

# Preoperative anemia in major elective surgery

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■ Cite as: *CMAJ* 2023 April 17;195:E551. doi: 10.1503/cmaj.221635

## 1 The prevalence of preoperative anemia is high

An estimated 23%–45% of patients undergoing major surgery have anemia, with the most common causes being iron deficiency anemia and anemia of inflammation or chronic disease.<sup>1,2</sup>

## 2 Preoperative anemia leads to adverse outcomes

Regardless of its severity, preoperative anemia is an independent risk factor for postoperative death, major morbidity, increased length of hospital stay and transfusion.<sup>1,3</sup> In patients undergoing cardiac surgery, a 10 g/L decrease in preoperative hemoglobin levels increased mortality odds by 16% (95% confidence interval 10%–22%).<sup>2</sup>

## 3 A preoperative hemoglobin of 130 g/L or higher should be targeted for both sexes

Females have lower circulating blood volumes and greater proportional operative blood loss than males.<sup>4</sup> Females with a hemoglobin of 120 g/L were shown to be twice as likely as males with a hemoglobin of 130 g/L to receive postoperative blood transfusions.<sup>4</sup> When treating preoperative anemia, targeting the same hemoglobin level in both sexes minimizes the risk of unfavourable outcomes and transfusions.<sup>4</sup>

## 4 Patients undergoing major elective surgery, with expected blood loss of more than 500 mL, should be screened for anemia 6–8 weeks before their operation

Clinicians should order a complete blood count and ferritin levels, as iron deficiency anemia (ferritin < 30 ng/mL) is the most common cause.<sup>1,4</sup> When underlying inflammation is present, ferritin is less sensitive, and iron deficiency anemia can be diagnosed with a ferritin of 30–100 ng/mL and a transferrin saturation of less than 20%.<sup>1,4</sup> Patients with iron deficiency anemia should be investigated for an underlying cause (e.g., gastrointestinal blood loss, menorrhagia, malabsorption).

## 5 Preoperative iron deficiency anemia should be treated with iron supplementation

Patients with iron deficiency anemia at least 8 weeks from surgery should be treated with oral supplementation at equivalent doses of 40–60 mg elemental iron daily or 80–100 mg every other day.<sup>1,4</sup> If patients are within 8 weeks of surgery, or if they are unable to tolerate oral supplementation, they should receive intravenous iron.<sup>1</sup> For patients with refractory or other forms of anemia, erythropoiesis-stimulating agents can be considered along with a specialist referral.<sup>1,5</sup>

## References

1. Greenberg JA, Zwiep TM, Sadek J, et al. Clinical practice guideline: evidence, recommendations and algorithm for the preoperative optimization of anemia, hyperglycemia and smoking. *Can J Surg* 2021;64:E491-509.
2. Klein AA, Collier TJ, Brar MS, et al.; Association of Cardiothoracic Anaesthetists (ACTA). The incidence and importance of anaemia in patients undergoing cardiac surgery in the UK: the first Association of Cardiothoracic Anaesthetists national audit. *Anaesthesia* 2016;71:627-35.
3. Mueller MM, Van Remoortel H, Meybohm P, et al.; ICC PBM Frankfurt 2018 Group. Patient blood management: recommendations from the 2018 Frankfurt Consensus Conference. *JAMA* 2019;321:983-97.
4. Muñoz M, Acheson AG, Auerbach M, et al. International consensus statement on the peri-operative management of anaemia and iron deficiency. *Anaesthesia* 2017;72:233-47.
5. Kei T, Mistry N, Curley G, et al. Efficacy and safety of erythropoietin and iron therapy to reduce red blood cell transfusion in surgical patients: a systematic review and meta-analysis. *Can J Anaesth* 2019;66:716-31.

**Competing interests:** Yulia Lin has received research funding from Canadian Blood Services and Octapharma and is a consultant with Choosing Wisely Canada. No other competing interests were declared.

This article has been peer reviewed.

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