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ORIGINAL ARTICLE

Prophylactic Plasma Transfusion Before Interventional Radiology Procedures Is Not Associated With Reduced Bleeding Complications

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Abstract

Objective: To determine the association between prophylactic plasma transfusion and periprocedural red blood cell (RBC) transfusion rates in patients with elevated international normalized ratio (INR) values undergoing interventional radiology procedures.

Patients and Methods: In this retrospective cohort study, adult patients undergoing interventional radiology procedures with a preprocedural INR available within 30 days of the procedure during a study period of January 1, 2009, to December 31, 2013, were eligible for inclusion. Baseline characteristics, coagulation parameters, transfusion requirements, and procedural details were extracted. Univariate and multivariable propensity-matched analyses were used to assess the relationships between prophylactic plasma transfusion and the outcomes of interest, with a primary outcome assessed a priori of RBC transfusion occurring during the procedure or within the first 24 hours postprocedurally.

Results: A total of 18,204 study participants met inclusion criteria for this study, and 1803 (9.9%) had an INR of 1.5 or greater before their procedure. Of these 1803 patients, 196 patients (10.9%) received prophylactic plasma transfusion with a median time of 1.9 hours (interquartile range [IQR], 1.1-3.2 hours) between plasma transfusion initiation and procedure initiation. In multivariable propensity-matched analysis, plasma administration was associated with increased periprocedural RBC transfusions (odds ratio, 2.20; 95% CI, 1.38-3.50; $P<.001$) and postprocedural intensive care unit admission rates (odds ratio, 2.11; 95% CI, 1.41-3.14; $P<.001$) as compared with those who were not transfused preprocedurally. Similar relationships were seen at higher INR thresholds for plasma transfusion.

Conclusion: In patients undergoing interventional radiology procedures, preprocedural plasma transfusions given in the setting of elevated INR values were associated with increased periprocedural RBC transfusions. Additional research is needed to clarify this potential association between preprocedural plasma transfusion and periprocedural RBC transfusion.

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Prophylactic plasma transfusion is commonly performed before interventional radiology procedures despite increased attention on the deleterious effects and high costs of blood product utilization.[1] Nearly 4 million units of plasma are transfused each year in the United States alone,[2] and it has been estimated that approximately 50% of plasma transfusions occur outside of published guidelines.[3-5] In fact, the most commonly cited reason for plasma transfusion is correction of abnormal results of coagulation tests before an invasive procedure,[6,7] though previous studies have failed to show a correlation between mild to moderate coagulation abnormalities (ie, international normalized ratio [INR] $\leq$ 2) and bleeding complications in patients undergoing invasive percutaneous procedures.[8] In addition, plasma transfusion does not reliably normalize mild to moderate elevations in INR,[9-12] and in the absence of active bleeding, it is not recommended for the correction of mild coagulopathy. Furthermore, as studies have failed to establish a clear relationship between mild to moderate elevations in INR and increased procedural bleeding risk, the utility of decreasing an elevated INR for the prevention of bleeding complications remains theoretical at best.[8,13-15] Nonetheless, consensus guidelines released by

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the Society of Interventional Radiology Standards of Practice Committee identify an INR of less than 1.5 as the goal for patients undergoing procedures with moderate or high bleeding risk.[1]

The purpose of this investigation was to determine the association between prophylactic plasma transfusion and periprocedural outcomes in patients with abnormal results of coagulation tests undergoing percutaneous image-guided interventions, with a primary outcome of periprocedural red blood cell (RBC) transfusions. We hypothesized that prophylactic plasma administration would not be associated with decreased periprocedural RBC transfusion rates.

PATIENTS AND METHODS

This is a retrospective observational cohort study conducted under the approval of the Mayo Clinic Institutional Review Board. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines[16] were used in the design and conduct of this study, as well as in the reporting of results.

Inclusion criteria for this investigation were age 18 years and above and completion of a percutaneous invasive image-guided intervention (ie, inpatient or outpatient procedures performed by the Division of Vascular and Interventional Radiology) at a single tertiary care center in Rochester, Minnesota, between January 1, 2009, and December 31, 2013. Interventional procedures performed by physicians from other medical specialties (eg, cardiologists) were not included. An additional inclusion criterion was the presence of an INR in the 30-day interval preceding the procedure. Exclusion criteria included lack of valid research authorization and previous inclusion in the study (no patient was included twice). For patients with multiple interventional procedures, only the first procedure with a valid INR was included.

Outcome Variables

The primary outcome for this study was the presence of a periprocedural RBC transfusion. To qualify, the RBC transfusion initiation time was required to occur during the procedural encounter or within 24 hours after discharge from the procedural environment. Red blood cell transfusions initiated before entering the procedure suite were not included in the outcome evaluation. Additional secondary outcomes included unanticipated return to the procedural suite or transfer to an operating room within 24 hours of the index procedure, postprocedural intensive care unit (ICU) admission, postprocedural mechanical ventilation, ICU length of stay, hospital length of stay, and hospital mortality.

Predictor Variables

The primary predictor variable for this investigation was the presence or absence of preprocedural prophylactic plasma transfusion. For patients with multiple preprocedural INR values, the value closest to the time of the procedure was used. The presence and timing of all periprocedural transfusion episodes were extracted from the electronic health record. *Prophylactic plasma transfusions* were defined as plasma administered after the qualifying INR value and within 24 hours of the procedure. Plasma transfusions before the measurement of the qualifying INR were not included. Moreover, intraoperative and postprocedural plasma transfusions were not considered in the analyses, as our aim was to specifically investigate the effect of preprocedural plasma administration. In addition, this exclusion of plasma administration after the initiation of the procedure avoids the potential for cause-effect inversion with the outcomes of interest. To further ensure against cause-effect inversion, the *timing of plasma transfusion* was defined as the actual transfusion initiation time as documented in the electronic health record rather than the time of issue from the blood bank. Patient demographic characteristics, baseline clinical characteristics, and procedural and anesthesia-related details were also extracted from the electronic medical record. Procedures were classified into low, moderate, or high risk categories on the basis of bleeding risk as identified by the Consensus Guidelines for Periprocedural Management of Coagulation Status and Hemostasis Risk in Percutaneous Image-Guided Interventions (Table 1).[1]

Data Sources

Screening for potential study participants was performed using the perioperative datamart, an institutional resource that captures clinical and procedural data for all patients who are

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