Key points in reducing transfusion requirements in perioperative period

Mirela TIGLIS¹, Ileana PERIDE², Tiberiu-Paul NEAGU³, Andrei NICULAE², Ioana Marina GRINTESCU¹

¹ Clinical Department No. 14, “Carol Davila” University of Medicine and Pharmacy, Bucharest Romania
² Clinical Department No. 3, “Carol Davila” University of Medicine and Pharmacy, Bucharest, Romania
³ Clinical Department No. 11, “Carol Davila” University of Medicine and Pharmacy, Bucharest, Romania

ABSTRACT

Surgical intervention can lead to blood loss either through perioperative complications, or through disease severity until surgery. For this reason, mastering the main strategies to improve surgical patients’ haematological status, to reduce transfusion rate, and to correct haemoglobin level represent the state of art in surgical patient management. In the last period, due to COVID-19 pandemic and the blood shortage crisis across hospitals, applying principles meant to reduce blood loss, and therefore the rate of blood transfusion, have become even more important.

Keywords: bleeding, surgery, anemia, transfusion, perioperative period

INTRODUCTION: THE IMPORTANCE OF BLOOD MANAGEMENT STRATEGIES

Patient blood management (PBM) programs encompass a series of recommendations focused on maintaining patients’ haemoglobin concentration, haemostasis optimization and minimization of blood loss in order to improve surgical patients’ outcome, to reduce transfusion requirements and to enhance patients’ tolerance to anaemia [1]. Since the first use of the terms PBM, by Professor James Isbister, the worldwide implementation of these principles, based on a multidisciplinary and multimodal approach of surgical patients, the benefits of these strategies have led to improved outcomes and reduced costs [2-4].

Enhanced recovery after surgery (ERAS) programs represent the highest development in surgical patient perioperative management [5]. Some of the principles promoted by ERAS refer to haemoglobin level optimization, especially preoperatively in elderly, patients with coronary artery disease, members of Jehovah’s Witness, or chronic renal diseases, through pharmacological agents, like erythropoietin and intravenous or oral iron [6,7].

Millions of blood products are annually used in hospitals, to manage symptomatic anemia, mostly in surgical patients. Nevertheless, the risks associated with blood transfusion are well known, and are mainly represented by allergic reactions, coagulopathies, volume overload, acute lung injury, febrile reactions, acute haemolytic reactions, or diseases transmission, leading to with increased morbidity and mortality in surgical patients [8-10].

Moreover, a recent clinical trial conducted by Roshanov and al., included over 16,000 surgical patients, and showed that intraoperative or postoperative bleeding, which led to a postoperative haemoglobin concentration less than 7 mg/dl and blood transfusions, were associated with an increased 30-day mortality in non-cardiac surgery [11].
Another challenge with blood transfusion is represented by the fact that blood is an expensive and limited resource, the COVID-19 pandemic aggravating this problem and leading to so called “blood shortage” across the globe [12]. In face of this new crisis, supplementary blood management strategies have been adopted to reduce blood utilization [13,14].

**RISK FACTORS FOR PERIOPERATIVE BLOOD TRANSFUSION**

The main risk factors for requiring perioperative blood products transfusion are represented by low preoperative haemoglobin, hematocrit and albumin levels; female gender, low body mass; comorbidities – American Society of Anaesthesiologists (ASA) classification grade 3 or more; patients with severe systemic illness (e.g. chronic renal disease, cardiovascular and respiratory dysfunctions, gastrointestinal disease, hepatic failure); congenital or acquired haemostatic derangements (anticoagulant or antithrombotic therapy); type of surgery (e.g. colorectal cancer, hip or knee arthroplasty, spinal surgery, liver cancer), surgeon’s skill and experience [6,15-17].

**PREOPERATIVE STRATEGIES**

Various studies have shown that preoperative anaemia affects up to 60% of patients undergoing major elective surgery, being associated with increased blood transfusions, postoperative complications, wound infection, sepsis, prolonged hospitalization, delayed recovery, and negative outcome [7,18]. Therefore, measures in this regard should be initiated before surgery. In Table 1 are presented the main steps that should be followed during this period [6,19-22].

| Surgical principles | Anaesthetic principles |
|---------------------|-----------------------|
| 1. topical haemostatic agents | 1. central neuraxial anesthesia |
| 2. tourniquet | 2. acute normovolaemic hemodilution |
| 3. blood salvage systems | 3. permissive hypotensive anesthesia |
| 4. rigorous haemostasis – diathermy | 4. protective mechanical ventilation |
| 5. minimally – invasive surgical techniques (e.g. robotic, laparoscopic) | 5. antifibrinolytics (e.g. tranexamic acid) |
| 6. drains | 6. lower transfusion trigger |
| 7. point-of-care testing, platelet function assay | 7. point-of-care testing, platelet function assay |
| 8. rapidly correction of acidosis | 8. rapidly correction of acidosis |

Over the years, various studies have shown that the duration of surgery is the most important factor in terms of blood loss, and that increasing the intervention time, the risk of blood loss and complications appearance is doubled after two hours of operation [32-34].

**POSTOPERATIVE STRATEGIES**

Regarding postoperative period, there are various principles set out in Table 3 targeting patients’ haematological optimization, reducing unnecessary blood loss, increasing haemoglobin level, avoiding as much as possible blood products transfusion [3,13,24,35-37].

Various studies demonstrated the negative impact of postoperative anaemia on surgical patients’ outcome, being associated with increased rate of transfusion, increased length of hospital stay, infections, renal failure, and long-term negative impact on quality life scores [38,39].
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**CONCLUSIONS**

Throughout the years, various programs, like ERAS or PBM, have been developed in order to guide our clinical practice with the ultimate goal of reducing morbidity and mortality in surgical patients, along with ensuring a proper quality of life after hospital discharge. Surgery is inevitably associated with blood loss, the extension and gravity of the disease being directly proportional with anaemia development. Therefore, knowing the main strategies to optimize surgical patients’ haematological status, to reduce transfusion rate, and to correct haemoglobin level represent the state of art in surgical patient management.

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**TABLE 3. Postoperative strategies to reduce blood loss and transfusion requirements**

1. achieving euvoelemia – proper fluid therapy
2. postoperative limb positioning
3. postoperative autologous reinfusion with specific drainage systems
4. intravenous iron administration
5. erythropoiesis stimulation
6. restrictive transfusion threshold
7. minimizing iatrogenic blood loss (reduce blood draws, use of smaller phlebotomy tubes)
8. normothermia
9. proper pain management
10. schedule restarting anticoagulant / antithrombotic therapy
11. nutritional support
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