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REVIEW ARTICLE

''Patient Blood Management'' in orthopedic surgery☆

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Abstract Orthopedic and trauma surgical procedures (OTS) can lead to significant blood losses and acute postoperative anemia, which in many cases requires allogeneic blood transfusions (ABT). The clinical, economic and logistical disadvantages of ABT have promoted the development of multidisciplinary and multimodal programs generically known as Patient Blood Management (PBM) programs, which have as their objective to reduce or eliminate the need for ABT and improve clinical outcomes. These programs are supported by the implementation of four groups of perioperative measures: (1) use of restrictive transfusion criteria; (2) stimulation of erythropoiesis; (3) reduction of bleeding; and (4) autologous blood transfusion. In this article, a review is presented of the effectiveness, safety and recommendations of applicable strategies in OTS, as well as the barriers and requirements to the development and implementation of PBM programs in this surgical specialty.

PALABRAS CLAVE
Cirugía ortopédica;
Anemia;
Transfusión de sangre alogénica;
Hierro;

''Patient blood management'' en cirugía ortopédica

Resumen Los procedimientos de cirugía ortopédica y traumatológica (COT) pueden ocasionar pérdidas significativas de sangre y anemia postoperatoria aguda, que en muchos casos requiere transfusión de sangre alogénica (TSA). Las desventajas clínicas, económicas y logísticas de la TSA han promovido el desarrollo de programas multidisciplinares y multimodales, genéricamente conocidos como programas de Patient Blood Management (PBM), cuyo objetivo es el de reducir

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Agentes estimuladores de la eritropoyesis;
Pérdida quirúrgica de sangre;
Agentes antifibrinolíticos;
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Gestión integral del paciente

o eliminar la necesidad de TSA y mejorar el resultado clínico. Estos programas se apoyan en la aplicación de cuatro grupos de medidas perioperatorias: (1) uso de criterios restrictivos de transfusión; (2) estimulación de la eritropoyesis; (3) reducción del sangrado; y (4) transfusión de sangre autóloga. En este artículo, revisamos la eficacia, seguridad y recomendaciones de las estrategias aplicables en COT, así como los condicionantes para el desarrollo e implementación de los programas de PBM en esta especialidad.

Introduction

Orthopedic and traumatology surgical procedures (OTS), such as knee (TKP) and hip arthroplasties (THP), instrumented spinal operations or repairs of hip fractures can produce, on average, up to 2 L of blood loss resulting in acute post-operative anemia, which in many cases requires allogenic blood transfusion (ABT).[1–3] However, there are several factors which suggest that it might be advisable to transfuse less: human blood is a limited resource; the costs of the preparation, distribution and administration of blood components are high; transfusion has adverse effects such as: acute hemolytic reactions due to identification errors, the transmission of infectious diseases, acute lung damage, circulatory overload, immunomodulation, amongst others; and the different provisions of current legislation.[4]

These clinical, financial and logistical disadvantages of ABT have prompted recommendations for its restricted use, especially in order to avoid unnecessary transfusion, and for the development of multidisciplinary and multimodal programs for the integral management of these patients which are known generically as Patient Blood Management (PBM) programs, whose ultimate objective is to reduce or eliminate the need for ABT and improve clinical results. These programs are supported by the application of four groups of perioperative measures: (1) optimization of tolerance of normovolemic anemia to enable the use of restrictive transfusion criteria; (2) erythropoiesis stimulation; (3) correction of hemostasis and reduction of bleeding; and (4) the use of autologous blood[5] (Table 1). The efficacy and safety of, and recommendations for most of these measures are included in the update of the Seville Consensus Document on Alternatives to Transfusion (DS 2013)[6] and the European Guideline to the Management of Severe Perioperative Bleeding (ESA Guideline),[7] drawn up using the GRADE methodology (*Grading of Recommendations Assessment, Development and Evaluation*). GRADE makes graded recommendations which can be strong [1] or weak [2], positive or negative, and supported by high [A], moderate [B] or low/very low quality [C] evidence (Table 2).[6] When a strong recommendation is made, the terminology ''we recommend. . .'' is used, when a weak recommendation is made, a less conclusive statement is used such as ''we suggest . . .''.

Restrictive transfusion criteria

Establishing clearly defined transfusion criteria which can be applied uniformly during the entire hospital stay is the cornerstone of any PBM program (Table 3). In recent years, various clinical practice guidelines have been recommending the use of ''restrictive'' transfusion criteria rather than ''liberal'' criteria. Amongst these, the AABB (formerly the American Association of Blood Banks)[8] makes the following recommendations:

- **Recommendation 1**: The AABB recommends adhering to a restrictive transfusion strategy (7–8 g/dL) in hospitalized, stable patients (GRADE 1A).
- **Recommendation 2**: The AABB suggests adhering to a restrictive strategy in hospitalized patients with preexisting cardiovascular disease and considering transfusion for patients with symptoms or a hemoglobin level of 8 g/dL or less (GRADE 2B).
- **Recommendation 3**: The AABB cannot recommend for or against a liberal or a restrictive threshold for hospitalized, hemodynamically stable patients with acute coronary syndrome.
- **Recommendation 4**: The AABB suggests that transfusion decisions be influenced by symptoms as well as Hb concentration (GRADE 2C).

These recommendations help us to decide ''when to consider the need to transfuse'' whereas the recommendations of the DS 2013,[6] which complement those of the AABB, provide us with guidelines as to ''*how much to transfuse*'':

- **Recommendation 1**: In critically ill, polytraumatized and/or surgical patients, without cardiac and/or central nervous dysfunction, we recommend transfusion of packed red cells maintaining hemoglobin concentrations between 7 and 9 g/dL, to reduce the transfusion rate (GRADE 1A).
- **Recommendation 2**: In critically ill, polytraumatized and/or surgical patients, with cardiac and/or central nervous system dysfunction, we recommend transfusion of packed red cells maintaining hemoglobin concentrations