Working together to improve health care quality, outcomes, and affordability in Washington State.

Surgical Patient Optimization: Glycemic Control and Anemia 2025

Executive Summary

Anemia and poor glycemic control are key modifiable risk factors that worsen perioperative outcomes in those undergoing major surgery. Both preoperative anemia and perioperative hyperglycemia are associated with longer hospital stays[i], increased costs, higher morbidity and mortality[ii,iii], and worse recovery. Even mild anemia can affect 30-day outcomes, and perioperative glucose levels predict short-term mortality[iv], while evidence shows hyperglycemia impacts non-diabetic patients more negatively than those with diabetes. In Washington state, there is significant variation in practices regarding anemia management and glycemic optimization in patients with and without diabetes.

To address these challenges, the workgroup recommends a comprehensive framework focused on improving perioperative glycemic control in all patients, optimizing preoperative anemia, fostering multidisciplinary collaboration, and advancing payment reform. The report calls for system-wide adoption of evidence-based protocols to improve surgical outcomes for Washington residents. These guidelines are appropriate for surgical management of nonpregnant adults aged 18 and above.

Note: The need for glycemic control and anemia management is universal throughout all surgeries, but these guidelines are not a substitute for bedside clinical decisions in urgent or emergent procedures where time may not be sufficient to follow all recommendations.

Note: These guidelines are written from a perspective assuming a patient has a primary care provider who is referring them for surgery. If that is not the case, and the patient is seeing the surgeon first, it is recommended the surgical team should follow these recommendations and/or refer patient to other services as needed for optimization prior to scheduling an operation date.

Focus Area	Components
Preoperative Anemia Optimization	• Early identification and diagnosis, targeted treatment (iron, erythropoietin stimulating agents, etc.) • Nutrition optimization • Coordination of multidisciplinary care, and monitoring before surgery
Perioperative Glycemic Control	• Early screening for glucose dysregulation • Nutrition optimization • Preoperative glucose monitoring • Stress and inflammation management • Judicious use of pharmacologic interventions if needed
Multidisciplinary Collaboration	• Preoperative provider and surgical team collaboration
Payment Reform	• Minimizing financial barriers to glycemic control and anemia optimization • Incorporation of anemia and glycemic control into surgical optimization incentives

Procedures

Poor glycemic control and anemia have both been shown to be critical predictors of bad outcomes after many types of major surgery. While national and international guidelines therefore recommend screening and optimization before all major surgery, the workgroup recommends payors and health systems focus initially on implementing changes for a) patient populations that are particularly sensitive to glycemic control and anemia challenges, b) intermediate and major surgeries where risk of bodily stress response and bad outcomes are highest, and c) elective operations (i.e. non-emergent) for which there is by definition enough time to optimize patients before procedures.

Note: The table below provide examples only. Each facility or system should evaluate their own clinical data and case volumes to identify priority patient populations and surgical populations.

General Principles
Any Operation with entering of body cavity
Any Operation with expected duration >/= 90 minutes
Any operation where blood loss may exceed 500mL or 10% blood volume (whichever less)

Surgery	Example Range CPT Codes
Joint Replacement (Total Hip/Knee Arthroplasty) [v] [vi]	27130-27138; 27125; 27090-27091; 27236; 27437-27448; 27486-27488
All Spine Surgery (Excluding Discectomy) [vii]	63045-63048;63050-63051; 63081-63088; 22600-22641;22630-22634; 22558-22585; 63052-63053; 22840-22859;22206-22226
Abdominal Surgery (Cholecystectomy, Colon [viii], Most Gynecologic, Urology, Bariatric [ix] [x])	47562-47564;47600-47620; 44139-44147; 44150-44156;44204-44213; 43644-43645; 43770-43775; 43845-43848; 58150-58180;58120; 58260-58294; 58550-58554; 58570-58573; 58661; 58720; 58940; 50220-50240; 50542-50548; 55840-55845; 55866; 51590-51596;

Guidelines

Note: While the need for glycemic control and anemia management is universal for all patients and all operations, these guidelines are not a substitute for bedside clinical decisions in urgent or emergent procedures where time may not be sufficient to follow all recommendations.

Preoperative Clinicians (e.g., Primary Care Clinician, Perioperative Clinician, Surgery Teams, etc.)

Note: These guidelines are written from a perspective assuming a patient has a primary care provider who is referring them for surgery. If that is not the case, and the patient is seeing the surgeon first, it is recommended the surgical team should follow these recommendations and/or refer patient to other services as needed for optimization prior to scheduling an operation date.

Perioperative Glycemic Control

1. At the time a referral for major elective surgery is considered, evaluate glycemic control in all patients.
    a. Hyperglycemia is even riskier in people without diabetes. It is important to screen for risk factors and develop a plan for testing and treating hyperglycemia in all patients coming for surgery.
    b. Not all people with diabetes have been diagnosed yet. Screen each patient referred for surgery for risk factors not previously indicated on medical record (e.g., family history of diabetes, prediabetes, age 45+, BMI 30 kg/m2 +, familial history of diabetes, past medical history of gestational diabetes)[xi]
    c. Consider testing HbA1c. Perform testing as early as possible in presurgical process. (i.e. with enough time to be able to make changes to optimize patient health) HbA1c reflects average glucose levels for preceding 3 months and those with elevated HbA1C may have complex needs, worsening health, or other reasons for difficulty with glucose control.
2. For people with known diabetes:
    a. Determine if type 1 or type 2 diabetes. The treatment required for glycemic control has important differences for people with type 1 versus type 2. This should be documented in patient history or readily ascertainable from interview. Refer to specialist for determination as needed.
    ~~b.~~ Perform a preoperative risk assessment for known complications of longstanding diabetes that will impact perioperative care. Examples include ischemic heart disease, neuropathy, kidney disease, per most updated American Diabetes Association (ADA) guidelines.

c. Discuss and determine goals of medical optimization of glycemic control before surgery. Goals of optimization should be set collaboratively between patient and medical team, with consideration for co-occurring conditions, risks for hypoglycemic events, and availability of close post-operative follow up. With few exceptions, targets should be:
    i. HbA1c <8%. Note: HbA1c varies between individuals and as a consequence of some common clinical conditions (See Appendix D).
    ii. If using continuous glucose monitoring - goal of 70% time in range between 70-180 mg/dl. Note: For patients requiring insulin, continuous glucose monitoring is universally recommended according to ADA standards of care.
d. If a patient is unable to demonstrate good glycemic control (e.g., HbA1c < 8%) and/or high risk for hyperglycemia (without plan and/or resources for intraoperative and intensive postoperative glucose control):
    i. If procedure has already been scheduled, consider the benefits and risks of recommending delaying the procedure until glycemic control is optimized (and intensive perioperative glucose control plan/ resources are in place – see below).
    ii. Consider waiting to schedule the elective procedure until patient reaches their individualized threshold for glycemic control optimization (and intensive perioperative glucose control plan/ resources are in place – see below).
e. Plan for medication management, [xii] including but not limited to:
    i. Insulin transition plans for insulin-dependent patients with diabetes, including those on automated insulin delivery systems (AID)
        1. Basal insulin plus pre-meal short- or rapid-acting coverage supports improved glycemic outcomes and lower perioperative complications.
        2. Reduction of 10-25% basal insulin dose given evening before surgery can lower risk of hypoglycemia based on individual patient circumstances.
    ii. Holding oral and other non-insulin diabetes medications. Recommendations vary by drug class and may be influenced by renal function and other patient factors. (See ADA Guidelines)
        1. Metformin: Hold on the day of surgery. Some guidelines suggest it can be continued for less invasive procedures with anticipated normal oral intake.
        2. Sulfonylureas: Withhold on the day of surgery due to the risk of hypoglycemia.
        3. DPP-4 inhibitors: Hold on the day of surgery.
        4. Thiazolidinediones: Withhold on the day of surgery.

5. SGLT-2 inhibitors: Discontinue 3 to 4 days before surgery to reduce the risk of euglycemic ketoacidosis.
6. GLP-1 RAs and/or GLP-1/GIP Ras, DPP-4 inhibitors: Continue taking as scheduled, but require prolonged fasting time (currently clears only for 24hrs)[xiii]

3. For all patients, including those with pre-diabetes or at risk of perioperative hyperglycemia
    a. Screen for health-related social needs, including food insecurity
        i. Consider using tools (such as the Protocol for Responding to and Assessing Patients' Assets, Risks and Experiences (PRAPARE)) and document results in the medical record.
        ii. Refer to staff or community organization that can help to address identified needs (e.g., team social worker, local resource hub, etc.)
    b. Consider referring to specialized services that can support optimization and patient education
        i. A certified diabetes education specialist/Registered dietician/nutritionist
        ii. Diabetes Prevention Program
4. For ALL patients
    a. All patients should have perioperative glucose screening, even those without a diagnosis of diabetes. Hyperglycemia is even riskier in people without diabetes. It is important to screen for risk factors and develop a plan for testing and treating hyperglycemia in all patients coming for surgery.
    b. Communicate glycemic control status and optimization plan to surgery team in referral and/or handoff. Plans should include, but are not limited to:
        i. Pre-operative changes for insulin and non-insulin diabetes medications.
        ii. Nutritional support as needed, including referral to registered dietician/nutritionist
        iii. For those with diabetes and/or anticipated perioperative hyperglycemia, plan for and schedule close outpatient follow up. (e.g., multiple visits within 1-week post-operative for patients with uncontrolled diabetes including on 1st and 2nd post-op days).
        iv. If intensive outpatient follow up in not possible, consider inpatient admission for glucose control.
        v. Close follow up plan to re-check HbA1c before procedure and criteria to consider delaying procedure (e.g. HbA1C > 8% and inpatient admission or intensive outpatient follow-up are not arranged or not possible).
        vi. For those with unanticipated perioperative hyperglycemia, ensure adequate control and close follow up plan prior to patient discharge

Preoperative Anemia Optimization

1. At the time a referral for major elective surgery is considered, evaluate anemia status for ALL patients. Anemia optimization is not just about transfusion risk. Patients with anemia have increased blood loss, have less physiologic reserve so may require more intensive and invasive intraoperative management, and even mild anemia (12-13 g/dl) is associated with significantly increased 30-day mortality risk (and other complications). Note: Perform screening as early as possible in presurgical process (i.e. ideally before scheduling the operation because many anemia optimization steps will take 6-8 weeks or more).
    a. Screen for risk factors or symptoms of anemia.
    b. Perform hemoglobin testing, consider complete blood count. Recommend universal testing in any surgery where >500mL blood loss is possible and in any patient who cannot accept blood transfusions
2. For patients with anemia (Hb <13g/dL), identify underlying cause of anemia. Assessment should include the following:
    a. Reflexive testing of iron status (ferritin, C-reactive protein [CRP], iron, total iron binding capacity [TIBC], transferrin saturation [TSAT]).
        i. TSAT <20% (calculated as iron/TIBC * 100) is diagnostic of iron deficiency in all circumstances, but does not differentiate between absolute iron deficiency (low stores) and functional iron deficiency (low systemic bioavailability).
        ii. Ferritin <30 ng/ml is diagnostic of absolute deficiency of iron stores, but ferritin can be artificially elevated in inflammation so if CRP is elevated, ferritin values alone cannot be trusted.
    b. Comprehensive medical and medication history and physical exam (e.g., history of blood loss, excessive menstrual blood losses, autoimmune or chronic disease, insufficient iron intake, other reasons for poor absorption, pregnancy)
    c. Order other tests as indicated to diagnose underlying cause. Consider the algorithm in Appendix H and other evidence-based resources for evaluation of anemia in healthy individuals in outpatient setting.
    d. Consider specialist referral for further evaluation if indicated:
        i. Gastroenterology if gastrointestinal blood loss is identified
        ii. Hematology if no cause is not identified, if anemia does not respond to iron treatments (see below), or if moderate-to-severe anemia (Hb <10 g/dL) without iron deficiency.
3. Discuss and determine goals of treatment for anemia with the patient, including likely time course needed for treatments (6-8 weeks or more), including cause of anemia and individual patient factors and circumstances.
4. Treat anemia to optimize prior to surgery (goal = Hb > 12 g/dL)
    a. For those with identified cause of anemia, treat the underlying cause.

b. For patients with iron deficiency anemia, regardless of cause, supplement with iron formulation unless contraindicated. Consult pharmacy as able to support selecting iron supplementation methods that meet hemoglobin/iron goals, cost and timeline limitations.
    i. If 8+ weeks until surgery, can consider oral iron therapy
    ii. If <8 weeks, IV supplementation is recommended. IV supplementation is also recommended if oral iron is not effective or tolerated, or with severe anemia (Hb <10g/dL)
    iii. Consider addition of erythropoietin stimulating agents (ESAs)
        1. In patients with anemia of inflammation (e.g., kidney disease, autoimmune disease)
        2. Those who cannot accept transfusions
        3. Those with severe anemia with urgent surgery needing more rapid response

5. Communicate anemia optimization plan with the surgical team, including relevant lab values, underlying cause as identified, and treatment goals and plan.
6. Reassess anemia status 2-4 weeks after treatment initiation (goal = Hb > 12 g/dL) and minimum of 2 weeks prior to surgery (if surgery date already scheduled)
    a. Complete repeat lab testing to assess response to treatment (CBC, iron studies, etc.)
        i. If response is adequate, proceed to surgery
        ii. If response is inadequate (Hb <12 g/dL)
            1. For urgent surgery, discussing risks and benefits of further evaluation and timing of determining underlying cause of anemia during the preoperative period.
            2. For elective surgery with moderate or high risk of blood loss, recommend delaying surgery to further optimize anemia status. Consider changing formulation (oral → iv) or adding ESA if response is inadequate
7. Continue treatment for anemia as indicated after procedure complete.
8. Special considerations for patients that cannot receive blood products, even if they are not currently anemic:
    a. Take a full medical history including history of anemia, abnormal bleeding, coexisting conditions, medical/surgical history, and current medications that could impact hemostasis
    b. Consider discontinuation of medications that could induce coagulopathies (e.g., analgesics like NSAIDS, antibiotics like beta-lactams) [xiv], anticoagulants and review other medications or supplements that impact coagulations/platelet function
    c. Take steps to optimize preoperative red blood cell production, such as administering supplementary iron (even with normal iron stores) or using r-

HuEPO to increase slightly low hematocrit before anticipated major blood loss or for patients with ischemic heart disease

d. Consider higher preoperative hemoglobin goals (e.g., Hb >13 g/dL)
e. Determine with patient what blood products are acceptable or unacceptable. Clearly identify them in the medical record.
f. Follow evidence-informed guidelines for anemia optimization in patients that cannot accept blood products, such as: Clinical Strategies for Avoiding and Controlling Hemorrhage and Anemia without Blood Transfusion in Surgical Patients or more updated. Resources can be found here.

Surgery Team

Note: If non-optimized state is identified or suspected during evaluation by surgical team, assessment and optimization should be initiated prior to scheduling the operation, with date selection guided by expected time course of optimization plan.

Note: The guidelines as written below from the perspective of a surgical team performing all aspects of preoperative assessment and optimization. If working with a primary care provider or perioperative medicine clinician, the surgical team still is still recommended to confirm appropriate completion of all aspects.

Perioperative Glycemic Control

1. Before Surgery (Prior to scheduling an operation and pre-operative preparation prior to surgical date)
    a. At the time of referral for major elective surgery, evaluate glycemic control for patients with or at risk for diabetes.
        i. Hyperglycemia is even riskier in people without diabetes. It is important to screen for risk factors and develop a plan for testing and treating hyperglycemia in all patients coming for surgery.
        ii. Not all people with diabetes have been diagnosed yet. Screen each patient referred for surgery for risk factors not previously indicated on medical record (e.g., family history of diabetes, prediabetes, age 45+, BMI 30 kg/m2 +, familial history of diabetes, past medical history of gestational diabetes)[xv]
        iii. Consider testing HbA1c. Perform testing as early as possible in presurgical process. (i.e. with enough time to be able to make changes to optimize patient health) A1c reflects average glucose levels for preceding 3 months.
    b. If the person has new or uncontrolled diabetes, determine if the patient has an established primary care provider.
        i. if they do, refer to their primary care provider for optimization
        ii. If they do not, ensure they are able to see preop provider as early as possible before surgery; If unable to schedule with a preoperative provider, surgery teams should take ownership of preoperative optimization and review Preoperative Clinicians guidelines. Key components include:
            1. Plan for checking and managing blood glucose day of surgery.
            2. Consider consulting with hospital specialized diabetes or glucose management team for all, as available.
            3. If not done previously, screen for health-related social needs, including food insecurity. Refer to staff or community organization that can support addressing social needs.
2. Day of Surgery (prior to arrival at surgical facility)

    a. Provide preoperative hydration with water instead of carbohydrate loading for patients with diabetes (not to otherwise override patient-specific preoperative fasting/ NPO instructions)
    b. Confirm plan for holding and/or dose modification for all meds including insulin (short- and long-acting), non-insulin oral and injectable diabetes meds (many either with prolonged hold durations or prolonged fasting times or both), anti-hypertensives, anti-coagulant
3. Day of surgery (Upon arrival to pre-operative area)
    a. Confirm NPO status
    b. Confirm recent medication history and adherence to plan for holding and/or modifying doses of specific agents
    c. For all patients, check a blood glucose (FBG) preoperatively. This should represent a fasting glucose level. If elevated, consider reflexively checking HbA1c level to evaluate for diabetes.
4. During surgery (In the operating or procedure room [aka. Intraoperative])
    a. Check blood glucose level in the operating room.
        i. At minimum every 1 hour for patients with type 1 diabetes
        ii. At minimum every 1-2 hours for patients with type 2 diabetes
    b. For all patients with a blood glucose >180mg/dL, start insulin (pre-op holding or OR) and repeat blood sugar testing until consistently <180mg/dL
        i. For patients NOT scheduled for inpatient admission postoperatively, treat with short-acting insulin as necessary.
        ii. For patients with diabetes, consider the following general guidelines in Appendix F[xvi]
5. Special considerations for patients with continuous glucose monitor (CGMs) and automatic insulin device (AIDs)/ “Insulin pumps”
    a. Continuous glucose monitoring (CGM) should not be solely relied upon during procedures to inform medication administration. Either do not use CGM or, at minimum, validate CGM readings by checking intraoperative blood glucose.
    b. For procedures under 2 hours (actual duration, not booked/ estimated duration), automatic insulin devices (AIDs) or subcutaneous insulin infusion can be used provided they are placed outside surgical field, easily visualized, and easily accessed. If longer then 2 hours, recommend routine testing and treatment per above.
6. After surgery (Post-anesthesia care unit [PACU] and first 24 hours post-operatively). These recommendations apply to patients with type 1 or type 2 diabetes and all patients with intraoperative hyperglycemia >180 mg/dL (regardless of diabetes status),
    a. Monitor blood glucose every 1-2 hours at a minimum while in recovery for those with intraoperative hyperglycemia

b. Continue insulin treatment, including dose adjustment as needed, while blood glucose remains elevated.
c. Discontinue intravenous insulin once blood sugar levels are consistently below 180mg/dL and continue correction dose insulin as needed. If an insulin infusion was started, continue postoperatively until the patient can resume eating before transitioning to subcutaneous as needed
d. Reinstate preoperative diabetes treatments as appropriate once eating and blood glucose is controlled.
e. For those not scheduled for inpatient admission, confirm follow-up appointments and plans for close monitoring and treatment of post-operative glucose abnormalities.
f. Consider inpatient admission to treat hyperglycemia for persistent blood glucose readings above >180mg/dL despite treatment and for any patient where close outpatient follow-up is not arranged or not possible. For patients with type 1 diabetes in particular, also recommend to consider probability and consequences of acute hypoglycemia in non-inpatient setting.
g. If patient experiences postop nausea/vomiting, and has taken an SGLT2 inhibitor (e.g., Jardiance) within last 3 days, check beta hydroxybutyrate (or anion gap if unable) to evaluate for acute euglycemic diabetic ketoacidosis
h. Communication, education, and post-discharge planning
    i. Discuss low carbohydrate diet, tailored to cultural and linguistic needs and preferences
    ii. Refer those newly diagnosed with diabetes to outpatient endocrinology
    iii. Support scheduling with primary care to continue monitoring and treating hyperglycemia. Refer to establish primary care as applicable.
    iv. Communicate existence of intraoperative hyperglycemia to primary care provider

Preoperative Anemia Optimization

- Before Surgery (Prior to scheduling an operation and pre-operative preparation prior to surgical date)
    - Screen for anemia (causal conditions, risk factors, and symptoms).
    - Perform complete blood count with hemoglobin testing. Recommend universal screening for any surgery or invasive procedure where >500mL blood loss is possible and in any patient who cannot accept blood transfusions
    - Perform screening and testing as early as possible in presurgical process. (many optimization steps take 6-8 weeks or more so need time).
    - If the person has even mild anemia (hemoglobin <13 g/dL), determine if the patient has an established primary care provider.

        - If they do, refer to their primary care provider for optimization
        - If they do not, ensure they are able to see a preoperative clinician as early as possible before surgery who can manage evaluation and treatment of anemia prior to surgery
        - If unable to schedule with a preoperative provider, surgery teams should take ownership of preoperative optimization according to Preoperative Clinicians guidelines.
    - Key components of evaluation and optimization for those with low hemoglobin (<13 g/dL) include:
        - Identify underlying cause of anemia
            - Reflexive testing of iron status. TSAT <20% (calculated as iron/TIBC * 100) or ferritin <30 ng/ml are diagnostic of iron deficiency in all circumstances. Ferritin can be artificially elevated in inflammation so if CRP is elevated, normal ferritin values alone cannot be trusted.
            - Comprehensive medical and medication history and physical exam
            - Order other tests as indicated to diagnose underlying cause. Consider the algorithm in Appendix H
            - Consider specialist referral (e.g. hematology, gastroenterology) for further evaluation and treatment if indicated
        - Treat anemia to optimize prior to surgery (typical goal = Hb >12 g/dL; higher goal if patient cannot accept blood transfusion)
            - Treat the underlying cause.
            - If iron deficiency is present (irrespective of cause), supplement with iron formulation unless contraindicated. Consult pharmacy as needed depending on timing.
                - If 8+ weeks, can consider oral iron therapy
                - If <8 weeks, inadequate response to oral, or moderate-to-severe anemia (Hb <10 g/dL) intravenous iron is recommended.
            - Consider addition of erythropoietin stimulating agents (ESAs) if chronic inflammatory disease, patient cannot accept transfusions, or if urgent surgery needing more rapid response
            - Reassess anemia status 2-4 weeks after treatment initiation (goal = Hb > 12 g/dL) and minimum of 2 weeks prior to surgery (if already scheduled).
            - Consider change of treatment, escalation of treatment (e.g. changing IV formulation, adding ESA), and/or delay surgery if response is inadequate (i.e. Hb remains <12 g/dL)

- Day of Surgery and After Surgery
    - Confirm most recent hemoglobin status and review medical history
    - Confirm expected – and possible – blood loss and any mitigation strategies
    - Consider delay of operation for further optimization, especially if:
        - Procedure is elective with significant blood loss possibility,
        - Blood products are not immediately available, and/or
        - Patient cannot accept blood transfusions
    - Continue treatment for anemia as indicated after procedure complete.
- Special considerations for patients that cannot receive blood products, even if not currently anemic:
    - Take a full medical history
    - Consider discontinuation of medications that could induce coagulopathies
    - Take steps to optimize preoperative red blood cell production
    - Consider higher preoperative hemoglobin goals (e.g., Hb >13 g/dL)
    - Determine with patient what blood products are acceptable or unacceptable. Clearly identify on medical record.

Health Delivery Systems

- Include optimization of glycemic control and anemia in preoperative patient-facing materials.

Perioperative Glycemic Control

- Protocolize hyperglycemia treatment for patients with and without diabetes in all surgical settings based on most updated guidelines.
    - Protocols for clinicians should include the following at a minimum:
        - Screening for diabetes and anemia in preoperative evaluation
        - Identifying and treating iron deficiency anemia
        - Day of surgery blood glucose screening
        - Intraoperative target glycemic control ranges based on surgery risk stratification and patient condition (e.g., most commonly <180mg/dL)
        - Postoperative workflow for patients who receive insulin intraoperatively, including threshold to consider inpatient admission to treat glycemic control
        - Standardized discharge steps for patients with new intraoperative hyperglycemia/diabetes or anemia
- Ensure equipment is available perioperatively to check capillary blood glucose at least every 1-2 hours for patients undergoing elective major surgery
- Provide dedicated staff for support in scheduling follow up appointments, including with primary care and endocrinology for those with new intraoperative hyperglycemia
- Develop capacity to safely utilize intravenous insulin in non-ICU settings.

Preoperative Anemia Optimization

- Adopt standardized clinical pathway for identifying anemia and evaluation of underlying cause of anemia, and referral to primary care for ongoing management of anemia
- Promote adjustment of anemia policies through educational opportunities like in-services
- Incorporate auto-reflexive testing of ferritin, iron and transferrin for presurgical patients with Hb <13g/dL (regardless of sex at birth) for procedures with estimated blood loss of 500ml or a risk of transfusion 10% or higher
- Dedicate quality improvement initiatives for anemia optimization in presurgical patients.
    - Identify surgical populations with highest risk for transfusion and/or blood loss in procedure to pilot anemia optimization protocols
    - Identify champion in each targeted surgical specialty to promote change
    - Utilize relevant quality and process measures to track progress. Also see Evaluation Framework.

- Consider developing dedicated resources/team to direct patients that need further evaluation of underlying cause of anemia (e.g., preoperative anemia optimization clinic)

Health Plans

- As able, route patients undergoing major elective surgery to preoperative coordinator and/or case management team to support health education and coordinating care needs.
    - Incorporate standardized universal screening and addressing health-related social needs (e.g., food security, transportation)
- Share data on the rate of preoperative screening for anemia and diabetes with providers and/or facilities for major elective procedures
    - For instance, provider- or facility-facing dashboards with specific rates of HbA1c screening and Hb/Hct screening for major elective procedures
- Payment Redesign
    - Offer modest incentives to facilitate preoperative optimization for anemia and/or glycemic control for those with diabetes
    - Where feasible, integrate preoperative screening for anemia and glycemic control into quality programs for surgical optimization
    - Consider paying separately for glycemic control and anemia optimization activities (screening, treatment to target Hb or HbA1c) rather than include in bundle arrangements.
        - Ensure preoperative providers, including PCPs, are reimbursed for these activities.
        - Target procedures that meet general principles defined here
    - Consider incentives for delivery systems that have accreditation from national organizations in patient blood management (e.g., The Joint Commission)
    - Consider including requirement of preoperative anemia optimization and intraoperative glycemic control protocols in centers of excellence models for surgical centers (e.g., total hip/total knee replacement, spine surgery, etc.)
    - Minimize penalties for appropriate delay of procedure when optimization not achieved
- Track relevant measures/metrics for glycemic control and anemia optimization. See Measurement section and Evaluation Framework

Perioperative Glycemic Control

- Preoperative
    - Approve inpatient admission for major elective procedures for patients with HbA1c > 9%
    - Cover telemedicine/virtual diabetes-related visits
    - Route patients with diabetes to care management team, and outreach once procedure scheduled to support accessing outpatient services for

diabetes (nutrition therapy, medication management, diabetes prevention program)
        - Arrange close follow-up as possible within 3-7 days after major elective procedures for patients with uncontrolled diabetes
    - Cover HbA1c screening for patients annually and for patients with diabetes at least every 6 months
- Day of Surgery
    - Incorporate day of blood glucose screening and treatment in coverage for major elective procedures regardless of diabetes status.
- Postoperative
    - Incorporate treatment for hyperglycemia that requires intravenous insulin infusion as eligibility criteria for inpatient admission for procedures performed in an ambulatory setting.
    - Consider covering outpatient hospital-based team that manages glucose for 3-7 days postoperatively and facilitates transition to primary care instead of admission.

Preoperative Anemia Optimization

- Remove requirement for prior authorization for intravenous iron formulations that require fewer infusions/have a shorter duration of administration, and lower cost to patients while maintaining effectiveness and safety. See Appendix F for iron formulations.
- Minimize cost-sharing for outpatient infusion therapy
- Ensure network adequacy for infusion centers as able

Employers

- Request benefit vendors include strategies to incent surgical optimization, such as pay for performance or shared savings models that include preoperative providers.
- Where able, use centers of excellence for major procedures that include robust management for glycemic control and anemia optimization
- Require monitoring of preoperative screening for anemia and glycemic control in health plan coverage of major surgical procedures
- Select performance measures related to anemia and glycemic control for surgical quality (e.g., transfusion rate, surgical site infection) See Measurement section for specifics and Evaluation Framework

Washington Health Care Authority

- Consider supporting the creation of patient decision aids on presurgical optimization, including:
    - Importance of addressing conditions like diabetes and anemia preoperatively, and intraoperative hyperglycemia
    - Encouragement to get tested early as possible before surgery and why

Background

Optimizing modifiable risk factors before surgery is essential to improving patient outcomes and reducing complications. Among the most prevalent and impactful of these are perioperative hyperglycemia and preoperative anemia, both of which independently increase the risk of infection, longer hospital stays, and mortality. While common occurrences, hyperglycemia in patients with and without diabetes and anemia across surgical populations remain underrecognized and undertreated. Proactive screening, timely intervention, and coordinated care pathways can meaningfully reduce surgical risk, and provide improved outcomes.

Glycemic Control

Intraoperative hyperglycemia is linked to increased complications such as surgical site infection, systemic infection, hospital length of stay, morbidity and mortality across a range of surgical procedure types.[xvii] Screening for diabetes as a risk factor for surgery is common, as it's known that increased HbA1c (>8%) increases risk for infection and other postoperative complications.[xviii] However, patients without diabetes also commonly experience intraoperative hyperglycemia[xix], and often experience worse outcomes than patients with diabetes.[xx] Patients without diabetes are less likely to receive insulin perioperatively,[xxi] even when doing so can reduce postoperative complications.[xxii]

While the exact best target glucose level is unknown perioperatively, most guidelines set a range between 100-110 mg/dL and 180 mg/dL.[xxiii] For patients with diabetes, intensive glucose control (<120mg/dL versus <160mg/dL) does not reduce infections, length of stay or all-cause mortality.[xxiv]

It is recommended that patients undergo assessment of glycemic status well in advance of surgery, with particular attention paid to identifying undiagnosed diabetes or poorly controlled hyperglycemia. Delivery systems can improve patient outcomes by introducing proactive screening protocols, educating patients about the importance of preoperative glycemic optimization, and providing referrals for assistance through nutrition therapy and counseling as well as resources to support access to healthy foods. Clear thresholds for postponing elective surgery, such as persistent blood glucose above 180 mg/dL or inability to stabilize hyperglycemia, should be defined, and multidisciplinary teams should coordinate closely to optimize glycemic status prior to the procedure.

The workgroup also recommends routine day-of fasting blood glucose screening and post-operative screening for those undergoing major surgery. Professional societies recommend aiming for a preoperative glucose in the ~100–180 mg/dL range.[xxv, xxvi] Intraoperatively and during the first 24 hours after major operations, healthcare teams should obtain periodic glucose measurements (frequency depending on case risk and anesthesia/ICU setting) because even transient stress hyperglycemia is associated with higher surgical-site infection and other complications.[xxvii, xxviii] Teams should treat persistent in-hospital hyperglycemia (commonly defined as glucose ≥180 mg/dL) with insulin

(correctional or scheduled basal/bolus regimens per institutional protocols, and IV insulin for unstable/critical patients), rather than waiting for a diabetes diagnosis, since non-diabetic patients with stress hyperglycemia have been shown to experience disproportionately worse postoperative outcomes and are frequently undertreated.[xxix] Finally, clinicians should document follow-up plans (repeat glucose checks after discharge, consider outpatient diabetes evaluation if hyperglycemia persists) as perioperative hyperglycemia can unmask undiagnosed diabetes or indicate need for new outpatient management.[xxx, xxxi]

Anemia

Anemia estimated prevalence ranges from about 20-40%, and patients assigned female at birth and those of advanced age (70+) are more likely to have anemia.[xxxii] Preoperative anemia, even mild anemia (Hb 11.0g/dL – 12.9g/dL), is an independent risk factor for postoperative morbidity and mortality, as well as increased length of stay, and is a predictor of allogenic blood transfusion. Surgical specialties have various prevalence of anemia[xxxiii], but some studies have shown a higher prevalence in vascular, gynecologic[xxxiv], urologic, and colon surgeries.

The underlying cause of preoperative anemia should be evaluated early in the course of preoperative planning. National guidelines recommend screening for anemia at a minimum 4-6 weeks before the procedure.[xxxv] Screening for anemia is simple (i.e.,, complete blood count) and is usually already combined with other preoperative testing. Iron deficiency anemia is one the most common causes of anemia and is usually treatable with iron supplementation. Preoperative guidelines recommend intravenous administration of iron for iron deficiency anemia to raise hemoglobin levels effectively on a preoperative timeline.[xxxvi] Compared to blood transfusions, intravenous iron infusions are cost-saving, especially considering the avoidance of increased length of stay and medical complications.

Screening and treatment should be done in the context of a coordinated healthcare team that prioritizes optimization. Preoperative care settings can support providers and patients by developing clinical infrastructure such as workflows that reflexively order iron studies for those who it is appropriate and referral pathways for further evaluation for underlying causes. Clinical teams should help patients make comprehensive plans for preop anemia optimization that includes clearly defined hemoglobin goals, parameters for when procedure delay might be recommended, and referral for continued management of anemia postoperatively. Payors and purchasers can support optimization by providing separate reimbursement specifically for preoperative identification management, such as preoperative testing of hemoglobin and HbA1c and administration of insulin and/or intravenous iron.

Prioritizing Optimization

Decisions to delay a procedure should be guided by clearly defined thresholds and patient-centered goals. For glycemic control, surgery may be postponed if blood glucose levels are persistently above guideline-recommended targets—typically above 180 mg/dL—or if hyperglycemia cannot be stabilized with available interventions, thus raising the risk for postoperative infection and delayed healing. Similarly, when patients present with moderate to severe anemia (for example, hemoglobin below 11.0 g/dL), and especially when the underlying cause is not yet identified or treatable, it is often safer to defer surgery. This allows time for interventions such as iron supplementation or other therapies to achieve safer hemoglobin levels and reduce transfusion risk. By proactively applying protocols that define these safety parameters, multidisciplinary teams can work with patients to weigh the benefits and risks, ensuring that procedures occur only when patients are optimally prepared for recovery and long-term health.

Measurement

To monitor progress toward improvement in surgical optimization for glycemic control and anemia, the workgroup recommends several process and outcome measures to monitor at the system level to design quality improvement around and monitor progress towards goals. The following are measurement concepts that the workgroup endorses:

- Percent of patients with good glycemic control in immediate preoperative period and during and after surgical procedure.
- Percent of patients without anemia in immediate preoperative period
- Fewer post-operative days where blood glucose level is elevated
- Percent of patients undergoing major elective surgery receiving blood transfusions

Process and outcome evaluations should include measurement concepts such as

- Preoperative screening (e.g., HbA1c, Hb/Hct)
- Optimization activities (e.g., intravenous iron for iron deficiency anemia)
- Clinical care processes (intraoperative hyperglycemia treated with insulin)
- Postoperative complications (e.g., surgical site infection) and adverse events

Review the Process and Outcome Measures in our Evaluation Framework for detailed parameters.

Review the Bree Collaborative Surgical Optimization Evaluation Framework for further detailed information

Paying for Value

Bundled payment programs and shared savings initiatives have emerged as influential strategies in reshaping the economic and clinical landscape of major elective surgical

procedures. These payment models shift the focus from volume-based care to value-based care, aligning financial incentives with the quality and efficiency of surgical outcomes. In a bundled payment model, a single payment is made to cover all services associated with a surgical episode, including preoperative optimization, the procedure itself, postoperative care, and any related complications or readmissions. Shared savings programs, by contrast, reward providers for reducing costs below a benchmark while maintaining or improving quality. Together, these approaches encourage care coordination, risk reduction, and evidence-based practice, producing benefits that extend to patients, providers, and payors.[xxxvii xxxviii]

One of the primary advantages of bundled payments in elective surgery is the incentivization of preoperative optimization. For procedures such as total hip and knee arthroplasty, spine surgery, and other major elective procedures, controlling modifiable risk factors like hyperglycemia, anemia, and nutritional deficiencies reduces surgical site infections, postoperative complications, and hospital length of stay. Under bundled payment models, financial incentives align to motivate optimization prior to surgery, as complications or readmissions may not be covered. Medicare's Comprehensive Care for Joint Replacement (CJR) program demonstrated reductions in average episode spending and postoperative complications, without negatively impacting patient-reported outcomes.[xxxix] Bundled payments for spine surgeries also indicated have shown reduced episode spending and a reduction in readmission inpatient admissions.[xl]

Shared savings programs foster continuous improvement and multidisciplinary care delivery. Health systems participating in these programs often establish preoperative clinics, implement enhanced recovery after surgery (ERAS) pathways, and expand patient engagement and education efforts. These strategies have been shown to decrease intensive care unit (ICU) stays, transfusion requirements, and surgical site infections.[xli, xlii] By linking financial rewards to both cost containment and quality metrics, shared savings models support reinvestment into patient-centered initiatives such as prehabilitation programs, targeted risk reduction strategies for at higher risk for surgical complications, and advanced monitoring protocols.

Elective surgeries, with predictable care trajectories, are particularly well suited for these models. Standardized pathways decrease variation, promote adherence to best practices, and reduce wasteful utilization of resources. Importantly, large-scale evaluations suggest that these payment reforms achieve cost reductions without compromising equity or quality, with potential to improve access and outcomes across diverse patient populations.[xliii] Bundled payment and shared savings initiatives represent a proven approach to aligning incentives around quality, efficiency, and patient-centered surgical care.

Appendices

Appendix A. Bree Collaborative Members

Name	Title	Organization
June Altaras, MN, NEA-BC, RN	Executive Vice President, Chief Quality, Safety and Nursing Officer	MultiCare Health System
Colleen Daly, PhD	Director, Global Occupational Health, Safety and Research	Microsoft
Jake Berman, MD MPH	Medical Director for Population Health Integration	UW Medicine and UWM Primary Care and Population Health
Gary Franklin, MD, MPH	Medical Director	Washington State Department of Labor and Industries
Colin Fields, MD, AAHIVS	Medical Director, Government Relations & Public Policy	Kaiser Permanente
Darcy Jaffe, MN, ARNP, NE-BC, FACHE	Senior Vice President, Safety & Quality	Washington State Hospital Association
Norifumi Kamo, MD, MPP	Internal Medicine	Virginia Mason Franciscan Health
Kristina Petsas, MD MBA MLS	Market Chief Medical Officer, Employer & Individual	UnitedHealthcare
Greg Marchand	Director, Benefits & Policy and Strategy	The Boeing Company
Kimberly Moore, MD	Associate Chief Medical Officer	Franciscan Health System
Carl Olden, MD	Family Physician	Pacific Crest Family Medicine, Yakima
Nicole Saint Clair, MD	Executive Medical Director	Regence BlueShield
Mary Kay O'Neill, MD, MBA	Partner	Mercer
Susanne Quistgaard, MD	Medical Director, Provider Strategies	Premera Blue Cross
Emily Transue, MD, MHA (Chair)	Chief Clinical Officer	Comagine Health
Judy Zerzan-Thul, MD, MPH	Chief Medical Officer	Washington State Health Care Authority

Appendix B. Surgical Optimization Workgroup Charter and Roster

The Bree Collaborative
Surgical Patient Optimization Charter and Roster

Problem Statement

Modifiable attributes of patient health status such as anemia or blood sugar control can have negative consequences for recovery after surgery. Preoperatively anemic individuals have higher costs generally due to increased length of stay[xliv] and even mild preoperative anemia is associated with an increase in 30-day morbidity[xlv] lower quality of recovery and higher adjusted risk of death and disability.[xlvi] Some studies suggest poor A1c control preoperatively increases morbidity and mortality,[xlvii] but perioperative glucose is a stronger predictor of 30-day mortality.[xlviii] Enhanced Recovery After Surgery (ERAS®)[xlix] protocols improve length of stay and reduce total cost of care, complications, and readmissions.[l] However, Washington State has variation for A1c optimization before surgery, perioperative glycemic control protocols, and perioperative anemia control. Black patients are three to four times more likely to experience anemia perioperatively; Black, Hispanic, American Indian/Alaska Native patients more likely to experience uncontrolled diabetes/serum glucose, leading to inequitable outcomes.

Aim

To reduce surgical complications and cost by improving patient optimization before, during, and after surgery in Washington state.

Purpose

To propose evidence-informed guidelines to the full Bree Collaborative on practical and evidence-informed methods for improved surgical patient optimization for elective procedures, including:

- Identify best practices for anemia and glycemic status optimization around surgery, including innovative/emerging strategies (e.g., CGM monitoring)
- Identify and promote evidence-based enhanced recovery after surgery protocols
- Recommend strategies to integrate optimization of anemia and glycemic status (patients with and without diabetes) into perioperative protocols
- Recommend strategies to standardize and increase use of enhanced recovery after surgery protocols in Washington state
- Recommend reimbursement structures and employer strategies to incent improved optimization of anemia, glycemic control and use of enhanced recovery after surgery protocols

- Improved collaborative management of surgical patients between primary care and surgical care
- Identify best practices for systems with varying size/resource availability
- Other areas, as indicated

Out of Scope

- <18 years of age
- Emergent procedures
- Best practices for other indicators for surgical optimization (e.g., blood pressure, EtOH, nicotine, opioids)
- Transitions of care (e.g., hospital discharge)
- Intraoperative best practices for specific procedures

Duties & Functions

The workgroup will:

- Research evidence-informed and expert-opinion informed guidelines and best practices (emerging and established).
- Identify current barriers and future opportunities for implementing interventions.
- Consult relevant professional associations and other stakeholder organizations and subject matter experts for feedback, as appropriate.
- Meet for approximately nine months, as needed.
- Provide updates at Bree Collaborative meetings.
- Post draft report(s) on the Bree Collaborative website for public comment prior to sending report to the Bree Collaborative for approval and adoption.
- Present findings and guidelines in a report.
- Recommend data-driven and practical implementation strategies including metrics or a process for measurement. (can be part of evaluation framework)
- Create and oversee subsequent subgroups to help carry out the work, as needed.
- Revise this charter as necessary based on scope of work.

Meetings

The workgroup will hold meetings as necessary. Less than the full workgroup may convene to: gather and discuss information; conduct research; analyze relevant issues and facts; or draft recommendations for the deliberation of the full workgroup. A quorum shall be a simple majority and shall be required to accept and approve recommendations to send to the Bree Collaborative.

Bree Collaborative staff will conduct meetings, arrange for the recording of each meeting, and distribute meeting agendas and other materials prior to each meeting. Additional workgroup members may be added at the discretion of the Bree Collaborative director.

Name	Title	Organization
Carl Olden, MD (chair)	UW Residency Program Manager, Family Medicine Physician	Central Washington Family Medicine
Nicholas J. Kassebaum, MD	Medical Director	SCOAP/Spine COAP
Vickie Kolios-Morris, MSHSA, CPHQ	Senior Program Director	Surgical COAP and Spine COAP, Foundation for Health Care Quality
Cristina Stafie, MD, FASA	Medical Director Perioperative and Procedural Services	Kaiser Permanente
Dayna Weatherly-Wilson, RN	Manager, Value Based Care	Proliance
Eduardo Smith Singares, MD FACS, FCCM	Medical Director for Trauma & Emergency Surgical Services	Kadlec Medical Center
Rosemary Grant, BSN, RN, CHPQ, CPPS	Director, Clinical Excellence	WSHA
Timothy Barnwell, MD	Anesthesiologist	Confluence
Nawar Alkhamesi, PhD, MBA	Colorectal Surgeon	Kadlec Medical Center
Thien Nguyen, MD	OMC Surgery Section Chair, Director of OC Surgical Subspecialties	Overlake Medical Center
Andrea Allen, RN, MHA	Nurse Consultant, Program Manager, WA Apple Health, Fee For Service	Washington HCA
Irl Hirsch, MD	Medical Director	UW Diabetes Institute
E. Patchen Dellinger, MD	Professor Emeritus	University of Washington, Department of Surgery
Ty Jones, MD, CPPS, CHPW, CAQSM	Medical Director, Patient Safety and Healthcare Quality Leader	Regence
Robert Rush, MD	Chief Medical Officer Surgical Services	PeaceHealth Saint Joseph
Joe Frankhouse, MD, FACS	Colorectal Surgeon	Legacy Health

Scott Helton, MD, FACS	Director of Liver, Biliary, Pancreas Surgery Center of Excellence	Virginia Mason Medical Center
Venu Nemani, MD	Orthopedic Spine Surgeon	Virginia Mason Franciscan Health
Michael Bota, MD	Medical Director Population Health Clinical Value	MultiCare Connected Care
Janice Tufte	Patient Partner	Muslim Resource Center
Sharon Eloranta, MD	Medical Director	Washington Health Alliance (WHA)
Edie Shen, MD	Perioperative Internist	Harborview Medical Center

Appendix C. Guidelines and Systematic Reviews

Source	Guidelines
AHRQ	N/A
Cochrane Collection	Perioperative glycemic control for people with diabetes undergoing surgery (2023) Adverse sides effects of dexamethasone in surgical patients (2018) Iron therapy for preoperative anemia (2019) Erythropoietin plus iron versus control treatment including placebo or iron for preoperative anaemic adults undergoing non-cardiac surgery (2020) Interventions for reducing red blood cell transfusion in adults undergoing hip fracture surgery: an overview of systematic reviews (2023) Pre and peri-operative erythropoietin for reducing allogenic blood transfusions in colorectal cancer surgery (2009)
Specialty Society Guidelines	American Society of Anesthesiologists: Practice Guidelines for Perioperative Blood Management (2015) Society of Thoracic Surgeons, American Society of ExtraCorporeal Technology: Update to the Clinical Practice Guidelines on Patient Blood Management (2021) Recommendations from the International Consensus Conference on Anemia Management in Surgical Patients (ICCAMS) (2022) Centre for Perioperative Care: Guideline for the Management of Anaemia in the Perioperative Pathway (2022) British Society for Haematology: Identification and Management of Preoperatie Anaemia in Adults (2024)
Health Technology Assessment Program	Continuous glucose monitoring (2025)
Center for Disease Control	N/A
Institute for Clinical and Economic Review	N/A
BMJ Clinical Evidence Systematic Overview	Safety and efficacy of intravenous iron therapy in reducing requirement for allogenic blood transfusion: systematic review and meta-analysis of randomized clinical trials (2013) Effect of restrictive versus liberal transfusion strategies on outcomes in patients with cardiovascular disease in a non-cardiac surgery setting: systematic review and meta-analysis (2016)
Veterans Administration Evidence-based Synthesis Program	Enhanced recovery after surgery programs for patients undergoing colorectal surgery (2017)

Appendix D. Common clinical conditions that affect hemoglobin A1c (Cleveland Clinic)[li]

Condition	Effect on HbA1c	Mechanism or reason
Asplenia	Increase HbA1c	Decreased red blood cell (RBC) turnover due to increased RBC life span
CKD	Effects vary based on underlying disease and therapy	Increased hemoglobin A1c: Carbamyl-hemoglobin production in uremic patientsl; Erythropoietin defi ciency Decreased hemoglobin A1c: Shortened RBC survival; Erythropoietin administration ; Hemodialysis (lowering of urea levels reduces carbamyl-hemoglobin concentration
Chronic Liver Disease	Effects vary based on severity of underlying disease and therapies	Increased hemoglobin A1c: Jaundice (increased glycation reaction in the presence of higher bilirubin concentrations) Decreased hemoglobin A1c: Increased RBC turnover; Antiviral drug therapies may decrease RBC life span
Hemoglobinop athies	Varies with testing method and assay	Multifactorial including anemia and rapid RBC turnover
Hemolytic anemia	Decreases HbA1c	Reduced RBC total volume Increased RBC destruction shortens RBC life span
Iron deficiency anemia	Increases HbA1c	Reduced RBC turnover prolongs RBC survival Greater malondialdehyde concentrations increase hemoglobin glycation reactions
Pregnancy	Decreases HbA1c in first 2 trimesters May increase HbA1c in 3rd trimester	Increased RBC turnover decreases hemoglobin A1c Increased erythropoietin production decreases hemoglobin A1c Hemodilution decreases hemoglobin A1c
Transfusion	Variable HbA1c effects	Increased hemoglobin A1c: Elevated glucose concentration in storage medium Decreased hemoglobin A1c: Dilutional response
Vitamin B12 and folate deficiency anemias	Increases HbA1c	Reduced RBC turnover prolongs RBC survival

Further commentary here.[lii]

Appendix E. Considerations for perioperative glycemic control in patients with diabetes based on surgical and patient risk

	Surgical Risk Score					
Patient Risk Score		1	2	3	4	5
	1-not diabetic	NA	NA	Check a day of surgery blood glucose	Check a day of surgery blood glucose	Check a day of surgery blood glucose
	2-people with diabetes (HbA1c<8%)	NA	NA	check a day of blood glucose; schedule close follow up.	Check a day of blood glucose. Schedule close follow up. If unable to do so, Consider delaying procedure if severely elevated	Check a day of blood glucose. Schedule close follow up. Consider delaying procedure if BG severely elevated
	3-people with uncontrolled diabetes (HbA1c >/= 8%)		Optimize HbA1c preoperatively; check a day of blood glucose; schedule close follow up	Optimize HbA1c preoperatively; check a day of blood glucose; schedule close follow up; Consider delaying procedure if BG severely elevated	Optimize HbA1c preoperatively; check a day of blood glucose; schedule close follow up; Consider delaying procedure if BG severely elevated.	Consider delaying if BG severely elevated

Appendix F. General Intraoperative Insulin Guidelines for Patients with Diabetes

Duration of surgery*	Type 2 DM treated with diet	Type 2 DM treated with oral or injectable non-insulin meds	Type 1 or type 2 DM treated with insulin
Short (<2 hours)	Check blood glucose intra- and postoperatively.	Monitor every 1-2 hours – Consider treating with bolus short- or rapid-acting insulin if indicated	Monitor every 1 hour – Continued subcutaneous or bolus short-acting insulin often sufficient
Long (>/= 2 hours)	Monitor every 1-2 hours – Consider bolus short- or rapid-acting insulin if indicated	Monitor every 1-2 hours – Treat with bolus short-acting insulin if indicated; May need infusion	Monitor every 1 hour – Insulin infusion often required

* Note, this is actual duration of the operation not booked/ estimated duration.

Appendix G. Intravenous Iron Formulations [1]

Medication	Elemental Iron Concentration	Dosing (adults)	Premedication
Ferric Carboxymaltose (FCM)	50 mg/mL	Weight ≥50 kg: 1 or 2 doses of 750 mg, given 7 or more days apart or Weight <50 kg: 1 or 2 doses of 15 mg/kg, given 7 or more days apart	• Do not routinely premedicate for any of the IV iron products. • For patients with asthma or multiple drug allergies, often give methylprednisolone and a histamine 2 (H2) receptor blocker prior to the iron infusion. • For patients with inflammatory arthritis, often give methylprednisolone followed by a brief course of oral prednisone. • Do not give diphenhydramine as a premedication.
Ferric derisomaltose (previously called iron isomaltoside)	100 mg/mL	Weight ≥50 kg: Single dose of 1000 mg or Weight ≥50 kg: Up to 3 doses of 500 mg given over 7 days or Weight <50 kg: Single dose of 20 mg/kg	
Ferric gluconate	12.5 mg/mL	Multiple doses of 125 to 250 mg	
Ferrumoxytol	30 mg/mL	Single dose of 1020 mg or 2 doses of 510 mg, given 3 to 8 days apart	
Iron Dextran, low molecular weight (LMW)	50 mg/mL	Single dose of 1000 mg (diluted in 250 mL normal saline) given over 1 hour or Multiple doses of 100 mg	
Iron sucrose	20 mg/mL	Multiple doses of 100 to 300 mg	

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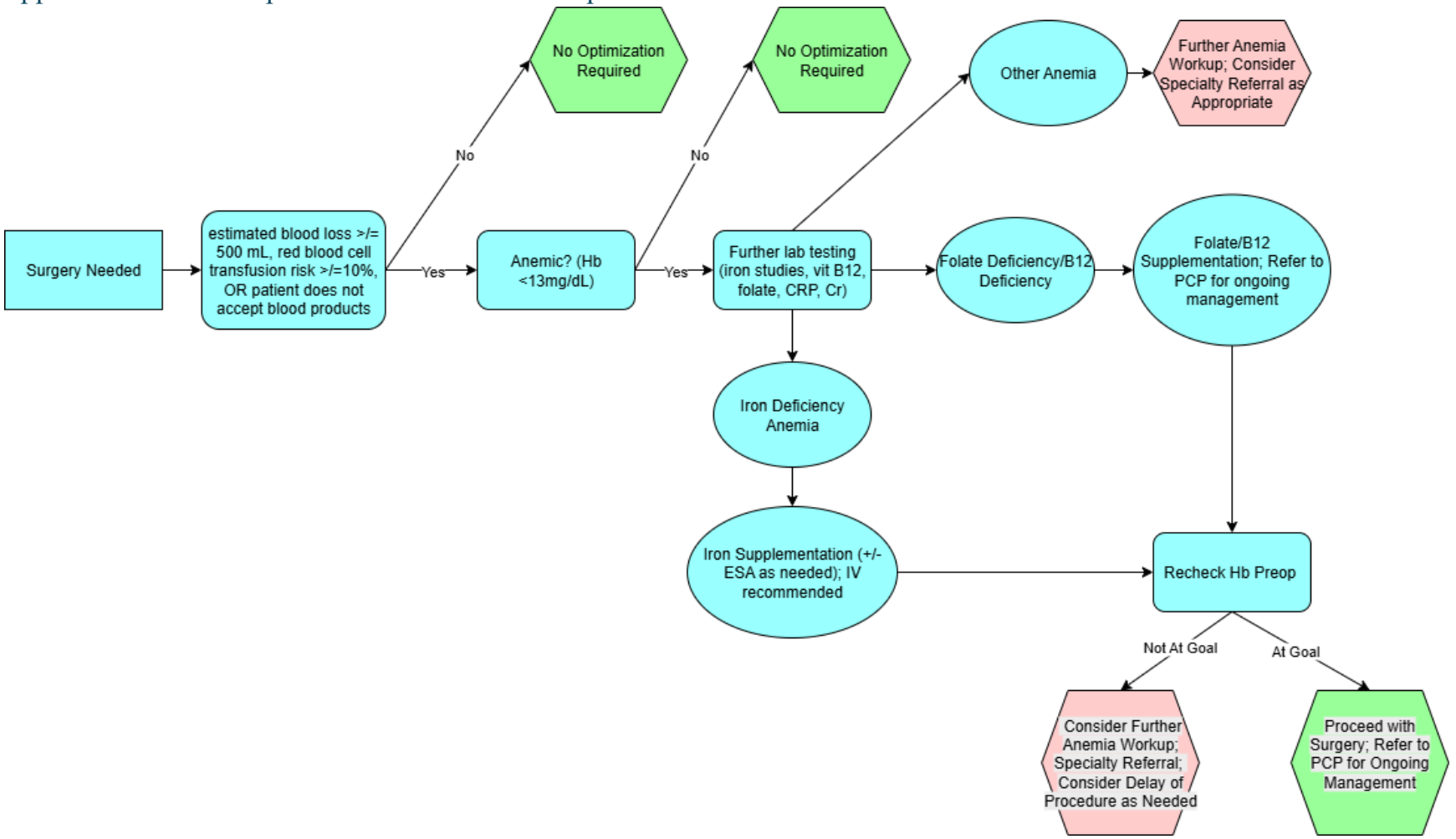
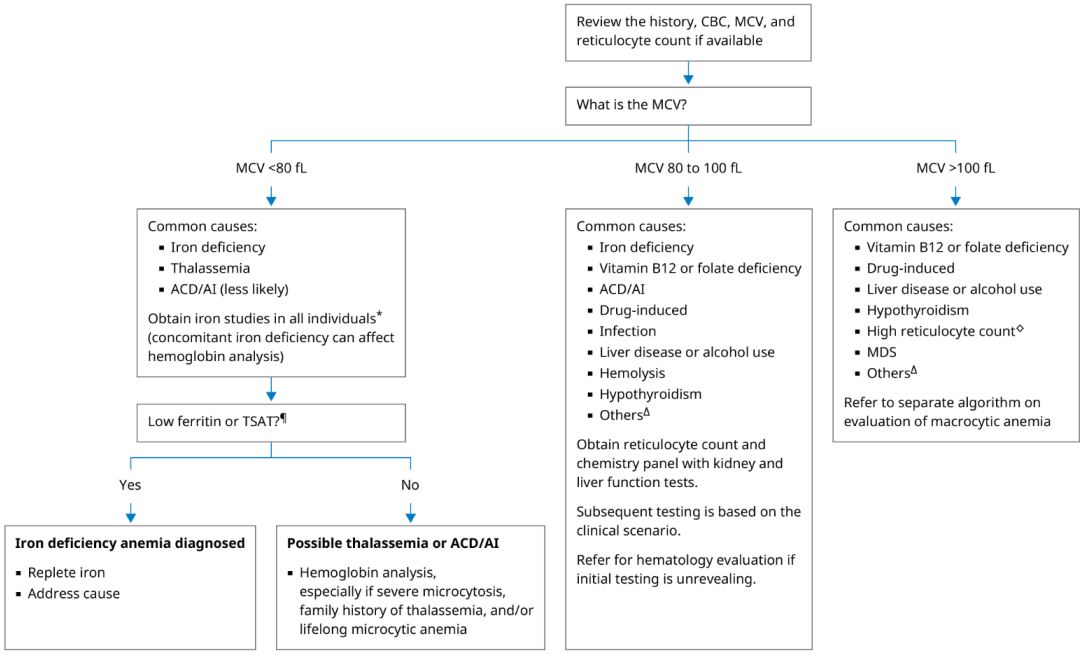
Appendix H. Anemia Optimization Workflow Example



Appendix I. Evaluation of Anemia in Adults [liii]



Anemia evaluation in outpatient settings. This algorithm is part of the UpToDate resource for anemia evaluation and is a tool that can support evaluation of underlying anemia.

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