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### I. Background Information and Objectives

Justice Horace [Krever's Commission Report \(1997\)](#) on Canada's Blood System recommended patients be advised of the benefits, risks and alternatives to blood transfusion. The report further specifies that this physician-patient interaction take place with language the patient can understand and occur in a timely manner (well in advance of surgery) to ensure that the patient can be a participant in the decision making process.

Canadian Medical Association [Guidelines for Red Blood Cell and Plasma Transfusion](#) for Adults and Children recommend "anemia should not be treated with red blood cell transfusions if alternative therapies with fewer potential risks are available and appropriate"

Currently across Canada, Perioperative Blood Conservation Programs number greater than 35. In April 2002, LHSC piloted a Perioperative Blood Conservation Program (PBCP) via the Ontario Transfusion Nurse Coordinator (ONTraC) project.

The objective of the PBCP is to improve patient care by reducing or eliminating the need for allogeneic blood transfusion in elective surgical procedures. That is, to optimize utilization of blood products by maximizing utilization of blood alternatives.

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### II. PBCP Practices

1. Patients receive education regarding benefits and risks of blood transfusion and alternatives to blood transfusion.
2. As early as possible in the pre-operative time frame patients' hemoglobin is screened relative to the proposed surgical procedure. Pre-operative hemoglobin has been identified as highly predictive of the likelihood of requiring perioperative blood transfusion (COPES Investigators Study Group Lancet 1993; 341:1227-23).
3. Optimizing pre-operative hemoglobin is a major patient care goal. Iron, vitamin B12, folate, erythropoietin are initiated as appropriate. Patients with newly diagnosed significant anemia (hemoglobin less than 110 g/L) are referred for further investigation.
4. The nature of the planned surgical procedure and anticipated blood loss may lead to recommendations for pre-operative autologous donation as an isolated strategy or augmented with erythropoietin.
5. Intra-operative blood conservation strategies, including but not limited to cell salvage, antifibrinolytics, hypotensive anesthesia, acute normovolemic hemodilution are considered if appropriate for the proposed surgical procedure.
6. Appropriate post-operative anemia management is promoted.

### III. Referral to PBCP

Ideally patients should be referred to the PBCP 8 -12 weeks, minimally 3 - 4 weeks pre-operatively. The Family Physician or Surgeon can refer patients to the program.

Referral criteria include:

1. elective surgical procedures with anticipated likelihood of blood transfusion of 10% or greater (group and screen/crossmatch required)
2. relative pre-operative anemia (defined as hemoglobin less than 130 g/L)
3. refusal of blood transfusion for personal or religious reasons
4. rare blood antibodies.

Patients wishing to discuss blood transfusion related issues might contact the program directly.

### IV. Information for Patients

Patients waiting for an operation may be referred to the following brochures for additional information. These brochures are available on the [LLSG Blood Transfusion Lab Website](#), or Staff at LHSC and SJHC can obtain the printed brochures by contacting [Forms Management at LHSC](#).

1. "You are Having an Operation: What are the Alternatives to Blood Transfusion?" (NS4859)

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2. "You May Need a Blood Transfusion" (NS4791)
3. "Preoperative Autologous Donation (PAD): Questions and Answers" (NS4857)
4. "Erythropoietin (EPO): Questions and Answers" (NS4856)
5. "Iron: Questions and Answers" (NS4858)

## V. Information for Health Care Professionals

### Perioperative Blood Conservation Program Algorithm

This algorithm has been implemented at LHSC. It functions as a guideline; patient and procedure specific clinical information may dictate variation to the algorithm.

The implementation of perioperative blood conservation strategies does not eliminate the possibility of allogeneic blood transfusion. Some patients may not respond to treatment as well as expected. In some surgical procedures, blood loss may be greater than anticipated.

## VI. Peri-Operative Blood Conservation Strategies

1. Patient's medical co-morbid conditions may limit the applicability of blood conservation strategies.
2. Transfusion alternatives are presented to the patient as an option, not a requirement.
3. Implementation of pre-operative blood conservation strategies does involve effort and time commitment on the part of the patient.
4. The 4 strategies are dependent on preoperative hemoglobin (Hb) levels and are as follows:
  - a. Hb <110g/L : Physician Assessment Guideline
    - i. Low hemoglobin, therefore a need to establish etiology.
    - ii. Physician coordinating the investigations or the hematologist may refer the patient for EPO strategy guidelines.
  - b. Hb 110-130g/L: Erythropoietin (EPO) Strategy Guideline
    - i. Synthetic erythropoietin increases red blood cell production in the bone marrow; for [additional drug information](#) refer to the LHSC Parenteral Drug Administration Manual.
    - ii. Requires oral iron supplements.
    - iii. Administration involves a series of weekly (every 7 +/- 2 days) subcutaneous injections beginning 2-4 weeks pre-op.
    - iv. Suggested dosage is as follows:
      - 20,000 IU/ml for patients weighing less than 50 kg
      - 40,000 IU/ml for patients weighing greater than 50 kg

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- v. Cost of 2-3 injections (\$1400-\$2100) is not covered by routine health care benefits, private insurance benefits or special authorization by MOH Drug Benefits Program (Section 8) are explored.
- vi. Patient requires repeat CBC and reticulocyte count pre-op day of surgery.
- c. Hb 130-150g/L: Pre Autologous Donation (PAD) Strategy Guideline
  - i. Decision to accept patients as autologous donors is at the discretion of the Medical Director of the Canadian Blood Services (CBS) after evaluation of their health status.
  - ii. Patient donates their own blood at a permanent CBS Centre 2-4 weeks pre-op.
  - iii. PAD is most suitable for surgical procedures where likelihood of requiring transfusion is high.
  - iv. Autologous donations have a shelf life of 35 days (in order for the donated blood to be eligible for use by the patient, the surgery must be performed within the 35 day time frame).
  - v. Requires oral iron supplements.
  - vi. Pre-operative blood donation lowers the patient's day of surgery Hb (few patients re-build Hb back to pre-donation level).
  - vii. Autologous blood is transfused based on the same transfusion trigger/criteria as for allogeneic blood.
  - viii. Once received from CBS, autologous units are stored in the BTL until required for transfusion or until the unit outdates.
  - ix. On admission to hospital, the green "Blood for Autologous Transfusion" card (1 card per autologous unit donated) given to the patient at CBS must be sent to the BTL as soon as possible.
  - x. Patient requires repeat CBC and reticulocyte count pre-op day of surgery.
- d. Hb >150g/L: Adequate Red Cell Mass Guideline
  - i. very low likelihood of requiring transfusion.
  - ii. exception is surgical procedures with anticipated major blood loss (femoral and acetabular revision hip surgery) where autologous donation may be appropriate.

## VII. Intra-Operative Blood Conservation Strategies

***Implemented at the discretion of the attending anesthesiologist/surgeon.***

1. Pentaspan/IV fluids
  - a. Maintain normovolemia, no ability to deliver oxygen.
  - b. Studies demonstrate low Hb is better tolerated in normovolemic state.

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2. Cell Salvage
  - a. The cell salvage device (operated by Clinical Perfusion Services staff) can collect surgical field blood.

**NOTE:** Policies and procedures must be strictly adhered to with appropriate documentation and quality control measures in place.
  - b. Shed blood is washed, filtered and processed to produce patient's own red blood cells suspended in 0.9 % sodium chloride.
  - c. Intention is to transfuse cell salvage blood at completion of procedure or if needed during the surgery.
  - d. Cell salvage blood can be transfused up to 6 hours after collection (stored at room temperature).
  - e. Most effective if Hb pre-op is adequate and the surgical procedure has an anticipated blood loss of 1000 ml or greater.
  - f. Requires blood collection from a sterile field.
3. Acute Normovolemic Hemodilution (ANH)
  - a. In the Operating Room, whole blood is collected from the patient (similar to CBS blood collection process) and replaced with IV fluids.

**NOTE:** Policies and procedures must be strictly adhered to with appropriate documentation and quality control measures in place.
  - b. As the surgical procedure is carried out, blood that is lost into the surgical field is more dilute, so patient loses fewer red blood cells.
  - c. ANH blood is transfused to the patient at completion of procedure or if needed during the surgery.
  - d. ANH blood can be transfused up to 8 hours after collection (stored at room temperature).
  - e. ANH is most effective for surgical procedures with anticipated blood loss of 1000 ml or greater. Patient must have adequate pre-op Hb and cardiac function.
  - f. Benefits of fresh whole blood include functional platelets and clotting factors.
4. Antifibrinolytics
  - a. Drugs such as aprotinin and tranexamic acid affect the clotting cascade balance of thrombosis and fibrinolysis. This has the potential to decrease bleeding.
  - b. The use of antifibrinolytics is appropriate for certain types of surgical procedures (cardiopulmonary bypass, revision hip procedures) with extensive complement activation.
5. Hypotensive Anesthetics
  - a. Epidural technique, inhalation anesthetics or medications are used specifically to lower blood pressure by a minimum of 25% of pre-op blood pressure
  - b. Lower blood pressure perfusing tissues = less bleeding

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### 6. Surgical Techniques

Minimally invasive procedures where appropriate (stent/laparoscopic procedures).

Meticulous attention to hemostasis.

## VIII. Post-Operative Blood Conservation Strategies

1. Appropriate indication for transfusion is key
2. Avoid over-transfusion; avoid under-transfusion
3. Consider whether the patient in this situation requires increased oxygen delivery now or whether the time frame of 7-10 days for natural erythropoiesis is appropriate and whether the patient's ability to reproduce their own red blood cells is adequate
4. PBCP: **Post-operative Anemia Management Algorithm** (next page) is an example of a guideline for assessing/managing anemia in post-op patients.

## IX. Contact Information

For more information, contact:

Donna Berta, RN BScN, Transfusion Nurse Coordinator, LHSC  
1-519-685-8300 extension 77131/pager 17131; fax 1-519-663-2957

Physician support is provided by:

Dr. Fiona Ralley, Director of PBCP, Anesthesia and Perioperative Medicine  
1-519-685-8300 Extension 35737/pager 15445; fax 1-519-663-2957

Dr. Ian Chin-Yee, Hematologist for PBCP, Division of Hematology

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# Post-operative Anemia Management Guideline

Post-op Hb \_\_\_\_\_ (Pre-op Hb \_\_\_\_\_ ; Ht \_\_\_\_\_ , Wt \_\_\_\_\_ )

