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Thromboelastography Test - Any Value for Assessing Hemostasis During Surgery?

A member of the e-Network asked if anybody was familiar with a procedure called Thromboelastography (TEG) that measures the characteristics of the clot formation in vitro and that is used to determine the specific blood component deficiency of a bleeding patient during surgery. The member also wanted to know of any clinical lab that offers the test. To which many replies were received. I think it is fair to say that the following replies suggest that some individuals are very pleased with TEG while others feel the test is not useful at all.

1. One member stated that he is very familiar with thromboelastography and has published at least seven papers on it. According to the member, this test is utilized by about 50 hospitals for heart surgery. The member refers the membership to Linda Shore-Lesserson's article in Anesthesia and Analgesia in 2000. In this member's experience, TEG is definitely saving blood product usage. The member also suggests calling the company, Haemoscope of Park Ridge Illinois, and they will gladly send a great deal of published scientific literature.
2. This member reports that the surgeons use the TEG machine in the operating room. Basically this is a whole blood analyzer that analyzes the "steps" of clot formation. This member's institution is in the process of assuming this as a point of care test and SOPs are being developed.
3. This member reported that TEG is an old test that measures clot strength and retraction. The member remembers playing with a thromboelastograph in the late 1960s. TEG, according to this member, has recently gotten a new life. It is this member's belief that a company is marketing a new TEG instrument, and that Cedars-Sinai in Los Angeles is currently using the instrument. It is a point of care instrument and non-lab personnel will do testing.

Editor's NOTE: Reply #3 was sent to the blood bankers at Cedars-Sinai, and one of them had the following response (which is reply #4):
4. "The liver transplant team uses it; I am not aware of its use in cardiac surgery."
5. The member submitting this reply suggested that Bel Bonfils be contacted regarding this test. Apparently the test was developed and used in the Denver area several years ago.
6. The member submitting this reply stated that TEG is a point-of-care instrument used in the operating room that measures several components of clots as they form, with results obtained within 5-10 minutes. The member went on to state that the company selling the instrument claims that the use of TEG can save over 50% of blood components. Reference publications are available. There is currently a study by several institutions evaluating operating room use, directed by anesthesiologists.
7. This member stated that TEG is a rapid empirical screen of overall hemostatic function. It measures the elastic shear modulus of clotting blood. It is widely used during liver transplant but has little use in special coagulation or routine hematology because there are alternative tests that are more easily interpreted and more specific. See the web site below for illustrations of the principle and the different parameters that are read from the TEG tracing. Generally, the "look" of the tracing is more useful than the parameters reported from the tracing. It is perhaps most useful for indicating fibrinolysis. See Chandler, W.L., in Seminars in Thrombosis and Hemostasis, vol. 21, suppl. 4, pp.1-6; 1995, for an excellent review. Many centers offer the

test, the University of Washington has an excellent outreach program[Phone (206) 598-6131]. Again, since patients rapidly can change from fibrinolytic to hypercoagulable during liver transplant, it is most useful to run them at specific times during the procedure. The surgeons often will look at the tracings in real time during the transplant.

8. This member reported that his anesthesia STAT Lab performed this test for a while, but stopped it years ago because they felt it was "inaccurate and the data were not interpretable".
9. This member said that his institution used a TEG instrument placed in the cardiac operating room for a trial to determine if results could be used to guide transfusion therapy using the following parameters:
 - r > 15 minutes: administer FFP
 - MA < 40 mm: administer platelets
 - alpha angle < 40 degrees: administer cryoprecipitated AHF

The instrument was run and maintained by the intraoperative blood salvage team. It received mixed reviews and is no longer in use. The techologists reported difficulty with QC and reproducibility, and there was some concern about the instrument meeting CLIA requirements. This member stated that Haemoscope Corporation, Skokie IL (708-329-0001), manufactured the instrument. The member recommended the following review article: Mallett SV, Cox DJA. Thromboelastography. British Journal of Anesthesia 1992; 69: 307-313.

10. This member reported that TEG is a diagnostic procedure well entrenched in certain surgical specialties, especially liver transplant. The test is typically run intraoperatively, using the results to determine which phase of coagulation/fibrinolysis is predominating during the surgery. The operator will interpret the various angles and deflections recorded by a probe immersed in clotting whole blood, discerning whether the patient needs more fibrinogen, or platelets. This member **knows of no reputable clinical lab that uses TEG**. Here are some references that this member provided:

1. De Nicola P, Mazzetti GM. Evaluation of thrombelastography. Am J Clin Pathol 1955; 25:447-452.
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4. Howland WS, Castro EB, Fortner JB. Hypercoagulability. Thromboelastographic monitoring during extensive hepatic surgery. Arch.Surg. 1974; 108:605-608.
5. Howland WS, Schweizer O, Gould P. A comparison of intraoperative measurements of coagulation. Coagulation 1974;53:657-663.
6. Kang Y, Lewis JH, Navalgund A, Russell MW, Bontempo FA, Niren LS, et al. Epsilon-aminocaproic acid for treatment of fibrinolysis during liver transplantation. Anes. 1987; 66:766-773.
7. Kang Y, Borland LM, Picone J, Martin LK. Intraoperative coagulation changes in children undergoing liver transplantation. Anes.1989; 71:44-47.
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9. Podolsak B, Minger AM, Oller J. Thrombocyte functions, thrombelastograms and fibrinogen of healthy children in different age groups. Eur J.Pediatr. 1977; 127:27-39.
10. Ruggiero G, DeBiasi R, Attanasio S, Bile G, Giusti G. Hemostatic abnormalities in chronic aggressive hepatitis and liver cirrhosis. Acta Hepato-Gastroenterol 1975; 22:221-228.
11. Spiess BD, Tuman KJ, McCarthy RJ, DeLaria GA, Schillo R, Ivankovich AD. Thromboelastography as an indicator of post-cardiopulmonary bypass coagulopathies. Journal of Clinical Monitoring 1987; 3:25-30.
12. Tuman KJ, Spiess BD, McCarthy RJ, Ivankovich AD. Effects of progressive blood loss on coagulation as measured by thromboelastography. Anesth.Analg. 1987; 66:856-863.
13. Umiastowski J, Suchecki T. The effect on thromboelastogram of normal blood and procoagulant activity of gel filtered uraemic platelets. Thromb.Haemostas. 1979; 42:1620 EP 1625
14. Wang JS, Lin CY, Hung WT, O'Connor MF, Thisted RA, Lee BK, et al. Thromboelastogram fails to predict postoperative hemorrhage in cardiac patients. Ann.Thorac.Surg. 1992; 53:435-439.
15. Zuckerman L, Cohen E, Vagher JP, Woodward E, Caprini JA. Comparison of thrombelastography with common coagulation tests. Thromb.Haemostas. 1981; 46:752-

756.

16. Zuckerman L, Ramstack JM, Vagher JP, Caprini JA, Mockros LF. Neutralization of heparin by cellular blood elements. *Thromb.Res.* 1975; 7:149-159.

11. This member's hospital will be implementing the TEG in an operating room stat lab early this summer, under the aegis of one of the cardiac anaesthesiologists. This member used it during fellowship...one of the liver transplant anesthesiologists swore by it...but it seemed like reading tealeaves, back then. This member will share the TEG experience with the e-network later in the year.
12. This is a commercially developed test explored by this member's anesthesiologists and reviewed by the hospital's diagnostic technology committee, which is the committee that must approve a test before it can be offered and billed as a clinical (i.e. non-research) test. The test was reviewed and felt not to be well proven as valuable. The application to use it was denied.
13. This member's hospital uses TEG on a regular basis for patients who are expected to or are at a high risk of massive bleeding during a procedure. It is used regularly to monitor patients during orthotopic liver transplant pre, during and post operatively and for some cardiac re-do's. In addition patients who are expected to have long pump runs are frequently monitored before and after bypass. The test is a very non-specific clotting test that generates measure of clot strength. There are several ways it looks at this including the time it takes to begin making a clot, the rapidity with which it strengthens, the maximum strength and whether or not it lyses after 60 minutes. This member thinks it is too non-specific to be of help in most situations other than fibrinolysis. It is also a useful tool to prove there is no coagulopathy and the patient needs to be taken back to surgery. In patients going on lepirudin for cardiopulmonary bypass, this member's facility has used it for a measure for when to put the patient on bypass, as they have found the ecarin clotting time unreliable as is the ACT.
14. The TEG is used to reduce the amount of products used in this member's Operating room. It is used by the perfusionist to aid the liver transplant team to determine the blood needs of the patient during surgery. It functions as a point-of-care testing, just as the Hepcon and ACT in surgery.

ADDENDA Feb. 27, 2001

15. The following clarification of [Reply #5](#) has been submitted on behalf of Bel Bonfils.

"Reply #5 suggested contacting Belle Bonfils Blood Center for that center's experience with TEG. According to the member providing clarification: "To my knowledge we did not use this technique at the Blood Center, but Dr. Kurt von Kaula at the University of Colorado made much use of this in his coagulation research and in evaluating patients with various coagulopathies. We did not use it to help determine patient transfusion requirements at the Blood Center. Kurt returned to Germany and no one else picked up this technology."

ADDENDA Feb. 28, 2001

16. I would suggest that anyone interested in TEG read this month's *Anesthesia and Analgesia*. There are two lead articles as well as a good editorial about its use in the operating rooms.

ADDENDA June 11, 2008

17. **A colleague in Denmark** comments that in his country some colleagues who treat trauma are **contemplating the introduction** of the thromboelastograph as a **routine tool in the transfusion management of trauma patients**. He would appreciate if US colleagues would offer an opinion as to the relevance of this technique in the acute management of transfusion support in trauma patients.

Please submit comments to the [e-Network Forum](#).

Ira A. Shulman, MD
CBBS e-Network Forum Editor & Moderator

W. Tait Stevens, MD
CBBS e-Network Forum Assistant Editor & Moderator



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