Administering Blood Products Before Selected Interventional Radiology Procedures: Developing, Applying, and Monitoring a Standardized Protocol

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Abstract

Purpose: To apply and monitor a single institution's adherence to internally established guidelines for the preoperative administration of platelets and/or fresh frozen plasma (FFP) before a specified subset of minimally invasive interventional radiology (IR) procedures.

Materials and Methods: Beginning in December 2008, we implemented a set of restrictive guidelines for preoperative platelet and/or FFP administration before IR procedures at a single academic hospital. Basing our program on the methodology of Lean Six Sigma, we compared the number and appropriateness of transfusions between the months of January and October in 2008 (prepolicy), again in 2010 (postpolicy), and finally in 2015 (follow-up). Patients with a platelet count less than or equal to 50,000 or an international normalized ratio greater than or equal to 1.7 met criteria for receiving platelets or FFP, respectively, before their IR procedure. For all three periods, we compared the rates of transfusion, hemorrhagic complications, and proportion of appropriate versus inappropriate blood product administration (BPA) per our guidelines.

Results: There was a significant increase in the number of appropriate BPAs between 2008 and 2010 from 58% to 76% ($P = .021$). Between 2010 and 2015, the rate trended up further, from 76% to 88% ($P = .051$). Overall, between 2008 and 2015, the improvement from 58% to 88% was significant ($P < .001$). The rate of hemorrhagic complications was extremely low in all three groups.

Conclusion: Restrictive guidelines for receiving platelets and FFP administrations before IR procedures can sustainably decrease the rate of overall BPA while increasing the proportion of appropriate BPA without impacting the rate of hemorrhagic complications.

Key Words: Lean Six Sigma, transfusion, guidelines, interventional radiology

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INTRODUCTION

Inappropriate administration of blood products in the hospital setting has an obvious impact on the cost of health care delivery as well as on patient safety [1-3]. For instance, Yazdi demonstrated that inappropriate guidelines can lead to wasteful practices that can result in blood banks being unable to meet their needs [4]. Furthermore, blood product administrations (BPAs) carry risk, such as bacterial contamination and antibody development [5-7]. A reduction in the cost of producing, processing, and transporting unnecessary blood products can be achieved by applying restrictive protocols guided by process-improvement methodologies such as Lean Six Sigma [8-10].

Based on our guidelines for platelet and fresh frozen plasma (FFP) administration before interventional radiology (IR) procedures on the Society of Interventional Radiology/Cardiovascular and Interventional Radiological Society of Europe (SIR/CIRSE) Standards of Practice guidelines, our goal was to investigate thresholds for BPA that might reduce the number of preprocedure

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transfusions. Current recommendations are for the platelet count to be 40,000 to 50,000 per deciliter and that international normalized ratio (INR) be in the range of 1.5 to 1.7, depending on the level of invasiveness of the procedure [5-7,10-12].

Four elective IR procedures were evaluated at a single institution: chemoembolization, radioembolization, percutaneous biopsy, and percutaneous tumor ablation. Our hypothesis was that the implementation of standardized guidelines could reduce the number of preprocedure BPA without increasing the risk of bleeding complications. Moreover, we sought to observe whether any gains were sustainable in the long term, and thus we reviewed our results 5 years after implementation of the guidelines.

MATERIALS AND METHODS

Institutional Review Board approval was obtained for this retrospective study. Patient consent was waived.

All referrals to IR undergo review by an IR physician or nurse practitioner before scheduling. Before 2008, the decision of whether or not to administer blood products preoperatively was at the discretion of practitioners involved in the screening process. That year, our faculty developed guidelines for 38 IR procedures (see Appendix A) that were based on the SIR/CIRSE Standards of Practice guidelines [5]. Using a modified Delphi process, we sought to re-examine those thresholds and possibly establish different criteria that could lower the administration of blood products. Ten procedures, such as drain exchanges, do not require results for INR or platelet count before the procedure. For patients scheduled to undergo any of the remaining 28 procedures, (1) if the INR was greater or equal to 1.7, FFP would be given, and (2) if the platelet count was less than or equal to 50,000 per deciliter, the patient would receive platelets before the start of the procedure.

Of those 28 procedures, four were included in this study: chemoembolization, radioembolization, percutaneous biopsy, and percutaneous tumor ablation. They were chosen for consistency, specifically because they are elective and IR staff is responsible for ordering (or not ordering) blood products before the procedure. In certain instances for the other 24 procedures covered by the guidelines, patients' primary physicians often acted independently and ordered blood products in response to their own laboratory tests and according to their own practices. Additionally, the 24 excluded procedures often included inpatients with morbidities and acuities that impact decision making.

From the electronic medical records (Epic, Madison, Wisconsin, USA), we obtained and tabulated all INR and platelet counts that were available within 30 days before the procedures identified. We created three cohorts of patients, taken from three separate years, each covering the same 9-month period from January to October. The first was from 2008 (before the implementation of the protocol), the second was from 2010 (after implementation and a period of establishing regular work routines), and the third was from 2015 (5 years after implementation).

We noted administration of FFP or platelets before any of the four procedures listed previously. The administration was linked to a procedure only if it was given within 30 days before the procedure in response to the most recent laboratory test values. Patients who received a BPA to treat their underlying illness(es) by their primary caregivers were excluded from analysis. For patients who underwent multiple procedures and received a preprocedure BPA within 30 days, each administration was only counted once and linked to the procedure most proximate in time.

According to their baseline laboratory test values and whether they received a preprocedure BPA or not, all patients fell into one of four categories: "appropriate," "not appropriate," "indicated," or "not indicated" (Fig. 1). For instance, if the laboratory test values correctly triggered an administration, a BPA was considered appropriate for that value and blood product received. It was possible, therefore, to have an appropriate administration of FFP but an inappropriate administration of platelets in the same patient. If a laboratory test value was abnormal, but a BPA was not given beforehand, the patient fell into the indicated group, such that they were indicated for a BPA but did not receive one. Most patients in all three cohorts fell into the category of not indicated because their laboratory test values were normal and no preprocedure blood products were given.

We also searched the database for patients who received one or more red blood cell (RBC) transfusions within 30 days *after* their procedure, as an indicator of a hemorrhagic complication requiring intervention. These patients' records were manually reviewed to determine whether a hemorrhagic complication might be responsible for the RBC transfusion. Hemorrhagic complications not requiring a transfusion were excluded. These data were then correlated to the preprocedure coagulation parameters to determine whether the thresholds that had been selected had an effect on the number of