

# Key points in reducing transfusion requirements in perioperative period

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## 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, haematocrit 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].

**TABLE 1.** Preoperative strategies to reduce blood loss and transfusion requirements

1. preoperative planning – evaluation with 28 days before surgery
2. optimization of patients’ functional status, good control of comorbidities
3. laboratory investigations: full blood count, ferritin, transferrin saturation (TSAT), markers of inflammation – C-reactive protein (CRP), VSH, fibrinogen, serum urea and creatinine
4. anaemia treatment: oral / intravenous iron, recombinant erythropoietin (rEPO), folic acid, vitamin B12, vitamin K
5. clear schedule for anticoagulant or antithrombotic therapy (± bridging therapy)

Another aspect that should be taken into consideration is lowering the transfusion trigger during this period, with the purpose of avoiding unnecessary risks, haemoglobin levels of 7 g/dl being accepted for asymptomatic patients. Over the years, these restrictive strat-

egies have shown superiority in terms of survival, morbidity, complication rate, and number of transfused units [23]. Furthermore, for elective surgery, it is considered that any intervention should be postponed until the haemoglobin level reaches normal values for gender and age [18,24,25].

Autologous blood transfusion (ABT) is often used in patients scheduled for major elective surgery, to increase the transfusion safety and to overcome the blood shortage [26,27].

## INTRAOPERATIVE STRATEGIES

During surgery, there are a series of measures that should be performed by both the surgical and anaesthetic teams, starting from ensuring an optimal ambient temperature, to patient’s positioning on the operating table, to warming the intravenous fluids or blood salvage systems use in case of major bleedings. In Table 2 are systematically exposed the essential strategies that can be used over intraoperative period [3,28-31].

**TABLE 2.** Intraoperative strategies to reduce blood loss and transfusion requirements

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 of haemostatic function (viscoelastic testing, platelet function assay)
	8. rapidly correction of acidosis

Over the years, various studies have shown that the duration of surgery is the most important factor in term 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].

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

1. achieving euvolemia – 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

## 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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