The Use of a Thromboelastography-guided Transfusion Algorithm in the Neurocritical Care Setting and its Association With Blood Loss, Length of Hospital Stay, Complications, and Mortality

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Learning Objectives

To provide education on the value of thromboelastography for routine use in Neurosurgical practice. This study, although retrospective, shows that thromboelastography can help guide rapid reversal of unwanted anticoagulation while decreasing thrombotic complications and mortality.

Introduction

Neurotrauma and Neurocritical care (NCC) patients have significant risk of morbidity and mortality from intracranial hemorrhage. Rapid identification of patients with coagulopathy followed by prompt reversal may lead to improved patient outcomes. The goal of our study was to evaluate the effect of our institutional thromboelastography (TEG) algorithm on estimated blood loss (EBL) in patients undergoing surgery, length of stay (LOS), in-hospital complications, and mortality.

Methods

A total of 100 consecutive patients admitted to our NCC unit were retrospectively evaluated. Patient demographics, admission TEG data, admission laboratory studies, TEG guided reversal of anticoagulation, perioperative data, length of hospital stay, disposition, and in-hospital complications were gathered from the electronic medical record. Multivariate linear regression and logistic regression analysis was performed for estimated blood loss in patients undergoing surgery, length of hospital stay, in-hospital complications, and mortality controlling for clinically important variables.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	Age	-.011	.026	.184	1	.668	.989	.939	1.041
	Sex	-.177	1.395	.016	1	.899	.838	.054	12.896
	TEG related transfusion	.941	1.821	.267	1	.605	2.563	.072	90.920
	Length of stay	-.069	.084	.684	1	.408	.933	.792	1.099
	Admission GCS score	.047	.154	.093	1	.760	1.048	.775	1.417
	Trauma	-.138	1.410	.010	1	.922	.871	.055	13.810
	Operative procedure	-.271	1.222	.049	1	.824	.763	.070	8.361
	Anticoagulation reversal	-3.460	1.718	4.057	1	.044	.031	.001	.911

a. Variable(s) entered on step 1: Age, Sex, TEG related transfusion, Length of stay, Admission GCS score, Trauma, Operative procedure, Anticoagulation reversal.

TEG guided anticoagulation reversal reduces mortality

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	Age	-.010	.018	.293	1	.588	.990	.955	1.027
	Sex	.525	.682	.593	1	.441	1.690	.444	6.433
	TEG related transfusion	-.239	.723	.109	1	.741	.787	.191	3.249
	Length of stay	-.059	.039	2.257	1	.133	.942	.872	1.018
	Admission GCS Score	-.257	.095	7.344	1	.007	.773	.642	.931
	Trauma	1.712	.755	5.135	1	.023	5.538	1.260	24.341
	Operative procedure	.327	.683	.230	1	.632	1.387	.364	5.287
	Anticoagulation reversal	-3.179	1.429	4.951	1	.026	.042	.003	.685
	Thrombotic complications	1.879	1.325	2.010	1	.156	6.545	.488	87.846
	Infectious complications	-1.203	.772	2.427	1	.119	.300	.066	1.364
	Complications rebleed	.266	2.005	.018	1	.894	1.305	.026	66.458
	Complications return to OR	3.127	2.934	1.136	1	.286	22.805	.073	7165.712

a. Variable(s) entered on step 1: Age, Sex, TEG related transfusion, Length of stay, Admission GCS, Trauma, Operative procedure, Anticoagulation reversal, Thrombotic complications, Infectious complications, complications rebleed, complications with return to the OR.

TEG guided transfusions reduce thrombotic complications

a,b

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	95.0% Confidence Interval for B Lower Bound	Upper Bound
1	Age	-2.259	1.891	-.322	-1.195	.240	-6.091	1.572
	TEG related transfusion	14.131	86.619	.020	.163	.871	-161.376	189.638
	Trauma	18.862	83.203	.033	.227	.822	-149.723	187.446
	Anticoagulation reversal	-34.966	197.037	-.017	-.177	.860	-434.200	364.268
	Admission GCS Score	-8.331	9.495	-.219	-.877	.386	-27.569	10.908
	Procedure grading	245.911	38.320	1.228	6.417	.000	168.267	323.554

a. Dependent Variable: Estimated Blood Loss

b. Linear Regression through the Origin

TEG guided anticoagulation reversal reduces mortality

Coefficients[a,b]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	95.0% Confidence Interval for B Lower Bound	Upper Bound
1	Age	.154	.063	.521	2.451	.016	.029	.278
	TEG related transfusion	-1.247	3.316	-.039	-.376	.708	-7.835	5.342
	Trauma	2.460	2.608	.104	.943	.348	-2.722	7.641
	Anticoagulation reversal	6.586	6.310	.087	1.044	.299	-5.951	19.123
	Admission GCS	-.088	.298	-.055	-.297	.767	-.679	.503
	Thrombotic complications	.119	4.407	.002	.027	.979	-8.636	8.874
	Infectious complications	-.964	3.462	-.025	-.278	.781	-7.841	5.913
	Complications rebleed	-5.894	9.242	-.055	-.638	.525	-24.255	12.467
	Complications return to OR	8.922	11.069	.068	.806	.422	-13.069	30.913
	Operative procedure	6.324	2.834	.224	2.231	.028	.693	11.955

a. Dependent Variable: Length of stay

b. Linear Regression through the Origin

TEG guided transfusions have no effect on LOS

Results

TEG guided transfusions and reversal of anticoagulation did not have a significant effect on blood loss following first major surgery during hospitalization or length of hospital stay. Older patients and those undergoing operative procedures during hospitalization had a significantly longer hospital stay. Patients who underwent TEG guided transfusions were found to have significantly fewer thrombotic complications. TEG guided medical reversal of anticoagulation was significantly associated with fewer rebleeding complications. Higher admission GCS score and TEG guided medical reversal of anticoagulation were significantly associated with lower mortality rates.

Conclusions

TEG guided transfusions and medical reversal were found to significantly decrease thrombotic complications and mortality respectively. The use of our institutional TEG-guided transfusion algorithm appears to have no effect on overall patient blood loss during surgery or length of hospital stay. Future prospective studies are needed to validate this initial analysis.