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Perioperative Red Cell Transfusions Are Associated With A Significant Risk Of Venous Thromboelbolism Within 30 Days Post-Operatively: Evidence From A Large North American Multicenter Prospective Registry.

Authors

1. Dr. Ruchika Goel (Department of Pathology, New York Presbyterian Hospital, Weill Cornell Medical College, New York)
2. Dr. Melissa Cushing (Division of Transfusion Medicine, Department of Pathology, New York Presbyterian Hospital, Weill Cornell Medical College, New York)
3. Dr. Aaron Tobian (Division of Transfusion Medicine, Dept of Pathology, Johns Hopkins University)
4. Dr. Clifford Takemoto (Division of Pediatric Hematology, Department of Pediatrics, Johns Hopkins University)
5. Dr. Steven Frank (Department of Anesthesiology/Critical Care Medicine, The Johns Hopkins Medical Institutions, Baltimore, Maryland.)

Abstract

Background: Red Blood Cell transfusions (RBCT) have been linked with subsequent risk of venous thrombosis. This study examined the relationship between perioperative red blood cell transfusions (RBCT) and deep venous thrombosis warranting therapy within 30 days post-operative.

Study Design and Methods: The ACS-NSQIP database is a multi-center prospective registry designed to evaluate risk-adjusted outcomes of surgical patients and includes 525 institutions (both teaching and non-teaching hospitals) across North America. Data are submitted electronically to the American College of Surgeons for all processing and analysis. Using the ACS-NSQIP database, outcomes of patients undergoing elective surgeries were compared. Various preoperative clinical variables significantly associated with the occurrence of postoperative venous thromboembolism (VTE) (i.e. either deep venous thrombosis or pulmonary embolism) warranting therapy on initial univariate logistic regression were included in the multivariable hierarchical logistic regression model. Stepwise selection was used to select the variables most statistically associated with postoperative VTE after initial clinically informed variable selection.

Results: A total of 750937 subjects who underwent elective surgery were analyzed from the ACS NSQIP files during 2014. Of these, 7395 (0.98%) subjects received one or more RBCT's within 72 hrs of surgery. A total of 4336 (0.58%) subjects developed a post-operative venous thrombosis which warranted treatment. Post-operative sepsis was reported in 13307 (1.77%). Subjects receiving RBC transfusions within 72 hrs before surgery as well as >1 RBCT either intra-op or within 72 hrs post op had significantly higher unadjusted odds of developing VTE (OR 6.8, 95%CI 5.9-7.9) [DVT (OR 8.2, 95%CI 7.0-9.6) or PE (OR 3.6, 95%CI 2.7-4.9)].

In a risk adjusted model adjusting for age, length of hospital stay, immobilization (including mechanical ventilation), presence of metastatic malignancy, concurrent sepsis, steroid administration, pre-transfusion hematocrit and pre-transfusion platelet counts, the odds of developing VTE was significantly higher in subjects receiving RBCT's within 72 hrs before surgery and at least 1 intra-operative/ 72 hrs post op RBCT as compared to those who did not receive any RBCT's (adjOR 2.1, 95%CI (1.7-2.4) [DVT (adjOR 2.3, 95%CI 1.9-2.8); PE (adjOR 1.4; 95%CI 1.0-1.90)]. The discrimination ability of the model was excellent.

Outcome	Odds ratios (95% Confidence intervals.
VTE	(OR 2.1, 95%CI 1.7-2.4)
DVT	(OR 2.3, 95%CI 1.9-2.8)
PE	(OR 1.4, 95%CI 1.0-1.9).

Conclusions: Perioperative RBC transfusions with multiple units are associated with development of new venous thromboembolism warranting treatment within 30 days of surgery, and reinforce peri-operative patient blood management practices.

Multivariable Analysis Model Predicting Risk Of VTE With Peri-Operative RBC Transfusions.

Predictor Variables	Odds Ratio Estimates	95% Wald Confidence Limits	
Peri-operative RBC Transfusions (Pre + Intra/post op)	2.05	1.74	2.41
Sepsis vs No Complication	2.73	2.49	3.00
Immbility/Ventilator dependence	1.96	1.63	2.37
Disseminated Cancer	2.60	2.38	2.85
Concurrent Steroid use	1.51	1.37	1.66
Age in years	1.02	1.02	1.02
Length of Hospital Stay	1.05	1.05	1.05
Pre Transfusion Hematocrit	1.002	1.001	1.003
Pre-transfusion Platelet Count	1.001	1.001	1.001

Odds Ratio Estimates

Effect	Point Estimate	95% Wald Confidence Limits	
1 Unit RBC Transfused	5.63	5.25	6.03
2 Units RBC Transfused	7.38	3.79	14.35
3 or more Units RBC Transfused	17.68	5.45	57.36

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
numposttrans 1 vs 0	**2.826**	**2.616**	**3.052**
numposttrans 2 vs 0	**3.054**	**1.529**	**6.101**
numposttrans 3 vs 0	**5.739**	**1.639**	**20.101**
OTHSYSEP Sepsis vs No Complication	**2.790**	**2.506**	**3.107**
VENTILAT Yes vs No	**2.171**	**1.789**	**2.636**
STEROID Yes vs No	**1.605**	**1.434**	**1.797**
DISCANCR Yes vs No	**2.379**	**2.132**	**2.655**
TOTHLOS	**1.045**	**1.043**	**1.047**

Odds Ratio Estimates

Effect	**Point Estimate**	**95% Wald Confidence Limits**	
1 Unit RBC Transfused	2.826	2.616	3.052
2 Units RBC Transfused	3.054	1.529	6.101
3 or more Units RBC Transfused	5.739	1.639	20.101
Sepsis	2.790	2.506	3.107
Mechanical Ventilation	2.171	1.789	2.636
Concurrent Steroid Use	1.605	1.434	1.797
Disseminated Cancer	2.379	2.132	2.655
Length of stay	1.045	1.043	1.047