

a level of 11 g dl^{-1} or more, or both at week 12) was significantly higher for the ferric carboxymaltose group (92.2%) than the placebo group (54%). Additionally, patients in the ferric carboxymaltose group showed significantly greater improvements in serum ferritin and transferrin saturation levels. Additionally, an RCT in 150 patients with postoperative functional IDA ($\text{Hb} < 120 \text{ g l}^{-1}$ for women or 130 g l^{-1} for men and ferritin concentrations 30 to $100 \mu\text{g l}^{-1}$ or transferrin saturation $< 20\%$) following cardiac valvular surgery demonstrated that weight-based dosing [according to the formula: $\text{total iron deficiency (mg)} = \text{body weight (kg)} \times (\text{target Hb} - \text{actual Hb g dl}^{-1}) \times 0.24 + \text{iron storage (mg)}$] with i.v. iron sucrose beginning the day after surgery and then every other day until the target dose was achieved, significantly increased Hb levels at postoperative day 14 and ferritin concentration at postoperative days 7 and 14 when compared with placebo.¹⁰⁰⁷ However, no difference in blood transfusion requirements or postoperative adverse outcomes was observed. Similarly, a single-centre retrospective study of 139 patients undergoing colorectal cancer surgery who presented with anaemia ($\text{Hb} < 13 \text{ g dl}^{-1}$), found that, compared with patients not receiving iron, 200 mg i.v. iron sucrose infusion up to three times a week during hospitalisation, there was improved recovery of Hb levels at 30 days postsurgery without increasing postoperative complications.¹⁰⁰⁸

In contrast to these results, some studies have not demonstrated a beneficial effect of iron administration. An RCT conducted in 120 elective cardiac surgery patients with postpump Hb of 7 to 10 g dl^{-1} compared postoperative administration of i.v. iron sucrose alone (200 mg day^{-1} to reach the total iron deficit) or i.v. iron plus a rHuEPO (single dose of 300 U kg^{-1}) with a control group.¹⁰⁰⁹ No significant difference was observed between groups for transfusion requirements or Hb increase up to day 30 postsurgery; however, a significant increase in ferritin levels was observed in the two treated groups at day 5. A similar but small RCT conducted in 38 patients who had undergone cardiac or orthopaedic surgery who did not have preoperative anaemia but presented with a Hb concentration 70 to 90 g l^{-1} on postoperative day 1 concluded that early postoperative treatment with i.v. iron sucrose (200 mg on days 1, 2 and 3 postsurgery) with or without EPO (600 U kg^{-1} on days 1 and 3 postsurgery) did not improve early recovery from postoperative anaemia, with no significant increase in Hb concentrations by days 7 or 28.¹⁰¹⁰ Additionally, another RCT in patients undergoing CPB surgery did observe an increase in serum ferritin levels at hospital discharge and 1 month later in patients receiving i.v. iron sucrose (three doses of 100 mg day^{-1} during preoperative and postoperative hospitalisation), but found no statistical difference in Hb levels (measured up to 1 month after discharge) or blood transfusion requirements between patients receiving i.v.

iron ($n = 54$) and those receiving either oral ferrous fumarate ($n = 53$) or placebo ($n = 52$).¹⁰¹¹ All patients in this study were randomised to the treatment groups prior to surgery and did not have preoperative anaemia.

The benefits of i.v. versus oral administration of iron have also been evaluated. An RCT conducted in 122 patients with postoperative anaemia ($\text{Hb } 8.5$ to 12 g dl^{-1}) following TKA found that i.v. ferric carboxymaltose administration (700 to 1000 mg on postoperative day 2) resulted in patients more frequently achieving Hb levels at least 12 g dl^{-1} and demonstrated a trend towards a higher Hb increase from day 4 to day 30 compared with patients receiving oral ferrous glycine sulphate (100 mg daily from day 7 onwards).¹⁰¹² As noted above, a study in cardiac surgery found that i.v. iron iii-hydroxide sucrose complex resulted in a greater increase in serum ferritin levels than oral ferrous fumarate supplementation; however, this study did not observe a statistical difference in Hb levels between i.v. and oral therapy.¹⁰¹¹ Additionally, multiple RCTs in orthopaedic surgery and cardiac surgery have indicated that oral iron supplements are not effective in treating postoperative anaemia.^{1013–1018} In agreement with these results, a systematic review in major orthopaedic surgery concluded that postoperative oral iron administration did not increase Hb or reduce transfusion requirements, and was associated with adverse gastrointestinal effects.¹⁰¹⁹ In contrast, an RCT comparing i.v. iron polymaltose infusion (500 mg single dose on day 4 postoperatively) to oral ferrous sulphate (210 mg daily, from day 5 postoperatively until Hb was $\geq 11 \text{ g dl}^{-1}$) following kidney transplantation found no significant difference in the time to resolution of anaemia.¹⁰²⁰ Randomisation to treatment was performed pretransplant, and the mean pretransplant Hb concentration was 12 g dl^{-1} .

In addition to studies evaluating how to treat postoperative anaemia, a recent RCT has evaluated the efficacy of intra-operative i.v. iron isomaltoside administration to prevent postoperative anaemia, with a total of 89 patients undergoing TKA receiving either i.v. iron (dose based on body weight and administered after the main procedure) or placebo during surgical wound closure.¹⁰²¹ At 30 days, the incidence of anaemia was significantly lower in the treatment group than in the control group. Additionally, Hb concentration, serum ferritin concentration and transferrin saturation were significantly higher in the treatment group. Similarly, a randomised trial in 57 healthy adults undergoing bimaxillary orthognathic surgery concluded that a 1000 mg dose of i.v. ferric derisomaltose after anaesthetic induction resulted in higher Hb levels and a significant increase in reticulocyte production index at 2 weeks postoperatively compared with placebo.¹⁰²² This supports the results of an earlier study, which demonstrated that peri-operative i.v. iron isomaltoside infusion (1000 mg) resulted in significantly increased Hb levels and a lower incidence of anaemia in cardiac surgery patients at 1 month after surgery.¹⁰²³