

Thromboelastogram

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Medical Practice Improvement Project

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Disclosures

I have no
disclosures

Although I
wish I did



Learning Objectives

- 1. What is TEG?
- 2. How is it used to help with massive transfusion?
- 3. What are the advantages and disadvantages ?
- 4. Learning how to read and interpret the TEG Tracings



What is TEG?

- Thromboelastography (TEG) is a viscoelastic hemostatic assay that measures the global viscoelastic properties of whole blood clot formation under low shear stress TEG shows the interaction of platelets with the coagulation cascade (aggregation, clot strengthening, fibrin cross-linking and fibrinolysis)"

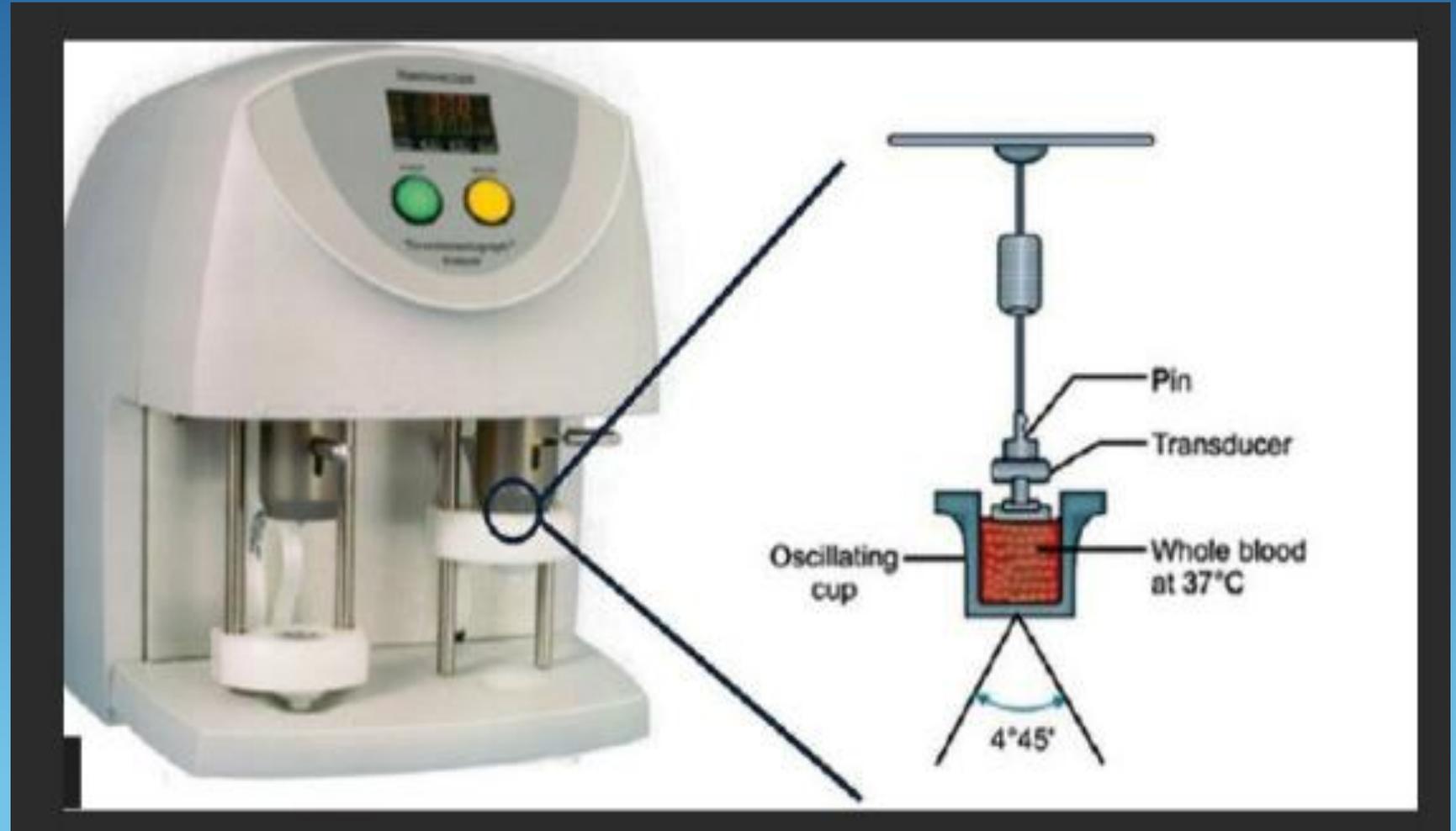


How does it work?

- Thromboelastography (TEG) is a medical device that measures the mechanical properties of a developing blood clot. It operates by moving a cup in a limited arc filled with sample that engages a pin/wire transduction system as clot formation occurs. The cup oscillates slowly around a submerged torsion pin, and as coagulation occurs, the pin adheres to the clot and moves. The magnitude of pin motion is directly related to the clot's strength.



TEG Analyzer



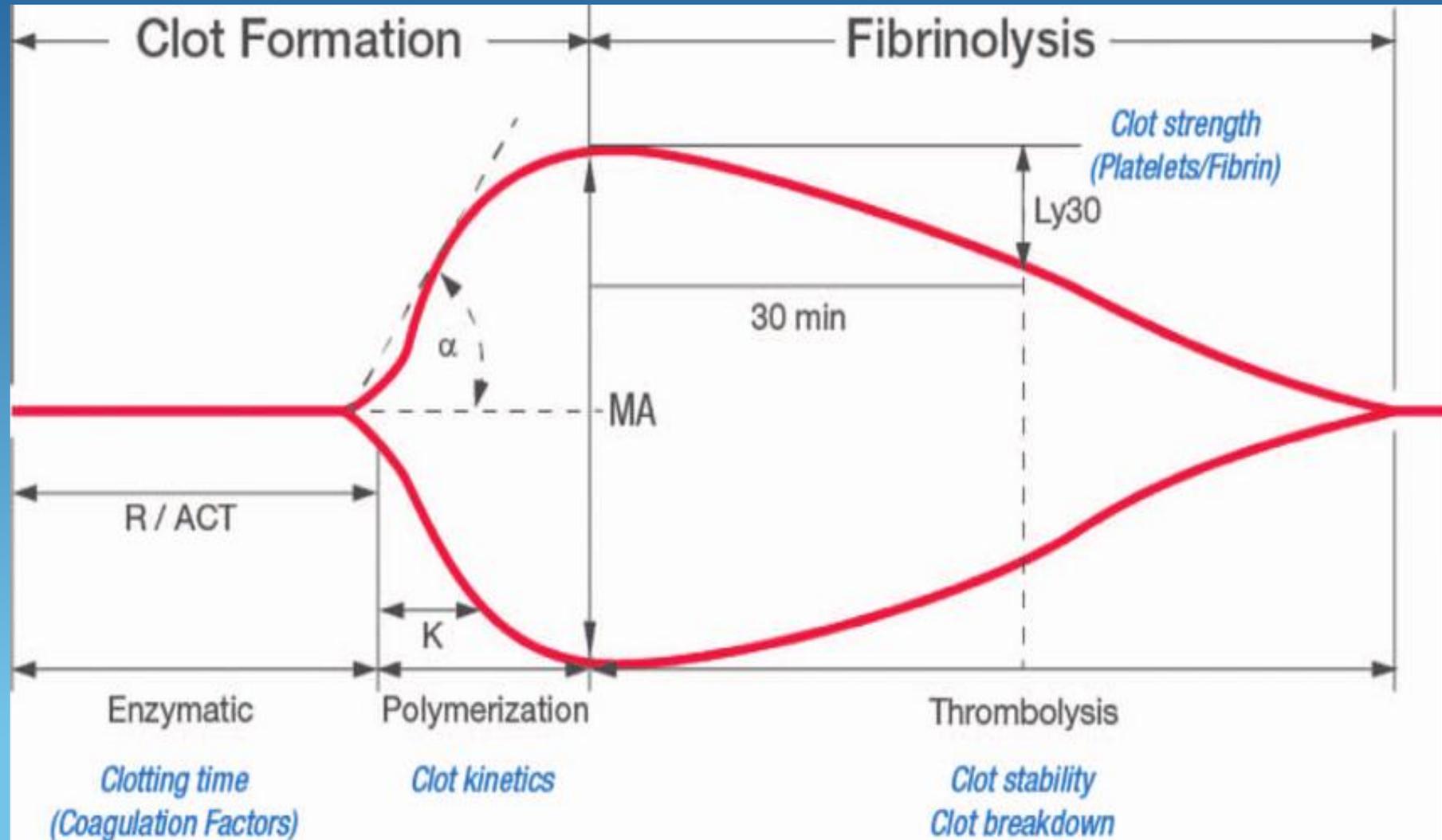
What Makes TEG So Special?

It is the only real time test that shows the actual bleeding time, clot formation, and clot degradation as a function of time.

Using the values assigned you will know how much additional blood products above and beyond the 1:1:1 ration is needed to correct the clotting cascade



TEG 101



What Does Each of the Values Mean?

Initiation (R)

- Represents period of time of latency from start to initial fibrin formation due to effects of Factor VIIa and Tissue Factor
- = INR
- **Amplification (K)**
- Represents time taken to achieve a certain level of clot strength due to thrombin and activation of platelets (where r-time = time zero)
- Usually, 20 % of clot strength
- Need for cryoprecipitate



What Does Each of the Values Mean?

- **Propagation (α -Angle)** Measures the speed at which fibrin build-up and cross-linking takes place (clot strengthening) and hence assesses the rate of clot formation.
- Need for DDAVP
- **Maximum Amplitude (MA)**
- A function of the maximum dynamic properties of fibrin and platelet bonding via GPIIb/IIIa and represents the strongest point of fibrin clot and correlates to platelet function: 80% platelets; 20% fibrinogen.



What Does Each of the Values Mean?

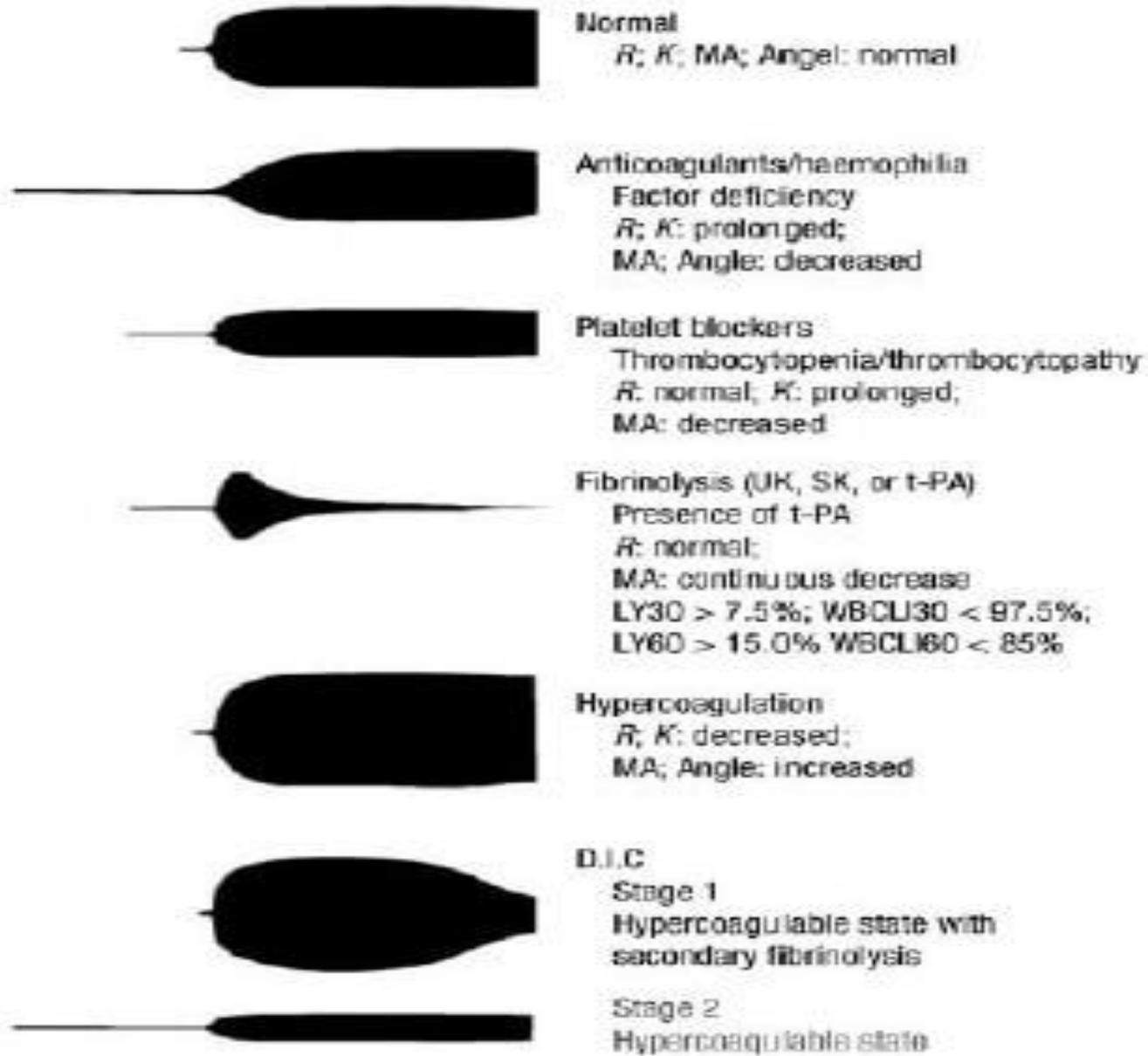
Clot stability (LY 30%)

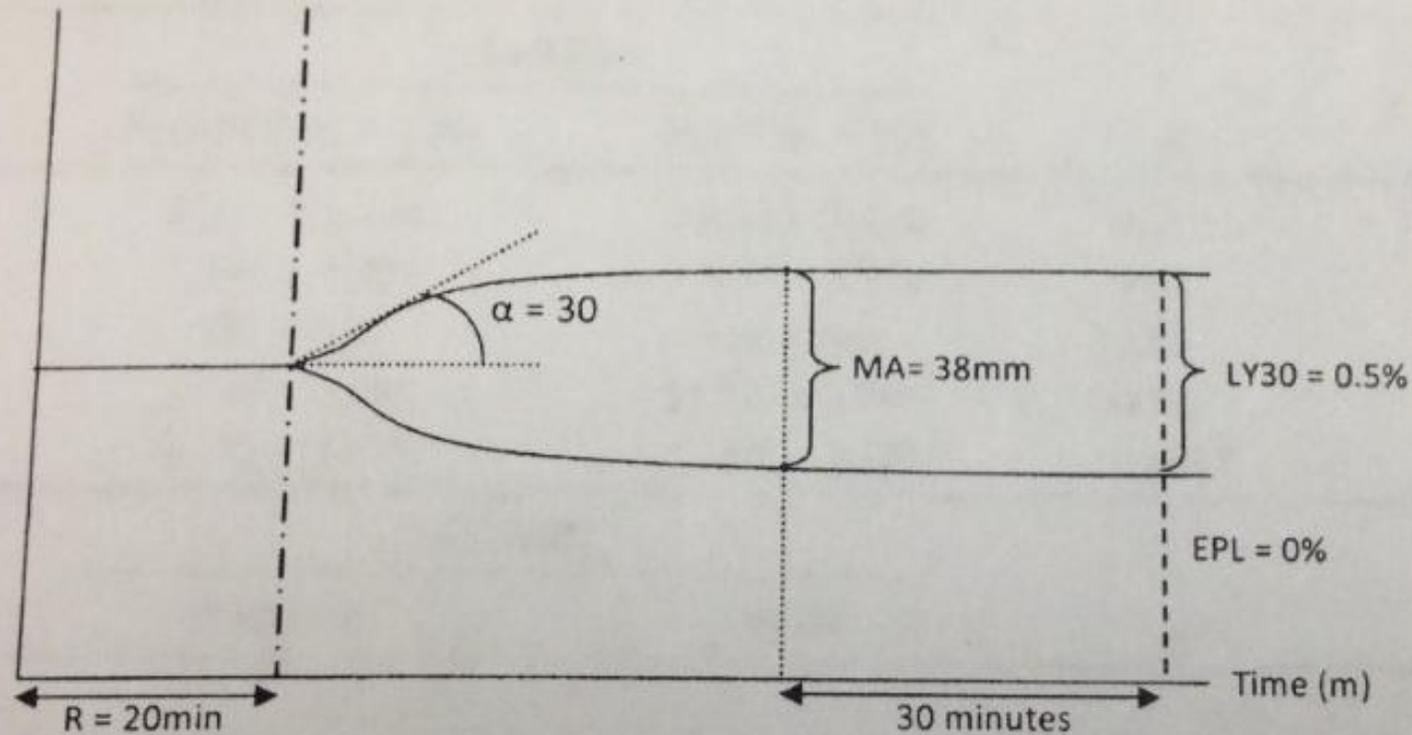
This is percentage decrease in amplitude 30 minutes post-MA and gives measure of degree of fibrinolysis

This is clot break down

- If more than 8% then the patient will need TXA
- Primary Fibrinolysis







REPLACEMENT ALGORITHM:

R time (mm)

7-10: 1 unit FFP or 4ml/kg

11-14: 2 units FFP or 8ml/kg

>14: 4 units FFP or 16ml/kg

MA (mm)

48-54: 0.3mcg/kg DDAVP

41-48: 5 units platelets

≤ 40 : 10 units platelets

Alpha (degree)

< 45: 0.6u/kg cryoprecipitate

EPL (percent)

≥ 7.5 : give fibrinolytic of choice

R = Time elapsed until clotting onset and represents activation of clotting factors. When this value is elevated, there is a deficiency of clotting factors, which should be replaced with FFP

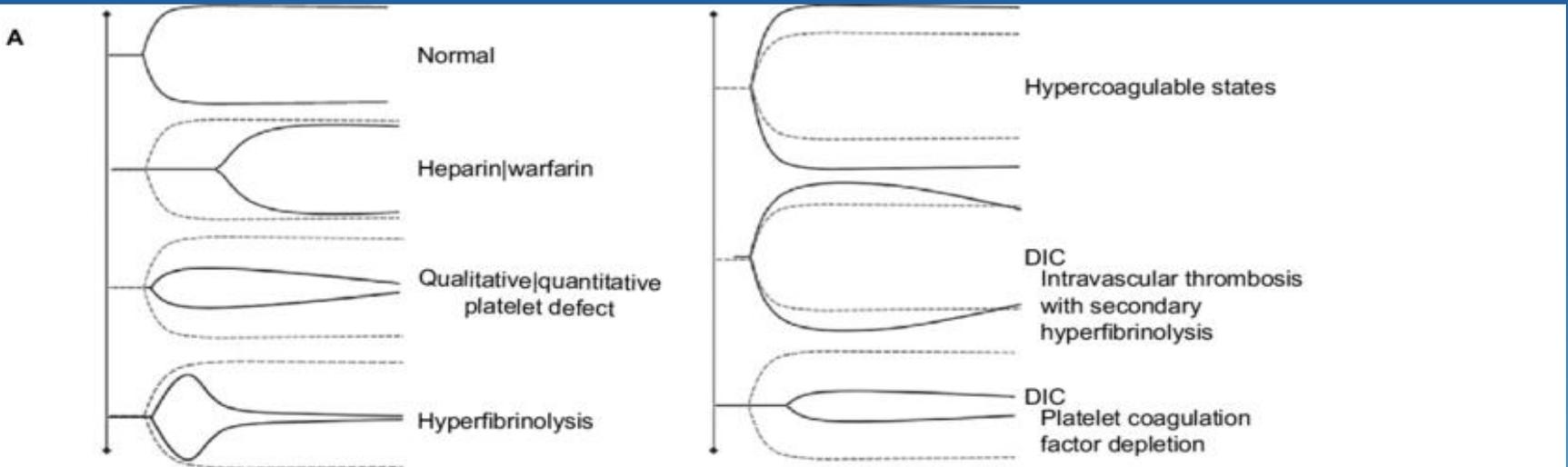
MA = Maximum amplitude. Greatest strength of clot and a direct function of properties of fibrin and platelet bonding and function. When this value is low, the patient should receive platelets.

α = Speed of fibrin build-up and cross-linking (clot strengthening) and an estimation of fibrinogen level.

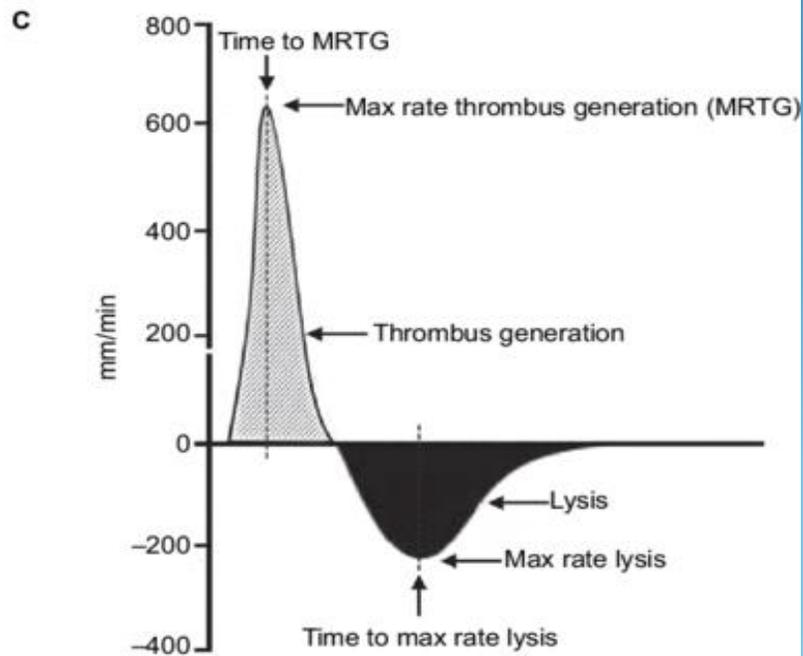
LY30 = Lysis at 30 minutes. Percent decrease from maximum amplitude 30 minutes after MA is reached.

EPL = Estimated percent lysis. The rate of overall clot breakdown and fibrinolysis.





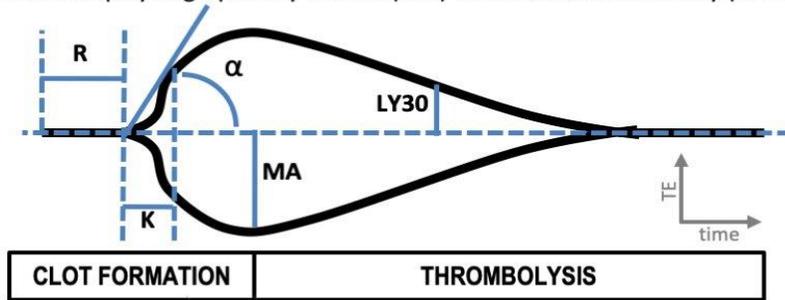
R	K	Angle	MA	G	EPL	LY30	CI
min	min	deg	mm	d/sc	%	%	
5-10	1-3	53-72	50-70	4.5k-11k	0-15	0-8	-3 to 3
Coagulation factors If R long, K long give FFP		Fibrinogen If, $\alpha \leq 53^{\circ}$ give cryo	Platelets If MA ≤ 50 mm give plts (also, cryo)			Fibrinolysis if LY30 $\geq 8\%$ give TXA	



THROMBOELASTOGRAPHY (TEG) by Nick Mark MD

General Principle

- A small cuvette is rotated to simulate sluggish venous flow and stimulate clot formation.
- The resistance to rotation due to the mass of the clot is measured, which allows the kinetics of clot formation to be assessed.
- This provides information about clot formation and breakdown, and also reflects problems with coagulation cascade and platelet function.
- This is displayed graphically as time (min) versus thromboelasticity (in mm).



Explaining the numbers

- **R - reaction time** - latency until clot formation begins as (normal 3-9 min) defined by an amplitude of 2 mm
- **K - K value** - time from the end of R until the clot reaches (normal 0.5 to 3 min) 20mm – reflects speed of initial clot formation
- **α - alpha angle** - the angle tangent to the curve at K (normal 54-80 degrees)
- **MA - maximum amplitude** - reflects total clot strength (normal 51-78 mm)
- **Lysis time (LY30)** - % lysis after 30 min - reflects the (normal 0-9%) fibrinolysis stage of clot development

TEG guided resuscitation protocols

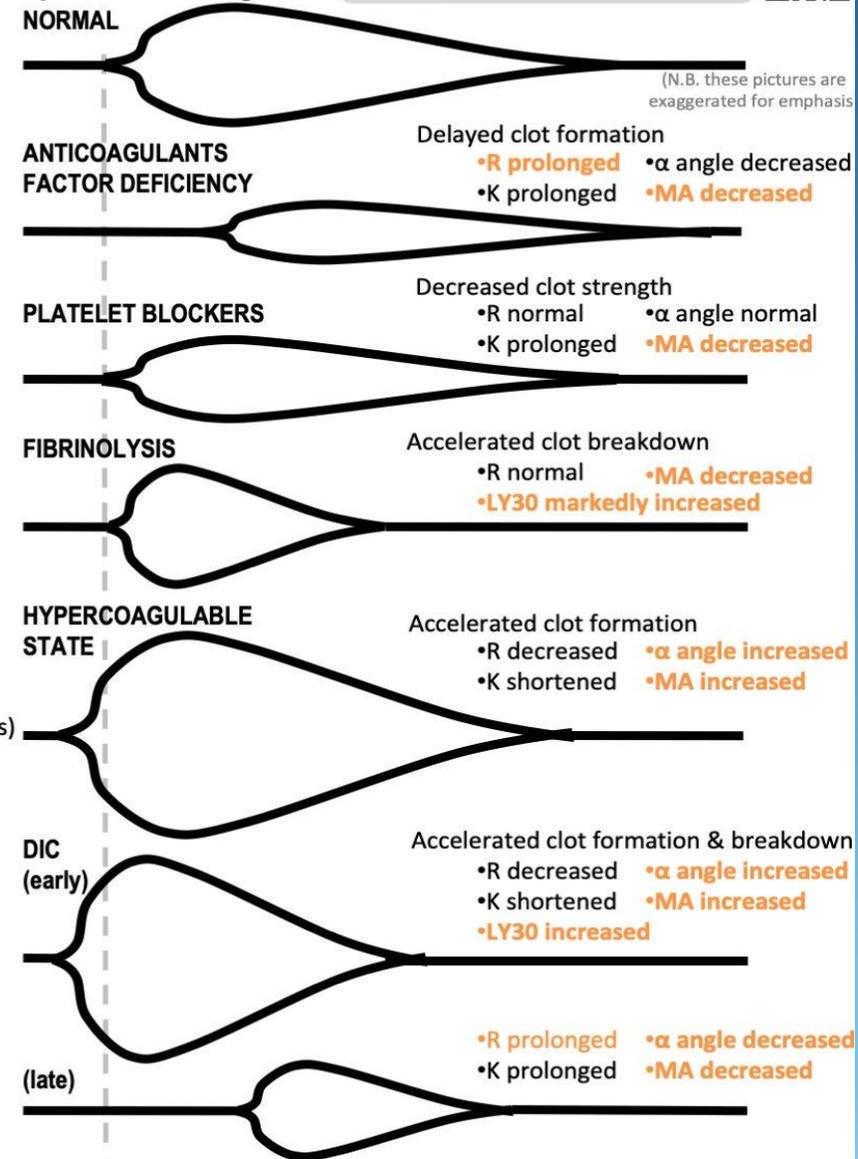
Advantage: Results available promptly: K, R within 5 minutes, MA and α-angle within 15 minutes, and LY30 within 45 minutes.

What do do?

- Increased R time => FFP
- Decreased α angle => cryoprecipitate
- Decreased MA => platelets (consider DDAVP)
- Fibrinolysis => tranexamic acid (or aminocaproic acid)

v1.0 (2020-04-01)

Specific Pathologies



- teg machines - Search Images (bing.com)
- teg machines how do they work - Search (bing.com)



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