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IRON DEFICIENCY ANEMIA
in the childbearing year

IRON DEFICIENCY ANEMIA

- Defined as reduced capacity for transport of oxygen in the blood, as demonstrated by lower than normal values of hemoglobin and/or ferritin. (1,2)
- Iron deficiency anemia occurs when red blood cell production is inadequate due to insufficient dietary intake and absorption of iron. It can also be caused by excessive blood loss (e.g., following postpartum hemorrhage). Iron deficiency is the most common cause of anemia worldwide. (3,4) Iron deficiency anemia, by definition, responds to treatment with iron. (5,6)
- Iron deficiency anemia in pregnancy often results in fatigue, cognitive impairment and poor quality of life for birthing parents, and has been linked to preterm birth, caesarean section, postpartum hemorrhage and postpartum depression. (7,8) Iron deficiency anemia in pregnancy has also been linked to low birth weight and small for gestational age newborns and may impact long-term neurodevelopment. (8,9)

DIAGNOSIS AND TREATMENT

This document offers an overview of management approaches to iron deficiency anemia during pregnancy and postpartum. It complements the following resources:

- *Iron deficiency anemia and you*, a plain-language resource for clients
- *Iron Supplements: a guide for midwives*, a midwifery resource, and
- *AOM CPG no. 17: Prevention and Management of Postpartum Hemorrhage.*

DIAGNOSIS

Both hemoglobin and ferritin levels can be used in the prenatal period to diagnose iron deficiency anemia; testing typically occurs in the first trimester or at intake into prenatal care and is repeated around 28 weeks gestation. In the postpartum period (up to 6 weeks), ferritin is less reliable for diagnosis of iron deficiency anemia; testing hemoglobin should be guided by the overall clinical picture and client risk factors.

DIAGNOSIS OF IRON DEFICIENCY ANEMIA		
Prenatal		
Lab Test	Value	Description
Hb	< 110 g/L	First trimester
	< 105 g/L	Second trimester
	< 105-110 g/L	Third trimester
	Hb levels may also be used to categorize IDA as mild (100-109 g/L), moderate (70-99 g/L) or severe (< 70 g/L) in pregnant people. (10) Due to the wide range of individual differences in hemodilution, hemoglobin values alone may not be adequate for assessing iron deficiency anemia during pregnancy. (5) Guideline groups vary in the thresholds used during the third trimester. (11)	
Ferritin	< 15 ug/L	Diagnostic of iron deficiency anemia. Provides information about the capacity of the body's iron reserves and is an important component of assessing iron deficiency anemia during pregnancy. (6,12)
	< 30 ug/L	This level indicates early iron depletion that is insufficient to meet the increased need for iron in pregnancy and unlikely to be resolved without treatment. (6) Some research suggests that this threshold (< 30 ug/L) may be more appropriate for diagnosis of IDA. (8)
	Guidelines groups vary in their use of <15 ug/L or <30 ug/L as diagnostic criterion for iron deficiency. (11) If serum ferritin levels are normal or elevated in the presence of low hemoglobin, further investigation into possible hemoglobinopathies (e.g. ß-thalassemia, sickle cell anemia, anemia of infection, hemorrhagic anemia, vitamin B12 or folic acid deficiency) may be warranted. Ferritin is an acute phase reactant and tends to be elevated in the presence of infection. For this reason, ferritin readings taken during illness may not be accurate. (5,12)	
Postpartum		
Lab Test	Value	Description
Hb	< 80 g/L	< 48 hours postpartum
	< 100 g/L	≥ 48 hours postpartum
	Peripheral vasodilation, extracellular volume, glomerular filtration and cardiac output all decrease in the first week postpartum and hemodilution begins to resolve. (10) Hemoglobin concentration should thus be given an opportunity to stabilize before performing any postpartum assessment of iron deficiency anemia. Some researchers and guideline developers suggest waiting at least 48 hours following birth before sampling blood for hemoglobin. (6,10,12) One study suggests that if hemoglobin needs to be assessed in the 24- to 48-hour postpartum period, a lower diagnostic cut-off of < 80g/L may be appropriate given these hemodynamic changes. (13) Most of the circulatory changes taking place tend to reach a steady state by five to seven days postpartum and so this may be the most reliable time to assess hemoglobin after birth. (10,12)	
Ferritin	N/A	Ferritin is an unreliable marker for assessing iron in the immediate postpartum. (10,12,14)
	Because the immediate postpartum period is associated with systemic inflammation, ferritin levels are likely to be artificially elevated for one to six weeks following birth. (10,12,14)	

Another biomarker of anemia that is sometimes used is Tsat (transferrin saturation), which may be useful to diagnose IDA in cases where clients with anemia have inflammation (i.e., where ferritin may appear normal). (15–17) Fasting Tsat <20% can indicate IDA.

Differentiating iron deficiency anemia and B12 and folate deficiency

- Iron deficiency anemia is associated with smaller red cells (decreased mean corpuscular volume (MCV)).
- Vitamin B12 and folate deficiency are associated with large red cells (increased MCV).
- Mixed deficiency causes a mixture of small and large red cells.

HB LEVEL	MCV LEVEL	FERRITIN	TYPE OF ANEMIA
Low	Low / Normal*	Low	Iron deficiency
Low	High	Low or normal	B12 or folate deficiency
Low	Normal	Low or normal	May indicate mixed anemia

*MCV values may appear normal even in the presence of IDA in pregnant clients due to increased RBC production in pregnancy. A normal MCV should not prevent a diagnosis of IDA.

TREATMENT OF IRON DEFICIENCY ANEMIA

The most recent Cochrane review examining treatment of iron deficiency anemia in pregnancy noted few high-quality trials assessing the effects of iron administration to treat anemia in pregnancy. (18) The review found that oral iron supplementation during pregnancy was associated with reduced risk of anemia and improved hematological indices (hemoglobin and/or ferritin) compared to placebo, along with increased gastrointestinal effects. (18)

Systematic review evidence examining 18 RCTs has shown intravenous (IV) iron therapy for pregnant and postpartum people with IDA may slightly increase hemoglobin levels and may make a substantial difference to ferritin levels compared to oral iron supplementation.(19) IV iron results in fewer gastrointestinal side-effects than oral iron in pregnant and postpartum people. IV iron may also be associated with improved fatigue and depression scores, compared with oral iron, though both approaches are effective. (20,21) Concerns have been raised about IV iron due to four cases of anaphylaxis, hypersensitivity, and a cardiac arrhythmia among 767 participants who received IV iron across eight small, low-quality trials. (18) However, the risk of anaphylaxis is increasingly rare with more recent IV formulations. (22)

Informed choice discussions and any handouts provided and reviewed should be documented in the client's chart.

ORAL IRON SUPPLEMENTATION

- 40 to 200 mg of elemental iron taken daily as oral iron supplements is recommended as the first line of treatment for iron deficiency anemia in both pregnancy and postpartum. Target adult dose is typically reported as 100-200 mg elemental iron daily. (23)
  - » 50 to 80 mg per day of elemental iron may result in less gastrointestinal discomfort and may be adequate for treatment. (5,6)
  - » 65 mg daily may be considered for clients with a ferritin level of < 30 mcg/L and Hb ≥ 110. (6)
- Side-effects of oral iron supplementation include nausea, vomiting, dyspepsia, constipation and diarrhea and are generally dose-dependent. Side-effects tend to subside with continued use though compliance is often a significant barrier to treatment. (24)
- Intermittent doses of oral iron (one, two or three times a week on non-consecutive days) may be at least as effective as daily dosing while resulting in less gastrointestinal discomfort. (25)
- A variety of oral iron preparations are currently available in Canada, including ferrous salts (ferrous sulfate, ferrous gluconate, ferrous fumarate), ferric salts (ferric pyrophosphate) and iron-polysaccharide complexes. Ferrous salts are more bioavailable than ferric salts or iron-polysaccharide complexes, but are associated with increased gastrointestinal side effects. (26)
- Client tolerance, compliance, cost and response should guide decision-making around type of supplementation. (17)
- Midwives and clients should review the amount of elemental iron in the iron preparation chosen to determine the dosing required to achieve response.

Instructions and reminders for clients who are taking oral iron supplements

- Iron is best absorbed on an empty stomach and in the morning when hepcidin levels are low.
- If gastrointestinal upset is a concern, iron may be taken with or just after meals at doses < 100 mg and gradually increased after 4 to 5 days. Clients may also try taking iron before bed.
- Taking oral iron supplementation with a source of vitamin C (dietary or supplement) may help with absorption of non-heme iron, while taking oral iron supplementation with calcium or tannins in coffee or black tea may inhibit absorption. (6)
- U.K. guidelines recommend avoiding slow-release and enteric coated forms of oral iron as they may move undigested past the ideal site of absorption (duodenum and proximal jejunum). (6)
- Dosing errors have occurred with mineral supplements due to confusion about labelled strength: this may be addressed by ensuring clarity around dosage for the client's specific formulation. (27)
- Oral iron tablets can be toxic to children, so storage safety is an important consideration for families with other children. (6)

Treatment follow-up

- Following completion of at least two weeks of adequate oral iron therapy, most guideline groups suggest reassessing hemoglobin levels to test therapeutic response with an expected increase in hemoglobin of 10 to 20 g/L over a 2-4 week period after treatment has started. (11) Iron stores (measured by ferritin) may take up to six months to replenish. (17)
- Iron therapy should be continued for three to six months even if symptoms of anemia are resolved. Both hemoglobin and ferritin levels may be tested following a three-month course of oral iron treatment to ensure iron stores are replete. (6,10,12)
- Oral iron is sometimes insufficient for replenishing severe deficiencies in overall iron stores, which may be seen in cases of iron deficiency anemia associated with significant postpartum hemorrhage. (24)

IV IRON THERAPY

- If anemia persists after at least two weeks of oral iron treatment with good compliance, there are concerns about malabsorption of oral iron, or there is a requirement for fast iron repletion (e.g. anemia diagnosed late in pregnancy with a planned home birth), IV iron may be considered from the second trimester onwards. (5,6,24)
- In the postpartum period, the SOGC recommends that IV iron be considered for clients with hemoglobin <80 g/L, regardless of symptoms. (28)
- To avoid iron toxicity, U.K. guidelines recommend that iron deficiency anemia should be confirmed with ferritin testing before IV iron is administered. (6)
- Currently, iron dextran, iron sucrose and sodium ferric acid gluconate are the most commonly used IV preparations in Canada. Since 2024, midwives in Ontario can prescribe and administer IV iron, including iron sucrose (Venofer).
- Venofer is currently the most administered IV iron formulation in Ontario. It may be administered at a dosage of 200-300 mg over two hours, and subsequent doses may be given every other day or weekly, as available and/or required (typically 3-5 doses). Side-effects may include: dysgeusia, hypotension, nausea, dizziness, hot flushes, arthralgia. (29,30) There is also a risk of serious hypersensitivity including anaphylaxis. (29) For more information on Venofer, see Appendix A.
- Midwives should be aware of their local institution's policies and procedures around IV iron administration. This may include logistics, timing and availability for arranging treatment, monitoring protocols during administration, time requirements for clients receiving treatment, potential costs etc. These factors should be reviewed with clients as part of the informed choice discussions around treatment of IDA and documented.
- The College of Midwives of Ontario clinical practice standard *Prescribing and Administering Drugs* should be followed. (31)
- The costs associated with hospital visits (including physician and hospital fees as well as travel, parking and childcare costs) may present a barrier to accessing IV iron for some midwifery clients.

BLOOD TRANSFUSION

Research increasingly suggests that risks of blood transfusion for obstetric patients may outweigh benefits except in extreme, life-saving circumstances. Risks of blood transfusion include transmission of pathogens, transfusion reactions and allo-immunization. (32)

One small trial with 13 participants found that compared with blood transfusion, IV iron may result in repleted iron stores and a higher Hb between 3-12 weeks, suggesting it may be a viable alternative to blood transfusion. (33)

Many researchers call for conservative use of blood products due to risks to long term immunological health and the health of possible future pregnancies. (24,34–38)

CHEST OR BREASTFEEDING AND IRON DEFICIENCY ANEMIA

- One study has shown an association between postpartum anemia and shortened duration of chest/breastfeeding. (39) Given that iron deficiency anemia increases the risk of fatigue, a commonly-cited reason for early nursing cessation, appropriate treatment of postpartum iron deficiency anemia may help clients meet nursing goals. (39)
- Effective treatment of postpartum anemia is also important because studies have shown that lactoferrin levels in human milk are similar in anemic and non-anemic study participants, suggesting that the body will adjust lactoferrin levels as needed even in the presence of anemia. (40) Though not entirely understood, this mechanism promotes healthy iron intake in the nursing infant, but may have negative consequences for the long-term health of lactating clients if iron deficiency anemia goes untreated.
- Although the increased fatigue associated with iron deficiency anemia may make nursing particularly challenging, maintaining secondary amenorrhea as long as possible may be beneficial in terms of conserving overall blood supply and, by extension, iron stores. (1)
- There is no contraindication to chest/breastfeeding while taking iron supplements at therapeutic doses. (41)

IMPROVING ACCESS TO NUTRITION AND SUPPLEMENTS FOR CLIENTS ON SOCIAL ASSISTANCE

Anyone pregnant and receiving Ontario Works is entitled to receive monthly financial support through the Pregnancy/Breastfeeding Nutritional Allowance. Midwives can complete forms provided by Ontario Works caseworkers to obtain this funding for clients.

Writing prescriptions for over-the-counter medications like iron supplements and prenatal vitamins may ensure coverage for recipients of Ontario Works. This may make iron supplements accessible for clients who cannot otherwise afford them.

ONTARIO WORKS SPECIAL DIET ALLOWANCE

Midwives cannot currently authorize the Ontario Works Special Diet Allowance for clients during pregnancy. If a midwife believes a pregnant client should be receiving a Special Diet Allowance, a referral should be made to a physician who can authorize access to this extra funding for conditions that may require a special diet, such as iron deficiency anemia.

Midwives can authorize the Special Diet Allowance for infants who require formula in cases where chest/breastfeeding is either contraindicated or there is inadequate lactation to sustain nursing. The Special Diet Allowance for infants is paid for the first 12 months of life.

SOCIO-CULTURAL CONSIDERATIONS

- Population-specific hemoglobin reference ranges have not been established.
- Midwives should consider clients in their wider social and cultural context, exploring underlying issues related to food security, cultural factors and nutrition as part of informed choice discussions on iron deficiency anemia.
- Lower baseline hemoglobin levels prior to pregnancy may be related to factors such as vegetarianism, veganism, poverty, food security, or prior hormone use (i.e. testosterone). (5,42)
- Adequate treatment of iron deficiency anemia prenatally may be especially important for clients who decline blood transfusion, (1,5) and those who have additional risk factors for PPH.

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APPENDIX A: IRON SUCROSE (VENOFER)

	DOSE	ROUTE	ACTION	MAX DOSE
Iron Sucrose (Venofer) Iron deficiency anemia	200-300mg	IV over 2 hours	• Serum iron values may be reliably obtained 48 hours after IV dosing	• 300 mg/day • Administration rate should not exceed 20 mg/minute

Mechanism of action	• Following IV administration of iron sucrose for individuals with anemia, iron is rapidly taken up by the liver, spleen, and bone marrow. The majority (97%) of injected iron is used for red blood cell (RBC) synthesis. Serum ferritin increases within 24 hours. (43) • Elimination half-life 6 h. (29) • Sucrose component excreted primarily in urine. (29)
Adverse reactions	• Serious hypersensitivity including anaphylaxis. (29) • Dysgeusia, hypotension, nausea, dizziness, hot flushes, athralgia. (29,30)
Contraindications	• Not recommended in first trimester of pregnancy. (30) • Hypersensitivity to medication or ingredients, evidence of iron overload, anemia not caused by iron deficiency. (29) • Consider hematology consultation for individuals with hemoglobinopathy (e.g., thalassemia or sickle cell disease). (44)
Other notes	• Estimated cost of single dose: $375 (44) • Iron content: 20 mg/mL (30,43) • Subsequent doses may be given every other day or weekly as available to replete target iron level (typically 3-5 doses). (30,45) • Total parenteral iron replacement dose based on Ganzoni formula, which can then be divided into several doses based on individual product monographs for maximum per single dose): total iron dose (mg) = weight (kg) × [target hemoglobin – actual hemoglobin (g/dL)] × 2.4 + iron stores (mg) [where iron stores for adults should consist of 500 mg]; to convert hemoglobin in g/L to g/dL, divide by 10. (44)
Storage	• Store at 15-25 °C. Do not freeze. (29)