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Thromboelastography: A Primer for Neurosurgeons

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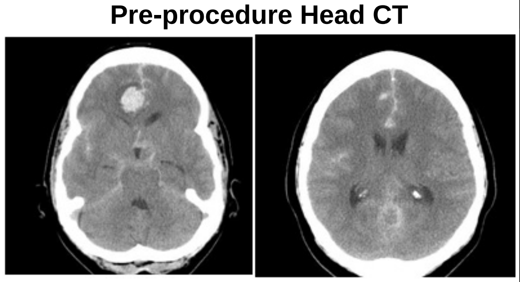
Introduction

Since its inception in 1948, thromboelastography (TEG) has been utilized as a diagnostic and therapy-guiding tool for coagulopathies. It is frequently used in cardiac and transplant surgery for determining a patient's coagulation profile outside of the prothrombin time (PT), international normalized ratio (INR), and partial thromboplastin time (PTT). More recently, it has garnered attention for its utility in trauma-associated coagulopathy. However, there remains a paucity of literature regarding using TEG in neurosurgical patients. Given the ability of TEG to identify coagulopathies based on etiology, quantify and determine both presence and degree of platelet inhibition, and guide therapy, it is an under-utilized tool in a neurosurgeon's arsenal. We present our initial experience using TEG and showcase one patient from a series of twenty-five patients that exhibits its functionality.

Pre-procedure Head CT

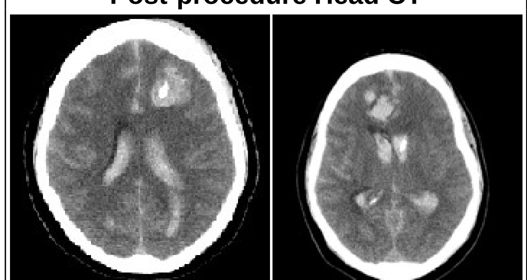


Non-contrast Head CT showing subarachnoid hemorrhage, ventriculomegaly and intraparenchymal hemorrhage secondary to ruptured right pericallosal artery aneurysm.

Methods

Advancing beyond conventional coagulation labs, TEG can identify the time to clot formation, clot strength, clot stability, and both percentage and mechanism of platelet inhibition. We highlight a patient presenting to our institution with a ruptured right pericallosal aneurysm who was found to have abnormal platelet function on TEG, which was not identified with routine conventional coagulation labs. The patient underwent placement of an external ventricular drain following FFP transfusion, but subsequently developed catheter-associated intraparenchymal hemorrhage and intraventricular hemorrhage. Further investigation with TEG showed that the patient had underlying platelet dysfunction, which could possibly have been treated with platelet transfusion prior to placement of external ventricular drain.

Post-procedure Head CT

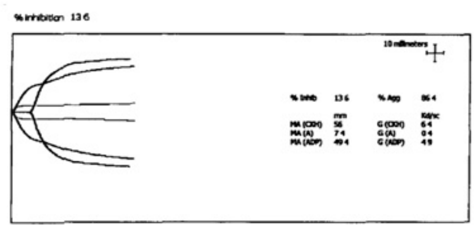


Non-contrast Head CT showing new left frontal intraparenchymal hemorrhage surrounding external ventricular drain catheter and new associated intraventricular hemorrhage.

Results

In this case TEG identified underlying platelet dysfunction in a patient who presented with subarachnoid hemorrhage, but only after an emergent invasive intracranial procedure had been performed. Further management was therefore guided by the results of the TEG, but earlier identification of platelet dysfunction is ideal in order to guide transfusion regimens in neurosurgical patients such as this one.

Platelet Mapping



Assay reveals significant platelet inhibition via ADP receptor mediation.

Laboratory values

Collected Date Collected Time	07/13/2012 12:12:00 EDT		
Procedure		Units	Ref Range
WBC	15.6 H	k/uL	[4.0-10.8]
RBC	4.23	million/uL	[3.60-5.00]
Hgb	13.5	gm/dL	[11.0-14.5]
Hct	39.4	%	[34.5-44.0]
MCV	93.1	FL	[81.0-100.0
MCH	31.9 H	pg	[27.0-31.0]
MCHC	34.3	gm/dL	[31.0-36.0]
RDW	13.3	%	[11.5-15.5]
Platelet	180 #1	k/uL	[145-400]

Collected Date Collected Time	07/13/2012 12:12:00 EDT		
Procedure		Units	Ref Range
PT	17.5 H	sec	[11.8-14.5]
INR	1.5 H		[0.8-1.2]
PTT	26.1	sec	[23.0-35.0]

Hematologic and coagulation laboratory values demonstrating normal platelet count and only mildly elevated PTT and INR prior to FFP transfusion.

Conclusions

TEG is useful in identifying antiplatelet medication hyper- or hypo-responders, recognizing platelet inhibition or dysfunction in patients from whom a medication history cannot be obtained, and guiding transfusion protocols when coagulation labs are equivocal. It can also potentially prevent complications from thrombosis or hemorrhage and decrease unnecessary transfusions. TEG is an under-utilized tool of which neurosurgeons should gain more experience using and a more facile understanding.

References

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