Commentary

Patient Blood Management - what is it as a concept?

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INTRODUCTION

Patient Blood Management (PBM) has emerged as a critical strategy in modern medicine, emphasizing a significant shift in focus from traditional interventions to novel strategies aimed at optimizing a patient's own blood. Initially developed to serve as a set of alternatives to blood transfusion, PBM has evolved into a complete strategy to prioritize the health of the patient's own blood while addressing a range of problems associated with blood transfusion[1]. By definition, PBM is a patient-centered, systematic, evidence-based approach to improve patient outcomes by managing and preserving a patient's own blood, while promoting patient safety and empowerment[2]. PBM is utilized not as any singular treatment modality, but as a multidisciplinary, comprehensive set of interventions that integrates principles of prevention, and patient-centered care. PBM is comprised of four essential elements: blood conservation modalities, anemia management, coagulation optimization, and patient-centered decision-making[1]. PBM has developed into a concept that can be applied to healthcare models, such as the prevention model, to demonstrate the proper utilization of interventions within each respective prevention level: primordial, primary, secondary, tertiary, and quaternary levels (**Figure 1**).

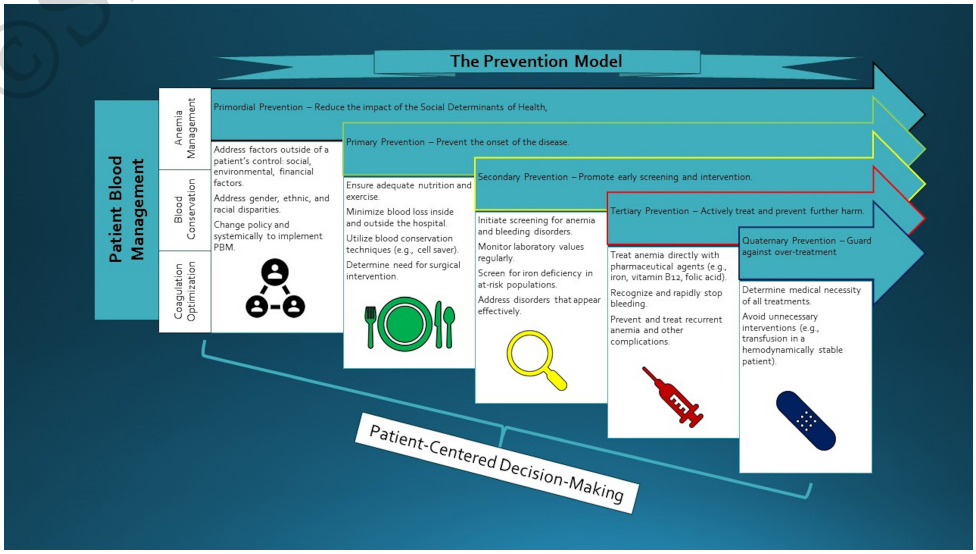

Figure 1 - Patient Blood Management interventions within the prevention model

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BENIGN HEMATOLOGY

Application to the prevention model also requires the analysis and understanding of benign hematology and its respective traditionally accepted methods of management. Hematology is currently practiced as inherently connected to oncology; it is trained and presented as a combined specialty that focuses primarily on oncologic conditions[3]. However, this leads to practitioners critically undeserving benign hematological conditions, such as iron deficiency anemia, an extremely prevalent and notable risk factor for poor health outcomes in all populations[4]. Anemia serves as a predictor and multiplier of morbidity and mortality, and is significantly undertreated in the hospital setting, especially in surgical patients[5]. This under recognition and treatment impacts quality measures throughout the healthcare continuum, such as length of stay, readmission rates, complications, and overall clinical and financial outcomes[6]. Other manageable hematological conditions in both settings include macrocytic anemias, anemia of chronic disease, and coagulopathic conditions of the blood (bleeding disorders). In outpatient settings, anemia has significant effects in the overall reduction of quality of life due to fatigue, shortness of breath, and other symptoms that may take years to be properly diagnosed and managed[7].

CURRENT MANAGEMENT METHODS

For decades, the default management strategy for many of these conditions was blood transfusions, without fully considering the long-term impact on patient health or the potential complications. Many providers may approach the treatment of anemia by addressing a hemoglobin level, defined as less than 13 g/dL. When this level reaches a point at which the patient becomes symptomatic or the provider becomes uncomfortable proceeding, a transfusion typically occurs[8]. Such an action disregards the underlying causes of anemia and proper management of conditions in the acute setting, leading to further problems with rebound anemia in rehabilitation and outpatient settings that must be further managed[9]. Bleeding disorders also pose a significant risk to patients and may independently lead to a patient's anemia, especially during surgical encounters. These encounters are typically managed with platelet, plasma, or cryoprecipitate transfusions without regard to the underlying cause of a coagulopathy, whether that be a previously diagnosed disorder or an exacerbated effect from acquired coagulopathy[10]. It should be noted that transfusion of blood components, due to their impact on major physiology of the body, should be considered as independent organ transplants, which, by concept, is considered a last option for every other transplantable organ in the human body. In the case of blood, it is a more culturally influenced treatment option, bypassing typical, evidence-based care algorithms that save transfusion for conditions where it is truly clinically indicated.

PBM AS A CONCEPT - ACHIEVING BLOOD HEALTH

The end goal of PBM is to achieve and maintain optimal blood health, a state where patients receive proper care for their blood, similar to other organs. The introduction of PBM methods into the healthcare continuum represents a departure from the traditional paradigm. PBM's arrival as a treatment modality reveals fundamental differences in philosophy. Traditional standards often emphasize "band-aid" or fleeting corrective measures (transfusion) pre- or post-diagnosis, focusing on treating symptoms rather than preventing their occurrence or managing the underlying condition[9]. PBM's goals of care are proactive, aiming to preserve the patient's own blood and enhance patient outcomes[11]. The general interventions of PBM can and should be integrated across all care areas. Each area corresponds to the levels of prevention[12], serving as an application of PBM as a concept in maintaining blood health, from addressing risk factors in societal contexts to refining therapeutic interventions in clinical settings. Though these levels can occur at different instances within the healthcare continuum, PBM follows the patient's entire lifespan, from the time of birth to end-of-life. As such, PBM is a multidisciplinary concept of care in which the interventions include all members of the healthcare team including the patient themselves[2]. Multidisciplinary patient-centered care serves as a major shift from the traditional paternalistic care pathway where the patient is not necessarily included in conversations regarding care plans.

APPLYING PBM TO THE PREVENTION MODEL

Central to PBM is its assimilation to the health promotion/disease prevention model, demonstrating the shift of care for blood health from eminence-based care (transfusion and replacement oriented) to evidence-based

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care (PBM methodology and prevention levels)[13]. PBM's goal of care is to address any patient's blood through its main interventions: blood conservation modalities, management of anemia, coagulation optimization, and patient-centered decision-making[2].

The prevention model contains five unique levels: primordial, primary, secondary, tertiary, and quaternary prevention, each addressing distinct stages of patient care and risk mitigation. Primordial prevention targets societal and environmental factors contributing to poor health, such as the social determinants of health (SDOH). Primary prevention emphasizes interventions to prevent disease altogether. Secondary prevention focuses on early screening, diagnosis, and intervention of disease. Tertiary prevention involves the active management of disease and prevention of disease progression. Quaternary prevention guards against unnecessary or unindicated treatment, including over-treatment of disease processes where interventions are not clinically indicated[12].

Applying PBM to primordial prevention emphasizes reducing the impact of SDOH, which typically are outside a patient's immediate control. This includes social, environmental, and disparate factors (gender/ethnic/racial disparities)[12]. Such factors include inadequate access to nutrition, healthcare, health education, and systemically and locally present disparities. Notable disparities include the care of women worldwide: it is common for women to be undiagnosed and undertreated for bleeding disorders and iron deficiency due to menstrual bleeding[14]. Hemoglobin thresholds were defined with disregard to women at its inception, hence the difference between the apparent normal value for men compared to women; the existence of these different values is purely due to disparity towards women present within the system[15]. PBM addresses these factors by emphasizing the importance of care of the patient's own blood at all stages of a patient's life. This embraces changes to healthcare policy that systemic issues present in the current healthcare system. The World Health Organization (WHO) published a policy brief highlighting the urgent need to implement PBM on a global scale, which directly urges providers to assist in the delivery of PBM on a systemic level, imploring providers to implement PBM as a part of their normal practice[16]. Though such policy changes are progressive and helpful to changing practice, a direct approach to any social, environmental, or disparate factors is complex and multifaceted and must include other disciplines.

Primary prevention emphasizes interventions aimed at preventing the onset of disease altogether, in this case, anemia. In the community, PBM urges proper nutrition to ensure proper iron stores and blood production, and adequate exercise to enable the body to tolerate the constantly varying consumption of oxygen daily. In the inpatient setting, primary prevention aims at minimizing blood loss whether through meticulous surgical techniques or the use of less invasive procedures. This also includes reducing the use of unnecessary phlebotomy in the inpatient setting which contributes to iatrogenic anemia, a highly prevalent and preventable condition widespread in hospitals today. Blood conservation modalities are also utilized within this level through surgical interventions such as intraoperative cell salvage, autologous normovolemic hemodilution, and proper use of topical hemostatic agents[2]. All these interventions prevent the onset of anemia in the community and acute setting.

Secondary prevention in PBM expands on this by promoting early screening and management of anemia or blood disorders, ensuring that these conditions are detected and treated before they significantly impact a patient's health. This includes regular routine lab work to monitor a patient's hemoglobin and hematocrit levels on an annual basis, as well as elective lab work for perioperative patients[17]. For women, specific and regular screening for anemia in the presence of heavy menstrual bleeding, dysmenorrhea, or other conditions must be ensured. Screening for iron deficiency in pregnancy is also important for both mother and fetus[14]. Optimization of coagulation in bleeding disorders before an invasive procedure is also included in this level of prevention.

Tertiary prevention seeks to treat anemia and established blood disorders, particularly through therapies that enhance blood function. In conditions like anemia, the underlying cause must be treated, such as in iron deficiency, vitamin B12 deficiency, or folic acid deficiency. PBM also emphasizes the importance of rapidly responding to and treating bleeding to prevent complications[2]. At this level, PBM also stresses the importance of preventing further disease and complications. Management of anemia can occur at this level as well by managing acute blood loss anemia or anemia of chronic disease.

Quaternary prevention guards against over-treatment, ensuring that the management of blood health remains aligned with the patient's physiological needs and avoids unnecessary interventions, such as transfusion in the hemodynamically stable patient. PBM urges providers to utilize the interventions provided to avoid unnecessary interventions that may cause inadvertent harm to a patient at any point during their care[2]. The principle that restraint and judicious decision-making are as critical to patient care as the intervention itself.

A PATH TO BLOOD HEALTH

PBM is not merely a framework for managing blood, it is a conceptual road to an ideal where blood health is seamlessly integrated into the standard of care. As healthcare continues to evolve, the principles of PBM should eventually become ingrained in providers' practices, no longer requiring a separate label but representing a natural extension of quality care. In this ideal scenario, PBM serves as a pathway to tiered care as seen in the prevention model, ensuring that every patient's blood is managed with the same precision and care as any other organ system. The implementation of PBM practices should, over time, facilitate the transition from reactive treatments to proactive, tiered blood care, reflecting the next evolution in patient-centered care. PBM as a concept will become all providers' standard of care, leading to its eventual obsolescence, the goal of the science practiced by the field's experts.

The Authors declare no conflicts of interest.

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