



Review Article *Cardiac Critical Care*

# Patient Blood Management: Moving Above and Beyond the Optimal Use of Blood!

Ajay Gandhi<sup>1</sup>

<sup>1</sup>Associate Clinical Director, India and South Asia, Werfen, India.

**\*Corresponding author:**

Ajay Gandhi,  
Associate Clinical Director,  
India and South Asia, Werfen,  
India.

[drgandhijay@yahoo.co.in](mailto:drgandhijay@yahoo.co.in)

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## ABSTRACT

Transfusion of blood components or products is among the most common procedures performed during a patient's stay in the hospital. However, apart from being life-saving in exsanguination, blood transfusion is also associated with adverse events such as transfusion-transmitted infections, allergic reactions, transfusion-associated circulatory overload, transfusion-related acute lung injury, and transfusion-related immunomodulation with nosocomial infections and cancer recurrence. These potentially fatal complications have raised perennial concerns among healthcare professionals with regard to blood transfusion and patient outcomes. Thus, in the last few decades, the safety of the blood product has remained the key focus area for almost every stakeholder, whether end user or policy maker. Optimal use of blood is a globally recognized and recommended policy that ensures that the right amount and type of blood component is transfused to the right patient at the right time. Essentially, it focuses on improving the safety and effectiveness of the clinical transfusion process. However, with the evolving knowledge around transfusion science, increasing involvement of surgeons, anesthesiologists, and other specialists in transfusion offerings and proceedings, and the accumulating evidence on the fact that blood transfusion can, often, be more detrimental to a patient's clinical status rather than benefiting it, has led to the endorsement and establishment of policy(ies) for optimal use of blood. Patient blood management (PBM), a concept coined and introduced almost two decades ago, encompasses, rather comprehensively, not just the policies and procedures of optimal use of blood and restricting transfusion to as minimum as possible but has a scope that spans much beyond that. PBM is driven and implemented through the three-pillar and nine-field matrix that incorporates the objectives of optimizing hematopoiesis, minimizing bleeding and blood loss, and harnessing and optimizing the physiological tolerance of anemia within the preoperative, intraoperative, and postoperative settings. PBM focuses on patient safety rather than product safety and, thus, ensures adopting a customized approach toward judicious and clinical use of the precious resource, blood. The principles and practices of PBM gained significant relevance and acceptability in the past few years, especially after the pandemic of COVID-19 when the World Health Organization issued a policy brief on its urgent implementation. Through this review article, we intend to establish not just the impact of PBM implementation towards improvement in patient outcomes but also the fact that the relevance and means of PBM extend far above and beyond just the optimal use of blood.

**Keywords:** Optimal use of blood, Patient blood management, Blood product safety, Patient safety

## INTRODUCTION

Blood transfusion is a major patient intervention. A blood transfusion may be called for, irrespective of the level of the healthcare system, the access to or availability of various resources, as well as the experience of the healthcare professionals managing the patient in need of the

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blood transfusion. One of the major limitations of blood and its products, which remains almost true to date, is that it cannot be artificially manufactured in factories.<sup>[1]</sup> This is a clear indication that there is an imminent demand-supply mismatch. This also denotes that the available blood must be subjected to standardized and judicious practices so as to eliminate even the slightest possibility of irrational or inappropriate use.

Blood transfusions, akin to a liquid transplant, are inherently hazardous and potentially deleterious to a patient's health status.<sup>[2]</sup> Considering these intricately connected variables, most of the policies, guidance, and recommendations, including authentic handbooks, recommend *modus operandi* and best practices around safe blood.<sup>[3]</sup> Several guidance documents also focus on optimal use of blood, which refers to transfusing the right blood component to the right patient at the right time and right place, and their prevalence and implementation are just beginning to find the place but not to an extent as much as that for the focus on safe blood product.

Transfusion medicine, as a subject, has evolved significantly but continues to focus on the "utilization" and "safety" of the product, but not much with respect to the implications of blood transfusions for patients in terms of blood use safety. The evolving knowledge and practices have laid the foundation for adopting, implementing, and establishing novel and evidence-based standards of care like patient blood management (PBM).<sup>[4]</sup> Although PBM usually refers to surgical patients, its clinical use has gradually evolved over the past few years. PBM is a compelling need for the healthcare ecosystem, particularly in developing countries, where anemia is common and blood continues to remain a scarce resource.<sup>[5]</sup>

PBM should be considered as a clinical "bundle" that helps in promoting the implementation of a patient-centered and multidisciplinary, multimodal strategy adopted to limit the use and the need for allogeneic blood transfusion in all at-risk patients with the aim of improving their clinical outcomes.<sup>[6]</sup> PBM certainly does not lend itself to being studied in the same manner as a single therapy (such as transfusion) does. PBM is not a concept or a protocol that can be assessed in randomized controlled trials since it follows the concept of personalized precision medicine.<sup>[7]</sup> Due consideration must be given to the fact that every patient is unique, and any therapeutic approach intended to manage the blood or a bleeding situation as such will vary according to the clinical situation.<sup>[8]</sup> PBM is not focused on the transfusion of blood components, not even on the blood derivatives and pharmacological agents. PBM is centered on patient care, patient outcomes, and safety. It is relevant more specifically to those who undergo major surgical or medical interventions that put them at an increased risk of complications or mortality.<sup>[9]</sup>

## DISCUSSION

### Transfusion Science: Quality and safety focus

The practice of blood transfusion became increasingly sophisticated, standardized, and supervised in due course of time. Transfusion medicine developed as a branch of medicine to encompass the science, principles, and practices related to the transfusion of blood and blood components, including hemovigilance. The triggers of transfusion, the evaluation of bleeding tendency, and the anemia and physiologic tolerance to low hematocrit are several key variables that determine the transfusion as such or the decision to transfuse.<sup>[10]</sup> However, the majority of the literature and best practice recommendations and guidance in transfusion medicine stresses on ensuring that all phases of the transfusion process, ranging from blood requisition to donor selection and screening routing through the process of phlebotomy, screening, and blood component preparation and separation before the blood component is finally issued are ensuring the absolute safety of the blood product.<sup>[11]</sup> Every time a decision to transfuse is made, everyone involved in the blood bank and the transfusion process is responsible and accountable for the rational transfusion of safe blood products.

### Optimal use of blood

In the past few years, there has been an impetus to ensure reasonable and clinical use of blood.<sup>[12]</sup> The objective is to provide the right amount and type of blood to the right patient at the right time. The focus areas, usually, are quality systems for clinical transfusion, errors, adverse events, and adverse reactions, documentation for quality, essential indications for blood components, clinical transfusion process, evaluation of transfusion practice, methods around clinical audit, and implement a training program for safe and effective transfusion. Hence, all in all, most interests and activities are intended to ensure that the "product" is safe and of the highest quality.<sup>[13]</sup> Moreover, this is very much a desired state as well. Only aspect missing is that there is minimal "patient" focus as such.

### Clinical use of blood

The objectives of clinical use of blood are the use of blood and blood products appropriately at all levels of the healthcare system in any country without compromising standards of quality and safety.<sup>[14]</sup> The focus area, usually, is appropriate use of blood and blood products, anemia, replacement fluids, clinical transfusion procedures, adverse effects of transfusion, clinical decisions on transfusion, transfusion in clinical practice setting specific, hospital transfusion committee, and education and training on the clinical use of blood. Although, with more and more thrust on "clinical use of blood, there has

not been an increase in the overall effectiveness of not just the transfusion as such but the decisions to transfuse as well. This has certainly increased the confidence of the prescribing surgeons and physicians in terms of the efficacy of blood and blood products in the management of their patients. With more and more emphasis on the clinical use of blood, the engagement and collaboration between the prescribers and providers has increased encouragingly.<sup>[15]</sup>

### Product safety to patient safety: The changing focus

Advancements in the understating of and availability of the latest technology for blood testing over the decades and increased emphasis on donor selection and screening have significantly decreased transfusion-related adverse events, especially the transmission of infectious agents; however, noninfectious complications continue to be a serious risk.<sup>[16]</sup> Noninfectious transfusion-related adverse events may happen due to various reasons specific to a blood component, the amount of blood transfused, and errors on the part of decision-making toward transfusion.<sup>[17]</sup> The increasing number of issues and evidence on complications of transfusions, *per se*, has functioned as the activator of shifting the focus toward the “patient” rather than the “product.”

### PBM: The paradigm change

PBM evolved in the past several years, focusing on the hematopoiesis as relevant and connecting links to all disciplines of medicine.<sup>[18]</sup> Proposed in 1998 and introduced in 2005, PBM's origins are traceable to the late 19<sup>th</sup> century, when blood transfusion was not feasible for managing exsanguinating hemorrhage or critical anemia.<sup>[19]</sup>

PBM is a patient-centered, systematic, and evidence-based approach to improve patient outcomes by managing and preserving a patient's blood while promoting patient safety and

empowerment.<sup>[20]</sup> PBM involves the timely, multidisciplinary application of evidence-based medical and surgical concepts aimed at (1) screening for, diagnosing, and appropriately treating anemia; (2) minimizing surgical, procedural, and iatrogenic blood losses and managing coagulopathic bleeding throughout the care; and (3) supporting the patient while appropriate treatment is initiated. There are several reasons to shift from product-centered transfusion practice to patient-centered PBM: The aging population has a worked-out demand for blood products as against the reducing donor base; the increasing “consumer” awareness that transfusion is a complicated service involving several different cost centers within a healthcare institution and amounting to a multiple of the blood product cost; the ongoing efforts to protect blood banking systems from existing, evolving, or altered pathogens, the emerging global evidence that blood transfusion is an independent risk factor for adverse outcomes and, a paucity of concrete evidence toward benefits of transfusion for a vast majority of transfusion recipients.<sup>[21]</sup>

PBM improves patient outcomes by improving the patient's medical and surgical management in ways that boost and conserve the patient's blood.<sup>[22]</sup> PBM, as we now realize, is a comprehensive, collaborative, and consensus-based standard of care that incorporates system-driven, scientifically evidenced, and schematically managed people, policies, and protocols to ensure that the patient sits at the center of every step and consideration in blood and bleeding management. PBM, backed by the guidance and recommendations, is not only the need of the hour but also the standard of care.<sup>[23]</sup>

### Optimal use of blood vis-à-vis PBM

Optimal blood use and PBM are both truly relevant and effective concepts. It is just that PBM, as a practice, helps in addressing and managing a patient's specific need with a goal directed approach<sup>[24]</sup> [Table 1].

**Table 1:** Optimal use of blood vis-à-vis PBM.

	Optimal use of blood	PBM
Concept	Transfusion-related decision-making.	Patient-centered decision-making.
Focus	Product safety.	Patient safety.
Stakeholders	Transfusion medicine professionals mainly.	Multidisciplinary: Surgeons, anesthetists, intensivists, hematologists, perfusionists, nurses, hemostasiologists, and transfusion medicine specialists.
Aim	Transfusion "best" practices.	Identification and treatment of cause (anemia, bleeding, and coagulation).
Objective	Improvement in blood component utilization.	Protecting and building patient's blood.
Patient perspective	Focus on "informed" consent.	Ensures "informed" choice.
Outcome	Attaining efficacy with a "minimal dose" of blood components.	Reduce blood transfusions, reduce complications, reduce costs, and improve patient outcomes.
Health economic impact	Reduction in cost of blood product acquisition.	Significantly added reduction in cost due to potentially preventable complications.
PBM: Patient blood management		

## CONCLUSION

PBM takes a paradigm shift from the widely prevalent and recommended practice of optimal use of blood. PBM focuses on the very essence, the patient itself. PBM is an evidence-based practice that should be implemented and regulated as the standard of care uniformly and universally. Policymakers and administrators should ensure systematic and standardized implementation starting from the grassroots level of healthcare facilities. This should include the inclusion of PBM as a subject matter within the health education curriculum around blood transfusion, setting up of anemia clinics, bleeding management competence build-up, enhancement of infrastructure toward coagulopathy evaluation, and management and national guidelines and recommendations on effective and patient-centric use of precious resource blood. In an era when the patient is also believed to be a consumer, every decision to transfuse must be treated beyond informed consent through proactive and inclusive communication, collaboration, and consensus of all stakeholders, including the patient and/or his attendants. The growing awareness and campaigns on best practices around blood transfusion should clearly establish PBM as the standard of care above and beyond just the optimal use of blood.

### Ethical approval

The Institutional Review Board approval is not required.

### Declaration of patient consent

Patient's consent was not required as there are no patients in this study.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

### Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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