Improving Transfusion Practices Through Patient Blood Management Programs

In 2019, more than 10 million red blood cell (RBC) units, 2 million plasma units, and 2 million platelet units were transfused in the United States, making blood transfusions one of the most common procedures performed during hospitalization. Although the number of transfusions had risen over time to support more advanced treatments and procedures, the rate of growth in the early to mid 2000s was not sustainable as the number of transfusions quickly outpaced the number of blood donations. An aging blood donor population and the consolidation of blood collection facilities to reduce cost were contributing factors to this growing discrepancy. During the same time, there was increasing evidence that transfusing certain patient populations at a lower hemoglobin level than traditionally used could potentially lessen the known risk from transfusion without negative effects on patient outcomes. It became obvious that transfusion practices needed to change to improve patient outcomes while maintaining an adequate blood supply. It was in this environment that patient blood management (PBM) programs were developed.

Patient blood management refers to an evidence-based approach for managing patients who may need transfusion by administering enough blood to optimize the clinical outcome while avoiding unnecessary transfusions and the inherent associated risk. The growth of PBM programs has occurred during the past decade and has been driven by 2 main factors. First, blood transfusions continue to outpace blood donations. Since 1997, the National Blood Collection and Utilization Survey has reported data describing blood collection and usage. Blood transfusions steadily increased until they peaked in 2008, while blood donations and collections remained stable or decreased. Since 2008, there has been a steady decline in blood transfusions and blood collections. Second, there is the recognition that restrictive transfusion thresholds are safe in most patient populations studied. Several randomized controlled trials and a Cochrane Review compared more restrictive RBC transfusion thresholds with a more liberal threshold (eg, withholding transfusion until a hemoglobin level of ≤7 g/dL vs ≤9 g/dL) and concluded that the 30-day mortality was no worse. In addition, evidence-based guidelines for use of other blood components became available to assist providers in making appropriate transfusion decisions.

Implementing a PBM program is complex. Evidence-based hemotherapy practices are only one component to successful PBM programs. Other key principles are limiting blood loss through phlebotomy, optimizing patient hemoglobin levels and coagulopathy before invasive procedures, using intraoperative blood salvage techniques, minimizing perioperative blood loss, using single-unit transfusions, providing real-time education at the time of ordering, and developing quality improvement systems to audit the effectiveness of such programs. Specialty organizations have embraced these concepts and joined forces through the American Board of Internal Medicine Foundation’s Choosing Wisely campaign to advocate for decreasing unnecessary transfusion. Information technology is an essential part of a successful PBM program. Given the many components of a PBM program, tools have been developed to monitor baseline and ongoing blood use, to identify patients who have been transfused, and to link their transfusion to laboratory values before and after transfusion. Computerized provider order entry, requiring the provider to enter the appropriate indication for transfusion at the

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time of ordering, reinforces accepted transfusion guidelines. Clinical decision support tools, such as interruptive alerts (pop-ups), which appear when transfusions fall outside of established guidelines, deliver instant education to ordering physicians and allow the provider an opportunity to reflect and to determine whether the patient truly has unique circumstances that require a deviation from established guidelines or a chance to change or cancel the order.

In this issue of Mayo Clinic Proceedings, Warner and colleagues describe the implementation of a PBM program in a large US academic hospital and the impact of the program on patient outcomes and blood utilization. The program was staged over time, with new interventions being added periodically to existing interventions. Blood utilization and patient outcomes were assessed at 4 distinct time periods. These included pre PBM (2010-2011), early PBM (2012-2013), enhanced PBM (2014), and sustained PBM (2015-2017). In addition to analyzing the effect over time, the observed transfusion use and clinical outcomes were also compared with the expected use and outcome if a PBM program had not been implemented. The authors showed a progressive decrease in the proportion of hospital admissions that used RBC transfusion over time and an overall decrease in the total number of blood components (except cryoprecipitate) transfused over time. These findings are consistent with a recent US population-based study that used the Agency for Healthcare Research and Quality’s National Inpatient Sample database.9 Other important findings of Warner and colleagues included a shorter hospital length of stay and fewer adverse events when evaluated as a composite variable than projected as if no PBM program existed. However, hospital mortality and individual hospital adverse events were not significantly different from projected. These findings are similar to the results of a 2018 systematic review of 20 cohort studies and meta-analysis that was performed by a consortium of international organizations interested in best RBC transfusion practices.10 This group concluded that the implementation of PBM programs led to a significant reduction in RBC utilization and a reduced length of hospital stay, without a significant reduction in mortality-related outcomes.

Much has been written about the individual components of an effective PBM program, but little information exists on the overall effectiveness of a PBM program. This report adds to the small body of evidence suggesting that PBM programs have been successful in curbing the use of blood without causing harm to patients. This is an important accomplishment in times when hospitals are struggling to contain cost and blood-collecting facilities are struggling to meet hospital demand for blood.

Future research should continue to focus on the overall effectiveness of PBM programs. Physicians should examine alternative therapies to transfusion, such as pharmacologic intervention, to add to existing PBM programs. Methods for optimal implementation need to be developed to decrease the complexity involved in executing such programs. Last, more studies focusing on cost-effectiveness of PBM programs would be helpful in convincing hospital administrators of the value in investing in such programs.

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