCY ANEMIA

In addition to addressing underlying causes, prevention strategies for ID/IDA include dietary optimization, use of fortified foods, and oral iron supplementation.[45]

Dietary iron can be categorized into heme iron and non-heme iron. Heme iron is the highest bioavailable form of iron (approximately 40% absorption) and is found in meat and fish.[46] Non-heme iron is less bioavailable (approximately 20 % absorption), and its absorption can be impacted by co-ingestion of certain foods and medication.[46,47]

Multivitamins usually contain very low doses of iron, which are insufficient to correct ID. They may also contain calcium, magnesium, zinc, and other minerals which interfere with iron absorption.[48]

A. Iron replacement therapy

Oral Iron

Dietary optimization may aid in preventing ID, but it is not an effective strategy for its treatment. When ID is already present, iron replacement therapy is required. Oral iron therapy is recommended as initial therapy to address ID.[48]

A wide variety of oral iron formulations are available in various forms, and some of the most commonly available in Canada are presented in Table 2.

Oral iron salts are recommended as first-line therapy, because they are supported by a large body of evidence regarding their efficacy and are the most cost-effective.[49] Usual treatment with oral iron salts involves 30 to 100 mg of elemental iron per day[50] or every other day,[51] often

Table 2. Common oral iron formulations available in Canada.

Category	Product (Brand) Name	Elemental iron per dose (mg)	Typical Dose	Cost
Ferrous Salt	Ferrous gluconate	35	1 - 3 tablets once daily	$
	Ferrous sulfate[a]	64	1 - 2 tablets once daily	$
	Ferrous fumarate (PALAFeR®)[a]	100	1 tablet once daily	$
	Ferrous ascorbate[b, c]	100	1 tablet once daily	$
Iron-Polysaccharide Complexes	Iron Polysaccharide (Triferexx 150)[b]	150	1 capsule once daily	$
	Iron Polysaccharide (Polyride Fe®)[b]	150	1 capsule once daily	$$
	Iron Polysaccharide (Polyride Fe® Ultra)[b,c]	150	1 capsule once daily	$$
	Polydextrose-Iron Complex (FeraMAX®)[b]	150	1 capsule once daily	$$
	Polydextrose-Iron Complex (FeraMAX® PD Maintenance 45)[b,c]	45	1 tablet once daily (chewable)	$$$
Iron Amino-Acid Complex	Ferrous Bisglycinate[c]	28	1 tablet once daily	$
Lipophilic Iron / Liposomal / Sucrosomial Iron	Ferric Maltol (ACCRUFeR®)[d]	30	1 capsule twice daily	$$$
	LCE Liposomal Iron (Ferosome Forte) Sachet[b,c]	21	1 sachet once daily	$$$
	LCE Liposomal Iron (Ferosom Forte) Capsule[b]	30	1 capsule once daily	$$$
Heme Iron (bovine)	Heme iron - low dose (Optifer alpha or Proferrin)[b]	11	1 tablet one to three times daily	$$
	Heme iron - high dose (Hemaforte)[b]	35	1 capsule once daily	$$

[a]Gastric side effects may be more common with this formulation.

[b]This formulation may be taken with food, though preferably separated from other medications.

[c]This formulation may be compounded with vitamin B12, folic acid, vitamin C, or a combination of these.

[d]This formulation is only available by prescription.

taken as a single dose.[40,48] Doses greater than 100 mg of elemental iron contribute to gut irritation and limit adherence.[48] The dosing of oral iron should be flexible to accommodate patient factors and preferences.[52,53]

Absorption of oral iron can be impeded by co-ingestion of certain foods and medications,[48] such as dairy products, as well as by phytates (found in whole grains and legumes), oxalates (found in leafy green vegetables and nuts), and polyphenols (found in tea, coffee, cocoa, red wine, and some fruits). Common medications that interfere with iron absorption include calcium supplements, thyroid medication, bisphosphonates and proton pump inhibitors.[54] Patients should be counselled to separate these agents from their oral iron supplements by one to two hours to improve absorption. Absorption of oral iron may be enhanced by the addition of vitamin C supplements[55] or vitamin C-containing foods.[47,55–58]

Gastrointestinal side-effects are the most commonly reported adverse effects associated with oral iron treatment, affecting 10-25% of individuals, which can include nausea, flatulence, abdominal pain, diarrhea, constipation, and dark stools.[57,59] It can be helpful for patients to start with lower doses (e.g. 30 mg of elemental iron daily) and increase gradually (e.g. 60-100 mg of elemental iron) according to tolerability and response.[60] Constipation can be managed with increased fluid, fibre, stool softeners, and laxatives as needed.

For patients intolerant of oral iron salts, other formulations may be considered; however, they are often more expensive and less effective, with limited supporting data. Polysaccharide iron supplements and heme iron supplements are less efficacious than iron salts in correcting ID.[61,62] Ferrous bisglycinate and ferrous ascorbate may have improved tolerability with acceptable efficacy,[63–65] but evidence is limited.

Once oral iron therapy has been initiated for ID/IDA, repeat hemoglobin and ferritin testing is recommended to evaluate efficacy. Timing of repeat testing is dependent on various clinical, obstetrical, and surgical considerations, with repeat testing typically occurring at one-to-three-month intervals.

For patients taking oral iron salts with 60-100 mg elemental iron per day, in the presence of adequate adherence and absorption and minimal blood loss, one can anticipate an increase in Hb by 5-10 g/L per week.[31] Treatment should continue until normalization, and maintenance treatment may be required to sustain iron and Hb levels based on the clinical situation.

RECOMMENDATION 5

Intravenous iron

Intravenous (IV) iron is a safe and effective option for iron replacement with limited gastrointestinal side effects. It can be safely administered in ambulatory settings and is indicated for patients who are refractory to or intolerant of oral iron, when rapid correction is required, or when hemoglobin is less than 90g/L.

Dosing of IV iron depends on the patient's Hb and weight as described by the Ganzoni Formula (Weight (kg) x (130 - current Hb (g/L)) x 0.24 + 500 mg)).[66] Assuming no ongoing losses, patients with IDA and a Hb <100 g/L would require 1000 to 2000 mg of elemental iron. Depending on patient preference and clinical factors, this may be delivered in divided doses (e.g. iron sucrose) or as a single dose infusion (e.g. ferric derisomaltose or ferric carboxymaltose).[67]

The choice of IV iron formulation may be determined by availability, cost, and institutional approvals. The most commonly available agents in Canada are presented in Table 3. No single iron formulation has been shown to be superior to another in terms of efficacy or safety, but differences in frequency and severity of immediate and deferred reactions are being studied.

Contraindications to IV iron include anemia due to causes other than ID, as well as conditions associated with iron overload. It should be used with caution in the first trimester of pregnancy.

Recent evidence suggests that IV iron may be used safely in patients with active infection.[68] Ferric carboxymaltose can be associated with reduced phosphate levels, especially with multiple repeated iron infusions within a short time interval (< 3 months). In such situations of patients with multiple comorbidities or those requiring frequent infusions, referral to specialists in internal medicine or hematology may be helpful.

Side effects of IV iron may include flu-like symptoms, headache, joint or muscle aches, hives, and pruritus. A complement activation-related pseudo-allergy (CARPA) is the most common mechanism for an acute, non-allergic hypersensitivity reaction. This phenomenon, referred to as a Fishbane reaction, occurs in approximately 1-2% of

Table 3. Common intravenous iron formulations available in Canada.

Product (Brand) Name	Typical Dose in the Outpatient Setting	Maximum Dose per Infusion (Nongravid)	Maximum Dose per Infusion in Pregnancy	Maximum Cumulative Dose in Pregnancy
Ferric gluconate (Ferrlecit®)[a]	125 mg weekly for up to eight doses	Not specified[e]	Not specified[e]	Not specified[e]
Iron sucrose (Venofer®)	200 - 300 mg every one to two weeks 3-5 doses are usually required[b]	300 mg	Not specified[e]	Not specified[e]
Ferric carboxymaltose (Ferinject®)	500 mg - 1000 mg once[b,c,d]	1000 mg	1000 mg	1500 mg
Ferric derisomaltose (Monoferric®)	500 mg - 1500 mg once	1500 mg	1000 mg	2000 mg

[a]This formulation is primarily indicated for patients undergoing dialysis.

[b]Subsequent maintenance dose is determined by iron deficit calculations and whether there is ongoing bleeding.

[c]Consider testing and monitoring of phosphate and Vitamin D levels in patients at risk for hypophosphatemia.

[d]Pediatric dosing is approved in Canada for this formulation, and further details are found in the product monograph.

[e]Dose amounts are not specified in the product monograph.

patients and is characterized by truncal pain, facial flushing, and anxiety.[69] Resolution occurs with interruption of the IV iron infusion, which can be resumed once the reaction has resolved. For patients with minor reactions, using a slower infusion time, providing a pre-treatment fluid bolus, or pre-treatment with antihistamine and/or hydrocortisone may be helpful strategies to improve tolerability, though data is limited.[70]

True anaphylaxis is rare with IV iron, occurring in 1/200 000 patients.[71] However, caution should be used in patients with a history of severe drug allergies or multiple drug hypersensitivities.[72,73]

Patients should be counselled on the risks and benefits of IV iron. Staff involved in the management of IV iron therapy should be adequately educated regarding instructions for dilution and administration instructions per product monograph, and as well as on the recognition and management of infusion reactions.

IV iron causes a rapid increase in serum ferritin levels within the first few weeks after infusion; as such, repeat laboratory testing can be performed after four weeks post-infusion, with timing of repeat testing dependent on clinical, obstetrical, and surgical considerations.

RECOMMENDATIONS 6 and 7

B. Red blood cell transfusion

The three pillars for Patient Blood Management (PBM) are well-described in the anesthesia literature and include: (1) routine preoperative screening for ID and prompt correction, (2) intraoperative strategies to reduce surgical blood loss, and (3) restrictive transfusion policies that consider patient symptoms.

Red blood cell transfusion can be lifesaving for massive hemorrhage, bleeding with hemodynamic instability, and anemia with signs and symptoms of ischemia. However, transfusion is associated with adverse events, such as severe and immediate transfusion reactions, blood-borne infections, and allergies.[74] For patients of reproductive age, transfusion also carries a 5-10% risk of alloimmunization, potentially complicating future pregnancies.[75]

There is no universally accepted Hb threshold that mandates transfusion across all patient populations; therefore, clinical judgment remains essential.[76] In the absence of hemodynamic instability, isolated chronic IDA responds rapidly to iron replacement in an otherwise healthy patient, even in cases of very low hemoglobin levels.[74]

RBC transfusion is indicated in situations of cardiovascular compromise, or debilitating symptoms, such as hypotension, chest pain, syncope, or tachycardia. If transfusion is used for resuscitation, iron replacement therapy can still be used to encourage self-driven erythropoiesis.[31]

RECOMMENDATION 8

C. Abnormal Uterine Bleeding

Abnormal uterine bleeding (AUB), and in particular heavy menstrual bleeding (HMB), is a prevalent condition affecting up to half of menstruating individuals and is the leading cause of ID/IDA in nonpregnant women of reproductive age.[5,27,77] These conditions contribute to functional impairments that affect physical, cognitive, and

psychosocial well-being, even in the absence of anemia.[78] These symptoms are all too often normalized by a lack of recognition by healthcare providers and society.

In a typical menstrual cycle, iron loss is approximately 1 mg per month. However, for those with HMB, blood loss can increase five-fold to six-fold.[79] AUB is the leading contributor of ID/IDA in nonpregnant women of reproductive age, where the volume of blood lost during a period exceeds the body's ability to replenish iron stores through diet or supplements before the next cycle, leading to a cumulative decline in iron levels.

Adolescence, with the onset of menarche, represents a critical period characterized by higher iron requirements and increased vulnerability to ID/IDA. ID/IDA in adolescence is often unrecognized by the patient or healthcare provider, but has been associated with physical and cognitive impairment that can significantly affect growth trajectory and quality of life.[43] Due to a combination of HMB and inadequate iron intake, there are high rates of ID/IDA amongst adolescent girls, even in high-resource countries.[80]

For patients with heavy menstrual bleeding, identification of ID/IDA can be achieved through basic history taking and laboratory assessment with CBC and ferritin.

In addition to iron replacement therapy, concurrent treatment of existing HMB is a critical strategy in correcting ID/IDA in patients with AUB. The FIGO classification of the causes of AUB in the reproductive years is well-described and helps guide targeted treatment strategies based on medical or structural etiologies.[81] This is reviewed in the Society of Obstetricians and Gynaecologist of Canada's (SOGC) Guideline No. 292-Abnormal Uterine Bleeding in Pre-Menopausal Women[82] and the Guideline on Gynaecological and Obstetric Management of Individuals with Inherited Bleeding Disorders.[83]

SUMMARY STATEMENTS 4 and 5 and RECOMMENDATION 9

D. Gynaecologic Surgery

Patients undergoing gynaecologic surgical procedures often experience concurrent AUB. Preoperative anemia (Hb <120 g/L) is widely recognized as an important risk factor for adverse outcomes in major gynaecologic surgery, namely hysterectomy and open/laparoscopic myomectomy, with potential adverse effects on other gynecologic procedures also. Preoperative anemia is a risk factor for surgical complications, including perioperative transfusion and surgical site infection. Other undesirable outcomes include prolonged length of hospital stay, hospital readmissions, and increased healthcare costs.[84–89] Optimization of iron and Hb status pre-operatively reduces surgical complications[90,91] and improves patient well-being.[92]

Clinical guidelines have designated preoperative anemia as a quality-of-care and patient safety indicator that should be routinely monitored and addressed.[23,93] Despite clear guidelines, approximately one in five patients undergoing elective hysterectomy or myomectomy for benign indications remains anemic at the time of major gynaecologic surgery.[87] The prevalence of preoperative anemia varies significantly across patient populations, surgical indications, hospital settings, and providers, suggesting substantial room for improvement in care standardization and optimization practices.[94,95] Patients undergoing hysterectomy for AUB or those with larger uterine size appear particularly vulnerable.

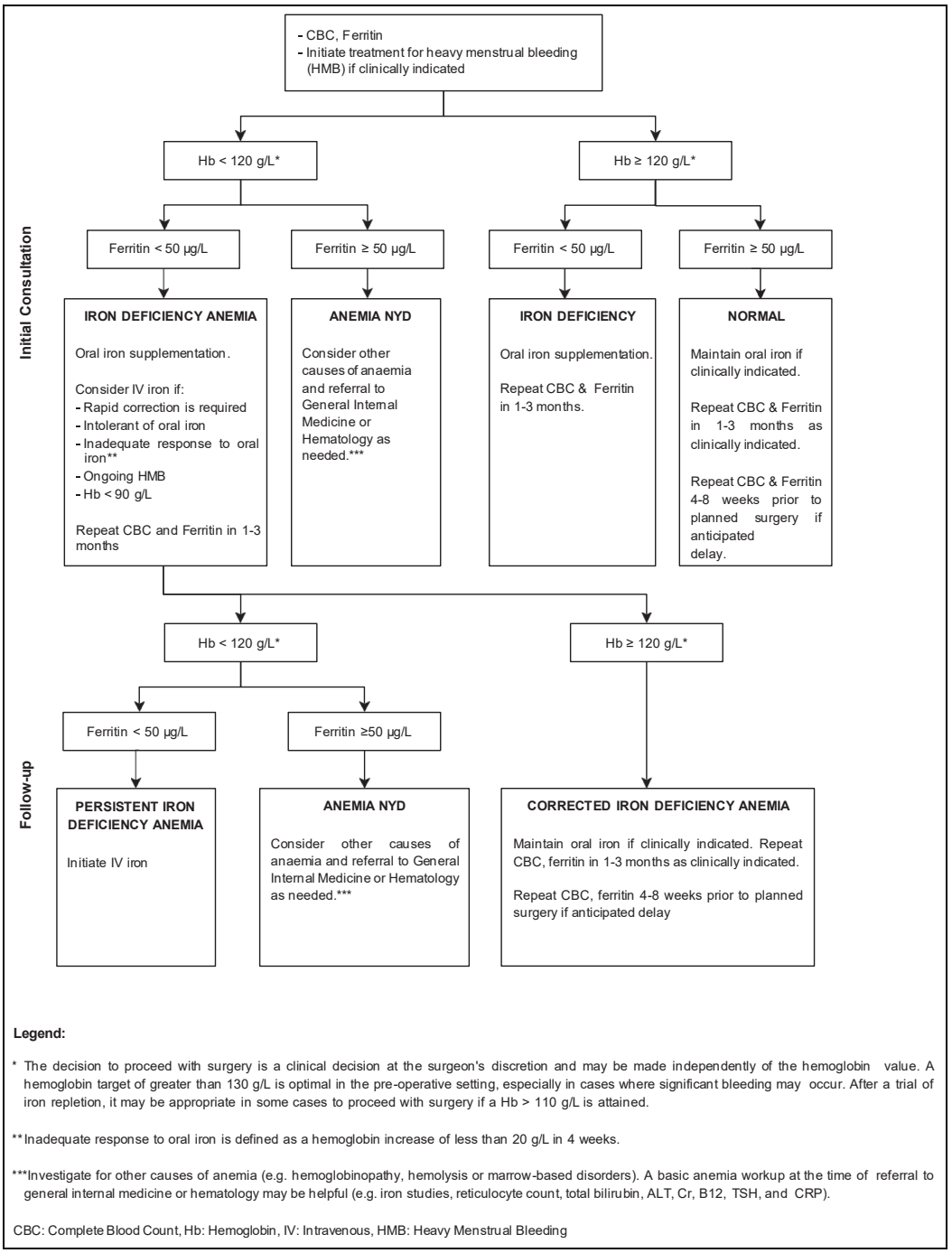
The relationship between preoperative Hb levels and transfusion risk is exponential: as Hb declines from 130 g/L to 100 g/L, the likelihood of transfusion increases nearly fourfold.[87] International clinical guidelines have thus proposed a preoperative Hb target greater than 130 g/L to minimize the risk of transfusion and related adverse outcomes.[23,96]

Given this strong association, surgeons should routinely incorporate patient blood management (PBM) strategies, including preoperative correction of anemia, into preparations for elective major gynaecologic surgical procedures (Figure 2). Institutions should have guidelines on postponing gynaecologic surgery until anemia is corrected.

In the context of major gynaecologic surgery, the early diagnosis of ID/IDA is an important strategy in Hb optimization, as it allows time for iron repletion prior to the planned procedure.[97] Menstrual suppression is critical in ensuring iron stores remain replete prior to gynaecologic surgery.

If clinical conditions allow, all patients undergoing major elective gynaecologic surgery should be screened for anemia with a CBC and ferritin well before their anticipated surgical date, ideally at the time of decision to operate. As patients may experience long wait times for their gynaecologic procedures, the initial gynaecologic consultation is an appropriate time to assess the patient's Hb and iron status to correct anemia and inform surgical planning. For otherwise healthy patients undergoing gynaecologic surgery for non-malignant conditions, a CBC and ferritin levels are adequate for initial screening.

Figure 2. Diagnostic and Treatment Algorithm for Iron Deficiency (ID) and Iron Deficiency Anemia (IDA) in Gynecology.



Legend:

* The decision to proceed with surgery is a clinical decision at the surgeon's discretion and may be made independently of the hemoglobin value. A hemoglobin target of greater than 130 g/L is optimal in the pre-operative setting, especially in cases where significant bleeding may occur. After a trial of iron repletion, it may be appropriate in some cases to proceed with surgery if a Hb > 110 g/L is attained.

** Inadequate response to oral iron is defined as a hemoglobin increase of less than 20 g/L in 4 weeks.

***Investigate for other causes of anemia (e.g. hemoglobinopathy, hemolysis or marrow-based disorders). A basic anemia workup at the time of referral to general internal medicine or hematology may be helpful (e.g. iron studies, reticulocyte count, total bilirubin, ALT, Cr, B12, TSH, and CRP).

CBC: Complete Blood Count, Hb: Hemoglobin, IV: Intravenous, HMB: Heavy Menstrual Bleeding

For patients with IDA who are scheduled to undergo gynaecologic surgery, oral iron therapy is recommended as first-line treatment if there is sufficient time leading up to surgery and provided menstrual suppression has been achieved. IV iron should be considered when gynaecologic surgery needs to be performed within a short timeframe, in cases of intolerance or inadequate response to oral iron, ongoing heavy menstrual bleeding, or moderate or severe anemia.

When significant blood losses have been encountered perioperatively, and the patient is acutely anemic but not hemodynamically compromised, IV iron is recommended immediately postoperatively, as elevated hepcidin levels in

the postoperative period impairs oral iron absorption and can lead to gastrointestinal side effects.

SUMMARY STATEMENT 6 and RECOMMENDATIONS 10, 11, 12 and 13

4. PRECONCEPTION, PREGNANCY, AND POSTPARTUM

A. Prevalence of ID/IDA in pregnancy

Iron deficiency is the most common cause of anemia in pregnancy. In Canada, anemia affects 8.3-28% of pregnant women,[98] while ID occurs in 50-90%.[98] Risk factors for ID/IDA in pregnancy include young maternal age, multiparity, and higher pre-pregnancy body mass index, and there are racial disparities, with non-Hispanic Black populations being more affected.[99] Vulnerable groups, including those with limited healthcare access and dietary restrictions, are at an increased risk of developing ID and IDA, highlighting the need for early recognition and targeted interventions in these populations.[10]

B. Contributing factors

Several causes lead to anemia in pregnancy. While a modest decline in Hb may occur due to increases in plasma volume, preexisting ID is the chief reversible cause of anemia in pregnancy.[100,101] Iron is essential for supporting the growth of the fetus and placenta, as well as maternal blood volume. Iron requirements increase during gestation, starting at 0.8 mg per day in the first trimester, rising to 4-5 mg per day in the second trimester, and up to 6-10 mg per day in the third trimester.[26,102,103] These additional requirements are often higher than what can be achieved through diet alone.

SUMMARY STATEMENT 7

C. Consequences of ID/IDA in pregnancy

Preconception and fertility

Iron deficiency may impact fertility, as intravenous iron therapy for ID in the presence of infertility was associated with a higher number of pregnancies, higher live birth rates, and lower miscarriage rates.[104]

Adverse maternal outcomes

Adverse maternal outcomes associated with ID/IDA include preeclampsia, placenta previa, antenatal admission, and longer hospital stays, as well as higher rates of complications at delivery, including caesarean birth, postpartum hemorrhage, thrombosis, and sepsis, which increase the likelihood of ICU admission and blood transfusions.[39,99,105–108] The risk of maternal mortality increases with the severity of anemia.[106,108,109]

Adverse fetal and infant outcomes

Iron is essential for normal fetal and postnatal neurodevelopment and a broad spectrum of physiological processes, including muscular and neurological function. Maternal ID/IDA contribute to adverse fetal and neonatal outcomes, including low birth weight, preterm birth, low 5-minute Apgar score, impaired cardiac function, and perinatal mortality.[110–112] In the long term, ID/IDA during pregnancy may negatively impact neurodevelopment, with associations with conditions such as autism spectrum disorder, attention-deficit/hyperactivity disorder, intellectual disability, and schizophrenia being reported in offspring.[113,114]

Maternal ID/IDA in the third trimester of pregnancy is a risk factor for neonatal ID.[115] To mitigate adverse infant outcomes, deferred cord clamping at birth can improve neonatal iron status and reduce anemia in both preterm and term infants, with effects extending beyond the newborn period.[112,116]

SUMMARY STATEMENT 8

D. Diagnosis

Preconception

All women of reproductive age who are planning pregnancy should be screened for ID/IDA with CBC and ferritin. Anemia should be treated and iron status should be optimized before pregnancy, along with folic acid supplementation and optimization of maternal comorbidities. Iron replacement therapy should be provided when ID is diagnosed.

Women with a personal history of heavy menstrual bleeding (menorrhagia) and/or a family history of postpartum hemorrhage should be evaluated for an underlying bleeding disorder prior to conception whenever possible. Screening before pregnancy is important because physiological changes during pregnancy can normalize or mask abnormalities in coagulation tests, potentially making diagnosis more difficult during gestation.

RECOMMENDATION 14

Pregnancy/antepartum

Symptoms and signs of ID/IDA in pregnancy. The symptoms of ID/IDA often overlap with the

physiological changes of pregnancy, making them easy to dismiss. Common symptoms include fatigue, weakness, dizziness, irritability, decreased stamina, hair loss, and dyspnea. These nonspecific symptoms can hinder early diagnosis. Measurement of Hb and ferritin can help differentiate between normal pregnancy-related changes and symptoms of ID/IDA.[110]

Screening with laboratory tests. All pregnant women should be screened for ID/IDA (Figure 3). A CBC and ferritin are recommended as part of initial prenatal bloodwork. Repeat testing at 24-28 weeks' gestation is recommended, as this period coincides with increased maternal iron demands.[117]

Anemia is defined as a hemoglobin (Hb) level of less than 110 g/L in all trimesters of pregnancy and in the postpartum period.[33] While these numbers reflect current norms, optimal targets may be higher for reducing ID/IDA symptoms and transfusion risk, especially in patients at risk of peripartum bleeding.

SUMMARY STATEMENT 9 and RECOMMENDATION 15

Postpartum iron deficiency and iron deficiency anemia

Rates of postpartum anemia are higher than antepartum anemia, affecting up to 50% of women in well-resourced countries and up to 80% in developing countries.[118] Postpartum ID and anemia have been linked to increased fatigue and a higher risk of postpartum depression.[119] Additionally, early cessation of breastfeeding is associated with postpartum anemia.[120] Maternal ID can negatively impact mother-child interactions.[121] Iron replenishment has been shown to alleviate symptoms of fatigue and depression,[119] and iron therapy in anemic mothers has been associated with improved emotional responsiveness.[121] Postpartum testing, especially within 24-48 hours of delivery, is recommended for individuals with significant blood loss (>500 mL) or uncorrected antepartum anemia to ensure timely intervention.

E. Prevention

Daily supplementation with 30-60 mg of elemental iron is recommended during pregnancy,[122] given that dietary iron intake is inadequate to prevent ID in most pregnant women.[123] The majority of over-the-counter and prescription prenatal multivitamins in Canada contain 24-35 mg of elemental iron. Therefore, in addition to a daily prenatal multivitamin, a daily iron supplement is recommended to meet the iron demands of pregnancy and prevent maternal anemia and ID.[124,125]

RECOMMENDATION 16

F. Treatment

Oral iron

Oral iron therapy with ferrous salts is the first-line treatment for managing ID/IDA in pregnancy.[106,117] Oral iron regimens are presented in Table 2. Oral iron should be taken 4 hours apart from prenatal vitamins and ideally on an empty stomach. To improve tolerability, particularly for individuals with nausea and vomiting of pregnancy, consideration can be given to alternate day dosing.[123,124,126]

When treating anemia with oral iron in pregnancy, a repeat CBC is recommended within approximately 6 weeks to confirm response. To replenish iron stores, oral iron therapy is recommended for at least 3 months after achieving a normal Hb level.[106,117]

Intravenous iron

Compared with oral iron, intravenous (IV) iron demonstrates superior efficacy for the treatment of IDA, as IV iron achieves the target Hb more rapidly, and it is associated with fewer adverse effects.[127,128] A substantial maternal benefit is noted when IV iron is given at least 6 weeks before delivery and in doses of greater than 800 mg.[129]

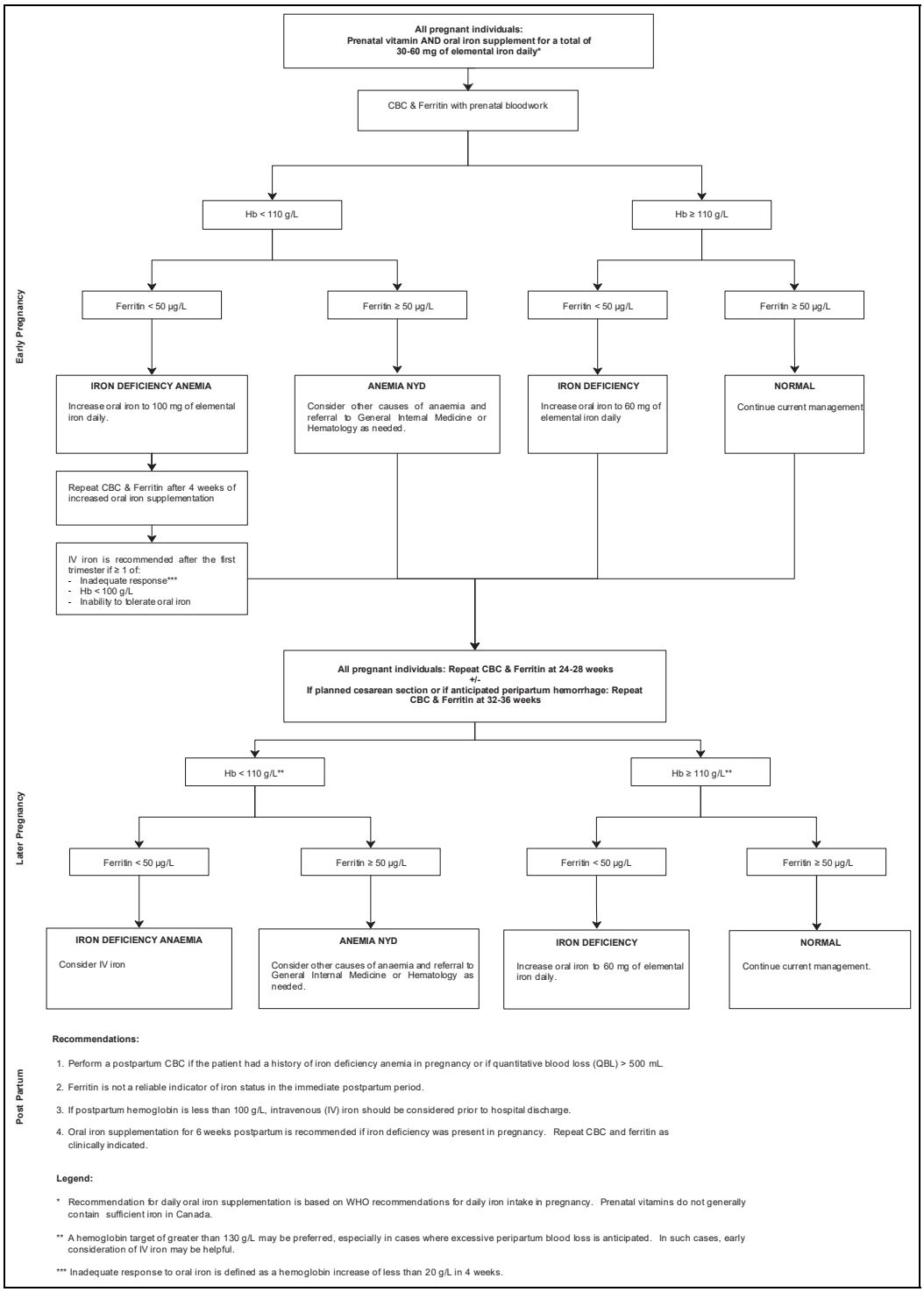
IV iron is generally avoided before 13 weeks[70] given a lack of safety data, but may be considered in select cases.[117] Fetal monitoring during or following IV iron administration is not routinely required.[70] Severe infusion reactions are rare and have been associated with fetal bradycardia. In these cases, stabilization of the maternal patient is the priority. Fetal assessment may be appropriate thereafter at fetal viability.[64] This may require transport from an infusion centre to obstetrical triage.

SUMMARY STATEMENT 10 and RECOMMENDATION 17

Pre-delivery management

Pre-delivery screening is critical for individuals who have been treated for IDA, or for those at increased risk for bleeding at the time of delivery, to allow for successful optimization of Hb prior to delivery.

Figure 3. Diagnostic and Treatment Algorithm for Iron Deficiency (ID) and Iron Deficiency Anemia (IDA) in Obstetrics.



While a pre-delivery Hb of 110 g/L is a minimum, every 10 g/L increase in pre-delivery Hb will decrease the odds of transfusion by 56%.[130] For patients at significant risk of hemorrhage at delivery, consideration can be given to aiming for a higher target, in keeping with the anesthesia literature, which suggests targeting a hemoglobin of ≥130 g/L for all patients undergoing gynaecologic surgery with an anticipated blood loss of greater than >500 mL.[23,131]

In addition, while postpartum hemorrhage will result in anemia, anemia is also an established risk factor for postpartum hemorrhage.[132] The SOGC categorizes risk

for postpartum hemorrhage based on antenatal risk factors,[132] and individuals at medium or high risk for postpartum hemorrhage require increased vigilance for identification and correction of ID/IDA.

While oral iron remains the first-line treatment for ID/IDA, given the importance of patient blood management in pregnancy, there should be a low threshold for initiating IV iron for iron replacement therapy, especially with advancing gestation and a shorter interval to delivery.

Postpartum management

Women with postpartum hemorrhage or uncorrected anemia detected antenatally should have a CBC drawn postpartum. Serum ferritin would have limited utility, as it is often elevated in the immediate postpartum and postoperative state.

To replenish iron stores, oral iron therapy is recommended for at least 6 weeks postpartum. In addition to oral iron, postpartum patients may benefit from IV iron, as there may be decreased enteric absorption of oral iron due to increased hepcidin in the postpartum state. A systematic review comparing IV iron with oral iron for the treatment of postpartum anemia found that IV iron resulted in Hb levels almost 10 g/L higher at 6 weeks.[118] As such, postpartum patients with IDA may benefit from intravenous iron prior to discharge.

IV iron should also be considered in the setting of postpartum hemorrhage. There is approximately 0.5 mg of iron in 1 mL of blood. Therefore, when 1000 mL of blood is lost, there is approximately a 500 mg iron deficit, and iron studies are not required for diagnosis of ID. When quantitative blood loss exceeds 1000 mL, IV iron should be considered postpartum to replenish iron stores prior to discharge.

When IDA has been identified during pregnancy or postpartum, a repeat CBC and ferritin level may be performed at approximately 6 weeks postpartum to confirm correction of anemia and resolution of ID.

RECOMMENDATION 18

SUPPLEMENTARY DATA

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jogc.2026.103428.

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