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How to implement of patient blood management pillar 1: An Italian expert opinion based on a "bundles" approach

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ABSTRACT

Worldwide iron anemia is a common disorder with a significant economic burden on health-care systems. Red blood cell transfusion is the mainstay to correct anemia in surgical settings, but it is also an overused procedure and recent data support its possible role in worsening patient outcomes. Patient Blood Management (PBM) is a multidisciplinary approach to optimize hemostasis, manage anemia, minimize iatrogenic blood loss, and improve tolerance to anemia. The present paper aims to provide a "bundles" approach, based on several preoperative anemia management measures, to implement PBM Pillar 1 in clinical practice.

1. Introduction

Worldwide approximately one-third of the population are anemic. In hospitalized patients the reported prevalence of anemia is approximatively 25 − 50 % percent, depending on comorbidities and demographic factors (e.g. age and gender), and increases within the processes of care (e.g. procedural blood loss and phlebotomies) [1]. Moreover, anemia has been recognized as an independent risk factor for adverse outcome including higher risk of hospitalization or readmission, prolonged length of stay in hospital, as well as morbidity and mortality [2,3]. However, moderate anemia is often ignored in the preoperative phase and inappropriately overtreated with red blood cells (RBC) transfusion during and after surgery. The preoperative elective surgery setting may be a productive area to focus on detection, evaluation and management of anemia. This article aims at providing a comprehensive "bundles" approach encompassing 16 Patient Blood Management (PBM) measures acting as a working template to develop PBM Pillar 1 practices for hospitals beginning a PBM program or trying to improve an already existing protocol.

1.1. Background on iron deficiency anemia

Iron deficiency, defined as a health-related condition in which iron availability is insufficient to meet the body's needs and which can be present with or without anemia [4], is the most common cause of anemia, thus affecting more than 2 billion people worldwide [5] going across all medical specialties (e.g. internal medicine, hematology, oncology, gastroenterology, nephrology, infectious diseases, cardiology, obstetrics and gynecology, surgery). Several conditions are associated with altered iron metabolism, because of low iron intake (e.g. malnutrition, vegetarians/vegans), increased iron demands (e.g. infancy/adolescence, second and third trimesters of pregnancy), decreased intestinal absorption (e.g. gastrectomy, bariatric surgery, celiac sprue, PPI use), chronic blood loss (e.g. benign or malignant lesions), drugs (e.g.salicylates, corticosteroids, non-steroidal anti-inflammatory drugs), acute blood loss (e.g. major surgery, postpartum hemorrhage) or multiple mechanisms associated with inflammation (e.g. chronic kidney diseases, inflammatory bowel diseases, obesity, chronic heart failure) [6]. Notably, iron deficiency is more complex to recognize when is masked by chronic inflammatory disorders, by the fact that inflammatory cytokines alter iron metabolism. Although the diagnostic approach includes blood cell count, serum ferritin, serum iron, transferrin (or total iron binding capacity) and transferrin saturation (or saturated iron binding capacity) (TSAT), the most efficient test for the diagnosis of iron deficiency is the serum ferritin combined with TSAT [4]. When a pathological cause is identified, iron supplementation

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should be combined with treatment of the underlying cause.

1.2. Role of iron supplementation in the era of new intravenous iron preparations

Iron is important to biologic functions (e.g. respiration, energy production, DNA synthesis and cell proliferation) [7]. The human body is able to store iron in several ways, including the recycling of iron after the breakdown of red cells and the retention of iron in the absence of an excretion mechanism. Iron deficiency refers to the reduction of iron stores that precedes overt iron deficiency anemia or persists without progression. Iron replacement should be done orally as the first choice. Oral iron efficacy often is limited by side effects, among which the most frequent impact on gastrointestinal system which may be caused by non-absorbed iron (potentially toxic for the gastrointestinal mucosa). These side effects are more common with oral than with intravenous administration [8]. Subjects with intolerance or refractoriness to oral therapy, cases with defective intestinal absorption, as well as patients who need a rapid correction of anemia and those who require a prolonged treatment, benefit from intravenous iron administration. Intravenous therapy has been increasingly used, because currently available preparations allow rapid normalization and are also effective in functional iron deficiency as well as in subjects with iron deficiency associated with inflammatory disorders. New intravenous preparations lead to the administration of high iron doses in a single injection in order to replace the total amount of iron needed in one-two infusions, allowing not only to correct the hemoglobin deficit but also to rapidly reintegrate the iron stores [9]. As a consequence, intravenous administration may be particularly useful in the preoperative setting when more rapid correction of anemia is necessary.

1.3. Patient blood management

Improvements in anemia management represent an opportunity to try to improve patient outcomes, as well as reducing costs and potential risks associated with blood transfusion. It is generally agreed that transfusion is not of benefit when the hemoglobin is greater than 10 g/dL, but may be beneficial when is less than 6 − 8 g/dL [10]. When patients are asked to consent to RBC transfusion, they rarely decline, unless they have religious objections. However, blood transfusion consent process usually does not taking into account patients' preferences, as well as scientific evidences. To avoid inappropriate blood transfusion practices, some agencies (e.g. The Joint Commission) promoted PBM approach, which is defined as "the timely application of evidence-based medical and surgical concepts designed to maintain hemoglobin concentration, optimize hemostasis and minimize blood loss in an effort to improve patient outcome" by the Society for the Advancement of Blood Management (SABM) [11]. Few reports have been published about detailed information on PBM; among these, Meybohm et al. provide a comprehensive approach based on several PBM measures in order to develop institutions' PBM practices [12]. The preoperative elective surgery setting may be a productive area to focus on screening and adequate treatment of anemia. In particular, preoperative patients should be questioned for factors that could increase risk of bleeding, as well as for comorbidities and medications (particularly anticoagulant and antiplatelets agents). A diagnostic flowchart defining the screening of preoperative patients should be established for invasive and elective surgical procedures, and paper forms resuming the diagnostic exams performed as well as the therapies used should be advocated. According to literature, the implementation of PBM may improve the preoperative management of anemic patients, reduce iatrogenic blood loss and RBC transfusion, as well as perioperative morbidity and mortality, hospitalization and costs [13,14]. Despite these benefits, actually many challenges limit the implementation of PBM into clinical practice (e.g. the lack of knowledge among clinicians from different areas, as well as the lack of interdisciplinary management and resources). Education will be necessary to improve the management of the anemic patients: clinicians may begin considering blood transfusion as a risk-conferring procedure and daily laboratory tests as not benign, routine or required.

2. How to implement patient blood management pillar 1: "bundles" approach

2.1. Methods

After an informal meeting about the theme of PBM Pillar 1, held in Milan in November 2019, a group of six Italian experts decide drafting a manuscript on implementation of PBM Pillar 1 into clinical routine, based on their independent opinions and personal experiences, as well as on evidence-based practices, in order to try to answer to the question "How to implement PBM pillar 1?" using a smart "bundles" approach. The article refers to clinicians beginning a PBM program, as well to those who are trying to improve an already existing protocol.

2.2. Patient blood management bundles

A strategy for overcoming the limits of PBM Pillar 1 implementation into clinical practice may be represented by a smart checklist of 16 "bundles" preoperative anemia management measures. Each bundle should be assigned to a qualitative level (e.g. "basic", "initial", "good", "excellent") and then adopted for the first time (if a PBM program is not already existing) or improve (if the PBM program is already existing), thus acting as a working template according to local conditions. Bundles include several tools such as the need of a multidisciplinary team (including trained nurses and specialists from different areas), the adequate interdisciplinary management of iron deficiency anemia, the communication with the patient regarding his/her treatment and the preoperative management of anemia. The key performance indicators (KPI), listed in Table 1, are the instrument to measure the implementation of PBM hospital program. The PBM team can use these set of indicators to define the percentage (%) of PBM implementation. A "basic" condition is obtained when less than 4 indicators have been implemented (0 − 25 %), "initial" implementation between 4 and 8 indicators (25 − 50 %), "good" corresponds to the implementation of 8–12 indicators (50 − 75 %) and "excellent" when all the key indicators have been implemented (100 %).

3. Future perspectives

Baseline data are needed, as well as a performance dashboard, to measure the impact of PBM Pillar 1 implementation. Furthermore, trending data will be important to track PBM Pillar 1 performance and monitor the progress of this "bundles" approach. Clinicians may test the correlation between the working template we propose and the medium hemoglobin level or the amount of anemic patients first of procedure. According to local conditions, single-center data should be analyze and then compared to all the other national institutions.

4. Conclusion

Despite the demonstrated advantages of PBM, several challenges (including the lack of knowledge, as well as the lack of interdisciplinary management and resources) limit its implementation. We proposed a smart "bundles" approach based on specific PBM Pillar 1 principles (e.g. forming a multidisciplinary team, organizing nurse education campaign, disseminating information at medical staff meetings, projecting brainstormings, using Web educational materials, obtaining institutional support and standardization across institutions, assessing baseline performance and careful monitoring) that can be expected to act as a working template in order to implement PBM Pillar 1 into clinical practice thus providing a better quality of care at lower costs.

Table 1
Key performance indicators (KPI) considered.

	Key performance indicators (KPI)	Basic 0 – 25 %	Initial 25 – 50 %	Good 50 – 75 %	Excellent 100 %
1	Multidisciplinary PBM				
2	Role of transfusion medicine specialists (prevention of blood wastage and optimal blood use)				
3	Involvement of anesthesiologists and intensive care specialists				
4	Involvement of surgeons (eg. orthopedic/trauma, cardiac, vascular, visceral, trauma, urology, gynecology, neurosurgery)				
5	Role of PBM coordinator and trained nurses				
6	Use of guidelines and national recommendations; availability of guidelines for preoperative anemia and iron deficiency management				
7	Checklist of selected surgical procedures with a preoperative screening for anemia				
8	Time between preoperative anemia screening and elective surgery procedures (ideally 2 – 4 weeks before surgery)				
9	Preoperative elective surgery setting (preoperative patients should be questioned for factors that could increase risk of bleeding/ iron deficiency/anemia, as well as for drugs (e.g. anticoagulant and antiplatelets agents) and comorbities)				
10	Diagnosis of iron deficiency anemia (eg, blood count, ferritin, transferrin saturation, calculation of the individual iron deficit); diagnosis of vitamin B12 or folic acid deficiency				
11	Extended diagnostic of anemia (eg, consultant for gastroenterology, hematology, endoscopy, bone marrow biopsy)				
12	Drugs prescription (iron therapy (oral or intravenous), vitamin B12, folic acid, erythropoietin				
13	Drugs administration (intravenous iron therapy, erythropoietin)				
14	Information about diagnosis and management of preoperative anemia should be shared with surgeon and general practitioner				
15	Periodic evaluation of the activities of PBM team				
16	Electronic database (collection of data concerning PBM implementation)				

Author contributions

All authors contributed to the writing of the manuscript. All authors read and approved the final manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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