

TEG6s for Obsgynaecritcare 2024

Adam Eslick

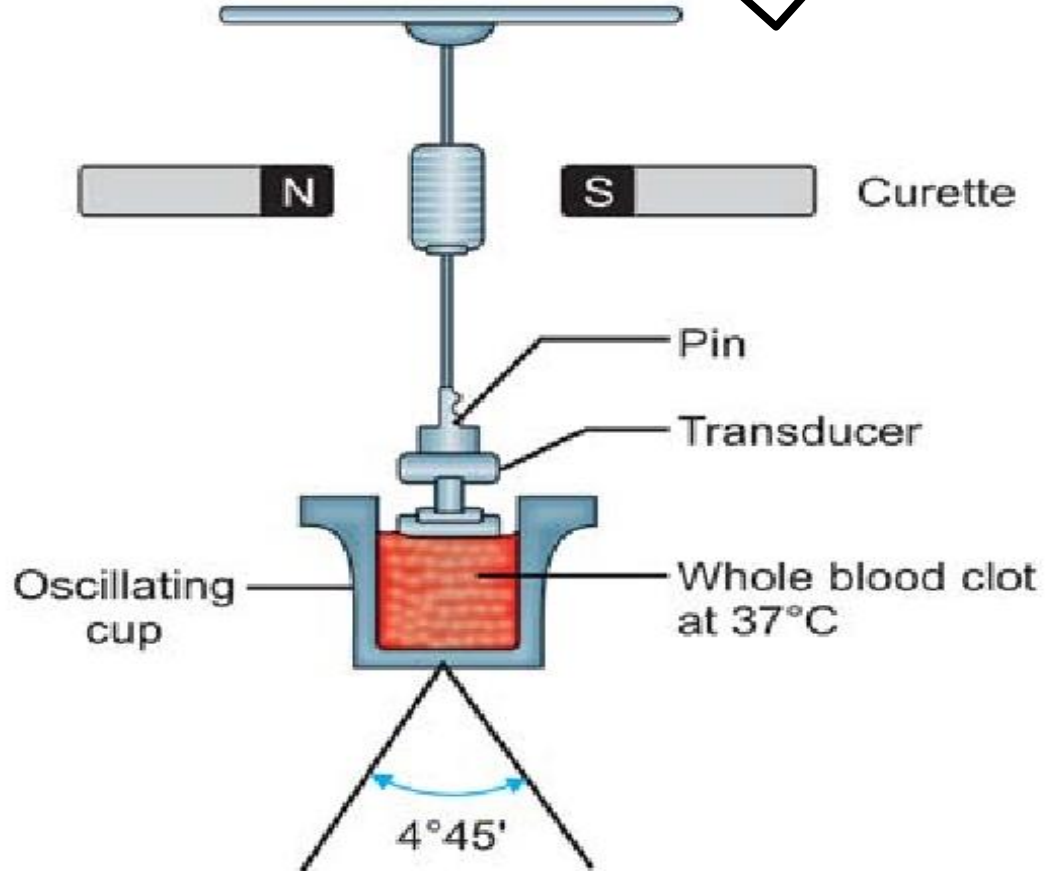
Staff Specialist Anaesthetist, Westmead Hospital



Technology

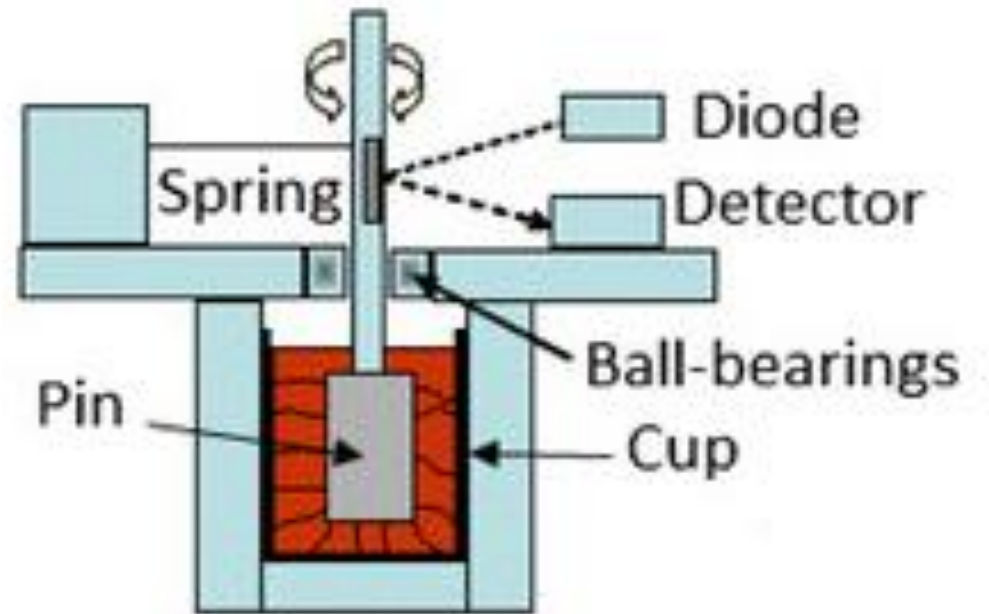
Cup
Moves

TEG



ROTEM

Pin
Moves



Breakthrough devices

TEG 5000

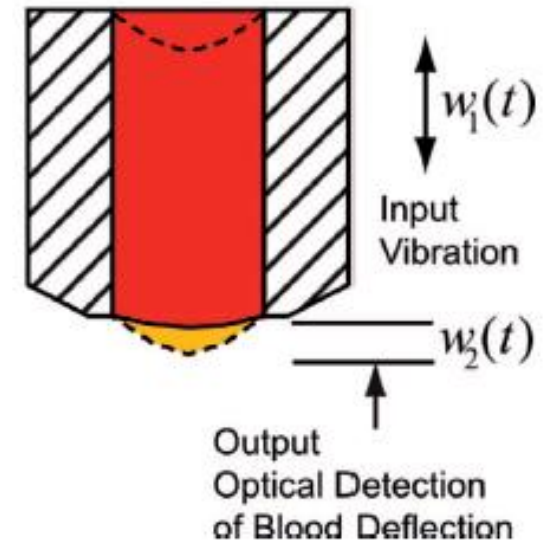


ROTEM DELTA



New technology: TEG 6s

- Cartridge based, nil reagent mixing, easy pipette (inexact volume)
- 4 analysis channels (simultaneous)
- Microfluidic cartridges
- Piezoelectric device causes the sample to vibrate
- Frequencies of the induced clot motion detected
- Fast fourier transform



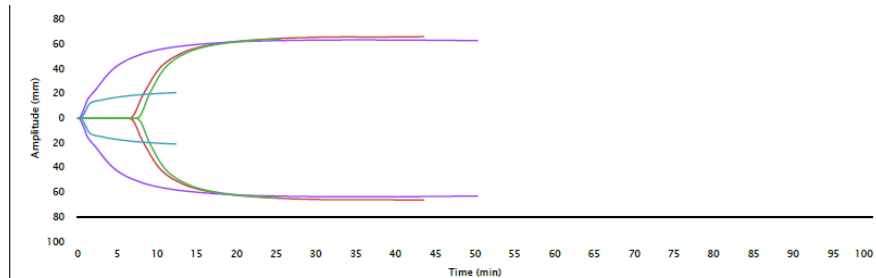
New devices: cartridges

TEG 6s



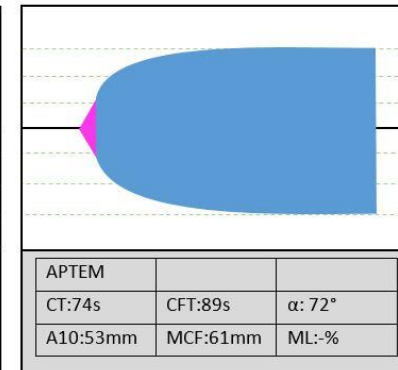
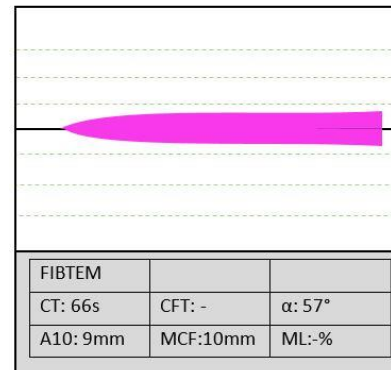
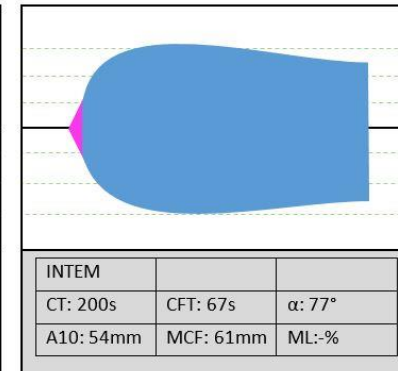
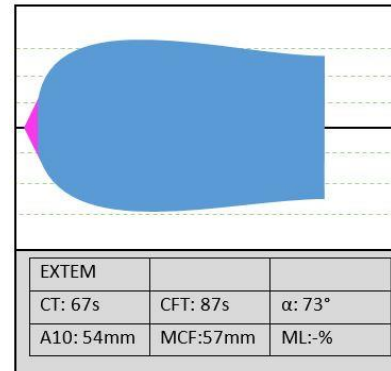
Results – Multi Channel Devices

TEG

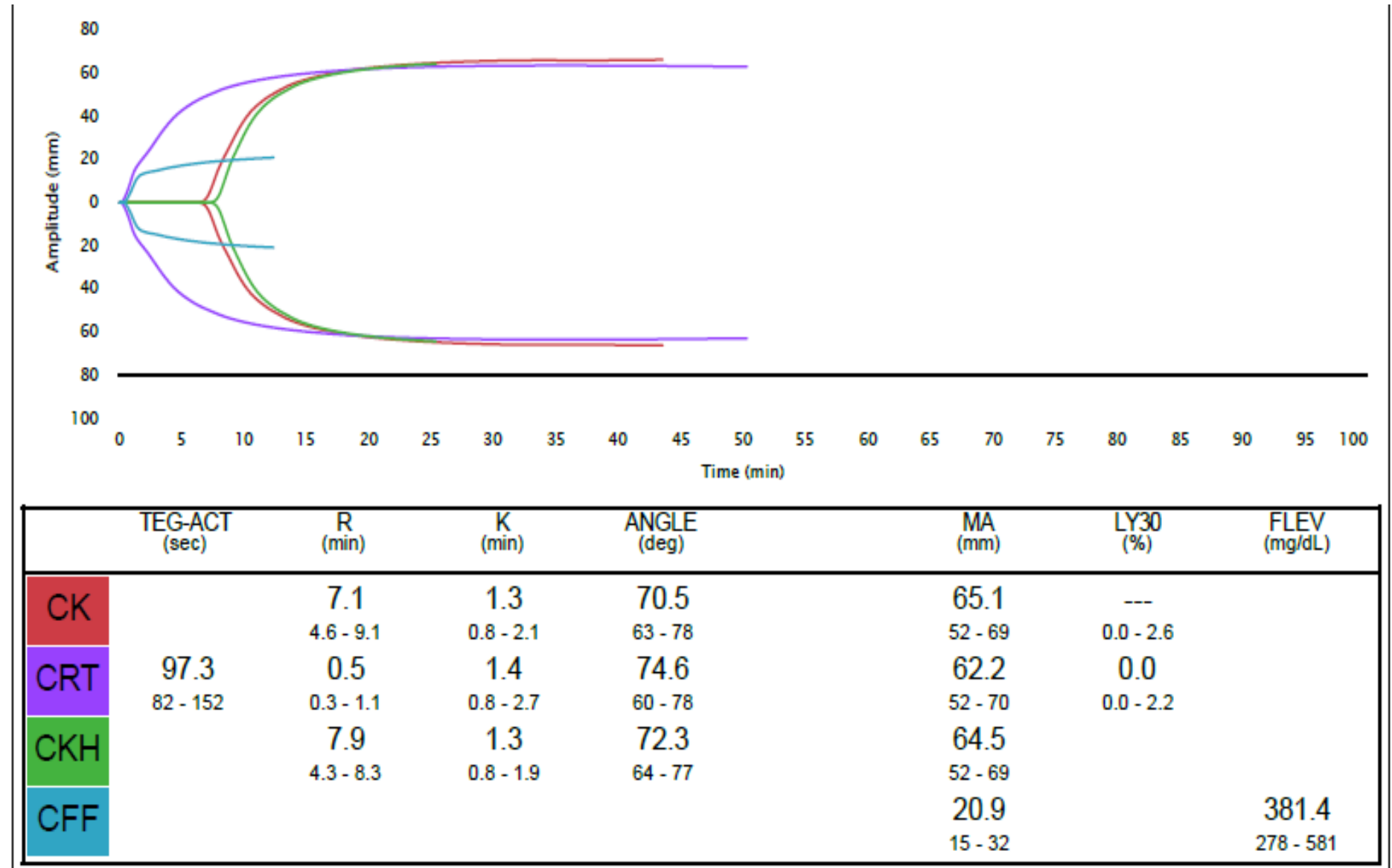


	TEG-ACT (sec)	R (min)	K (min)	ANGLE (deg)	MA (mm)	LY30 (%)	FLEV (mg/dL)
CK		7.1 4.6 - 9.1	1.3 0.8 - 2.1	70.5 63 - 78	65.1 52 - 69	---	
CRT	97.3 82 - 152	0.5 0.3 - 1.1	1.4 0.8 - 2.7	74.6 60 - 78	62.2 52 - 70	0.0 0.0 - 2.2	
CKH		7.9 4.3 - 8.3	1.3 0.8 - 1.9	72.3 64 - 77	64.5 52 - 69		
CFF					20.9 15 - 32		381.4 278 - 581

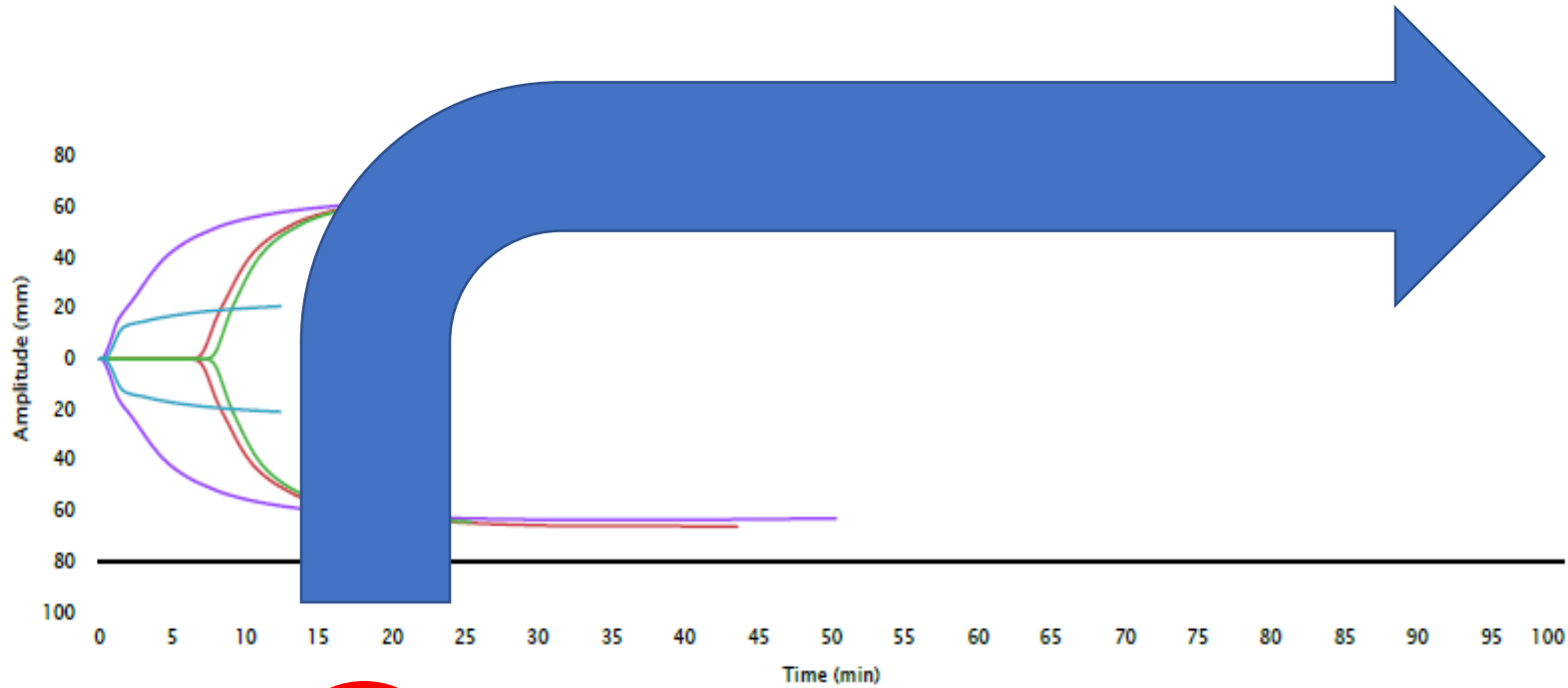
ROTEM



TEG



TEG

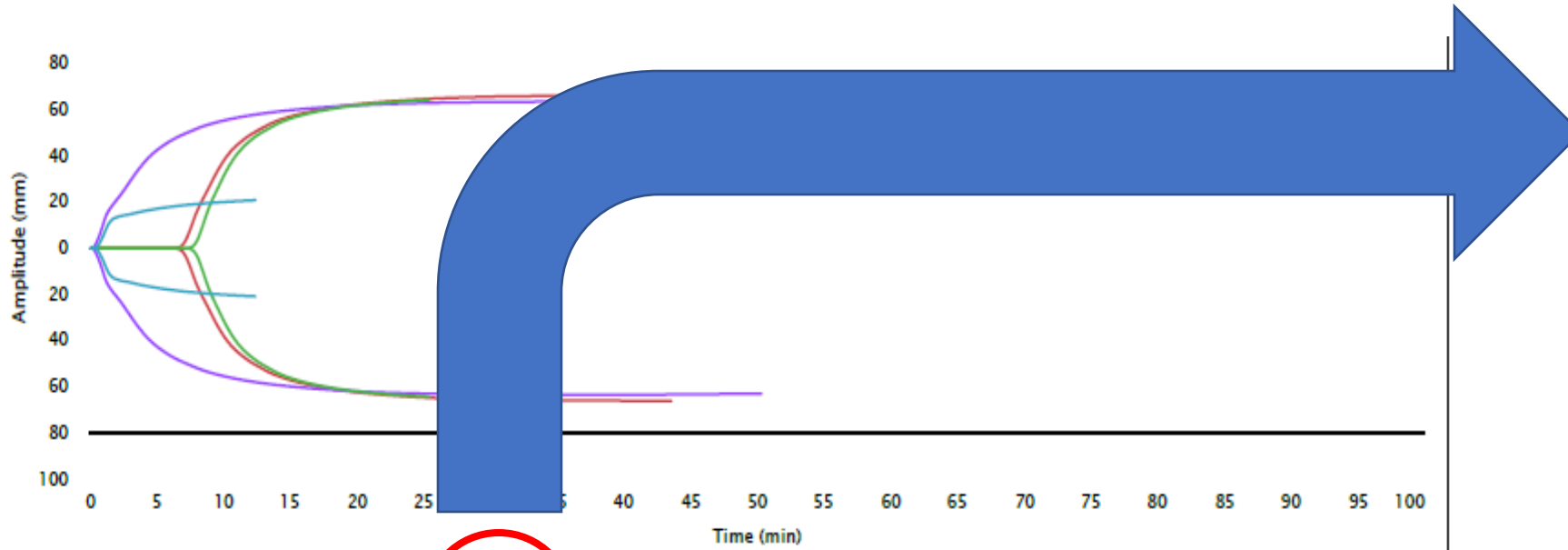


R-time: Time taken for clot formation to commence.
Measured at 2mm amplitude.

Assesses clot initiation: Clotting factors, anticoagulants

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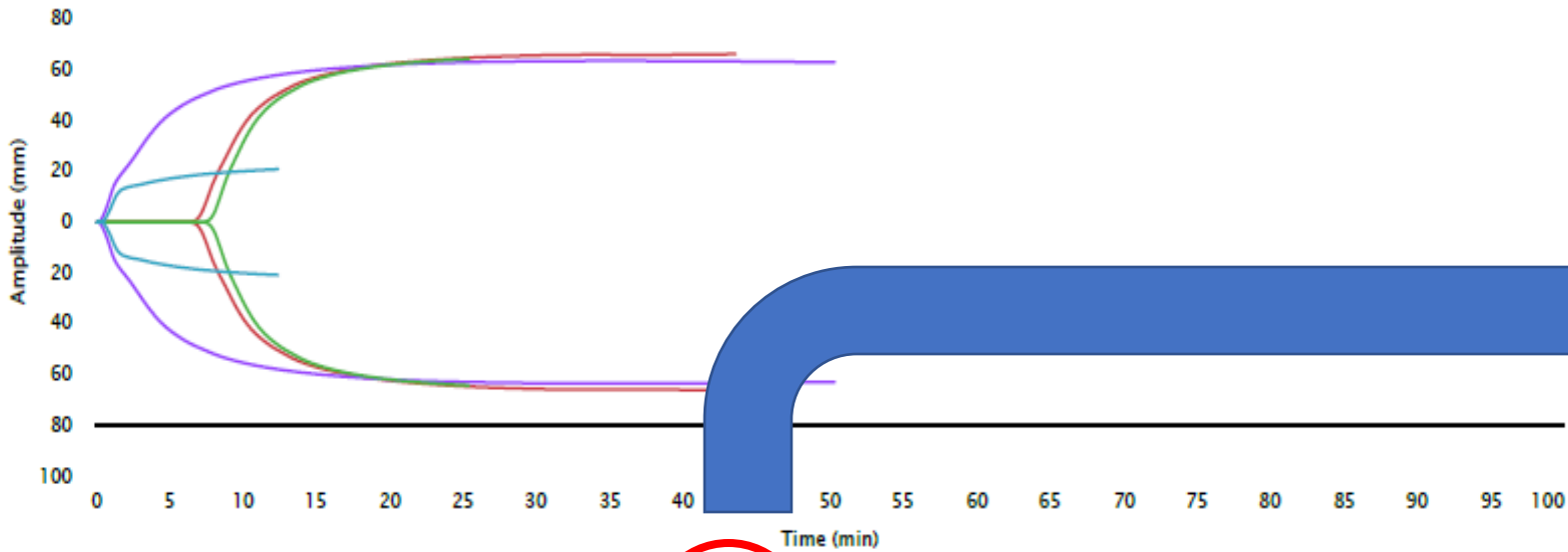
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Inversely proportional to thrombin generation.

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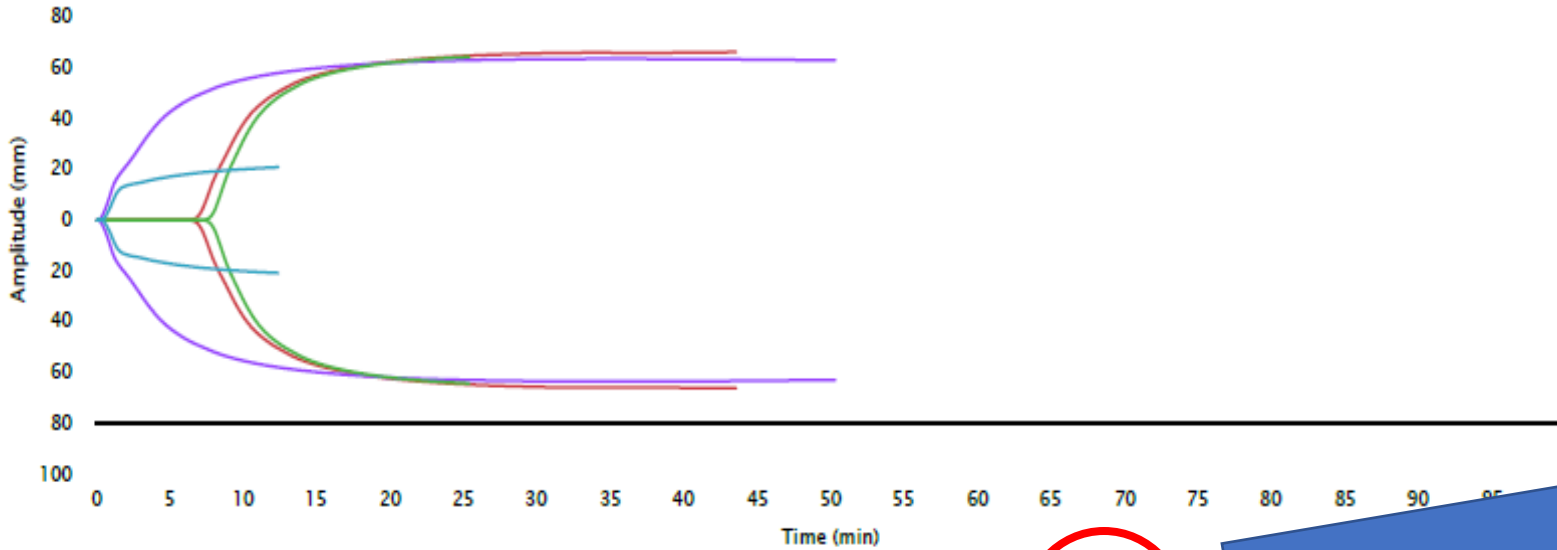
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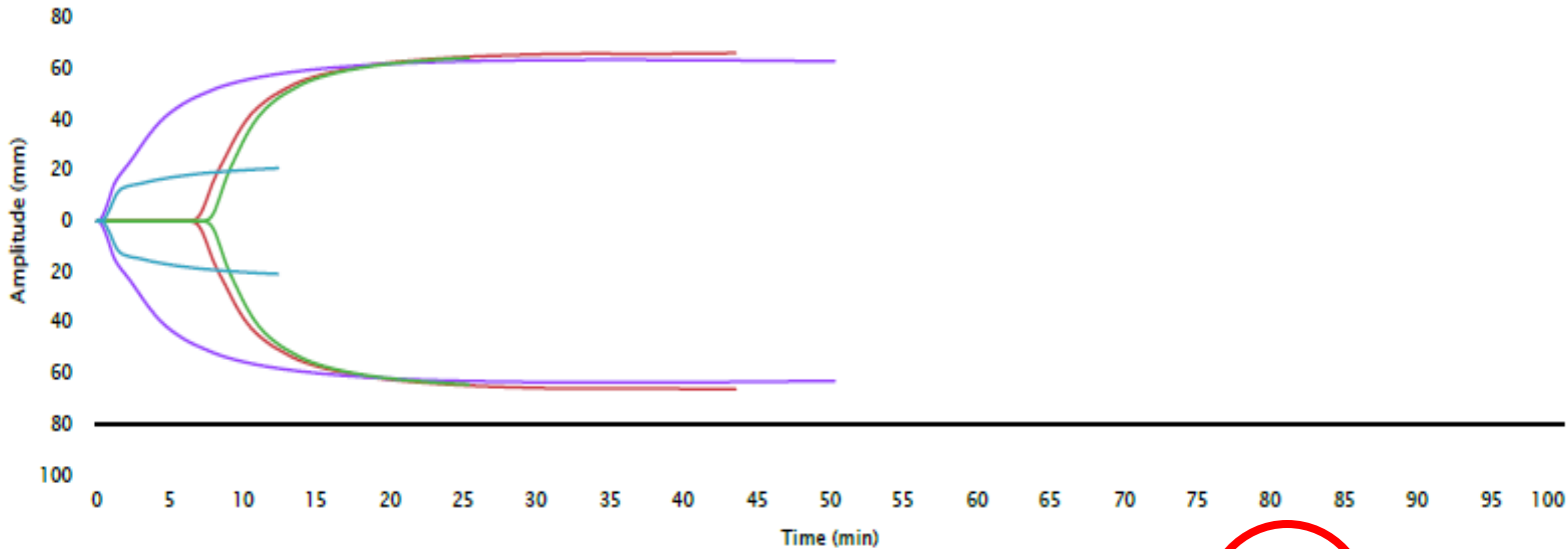
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TEG

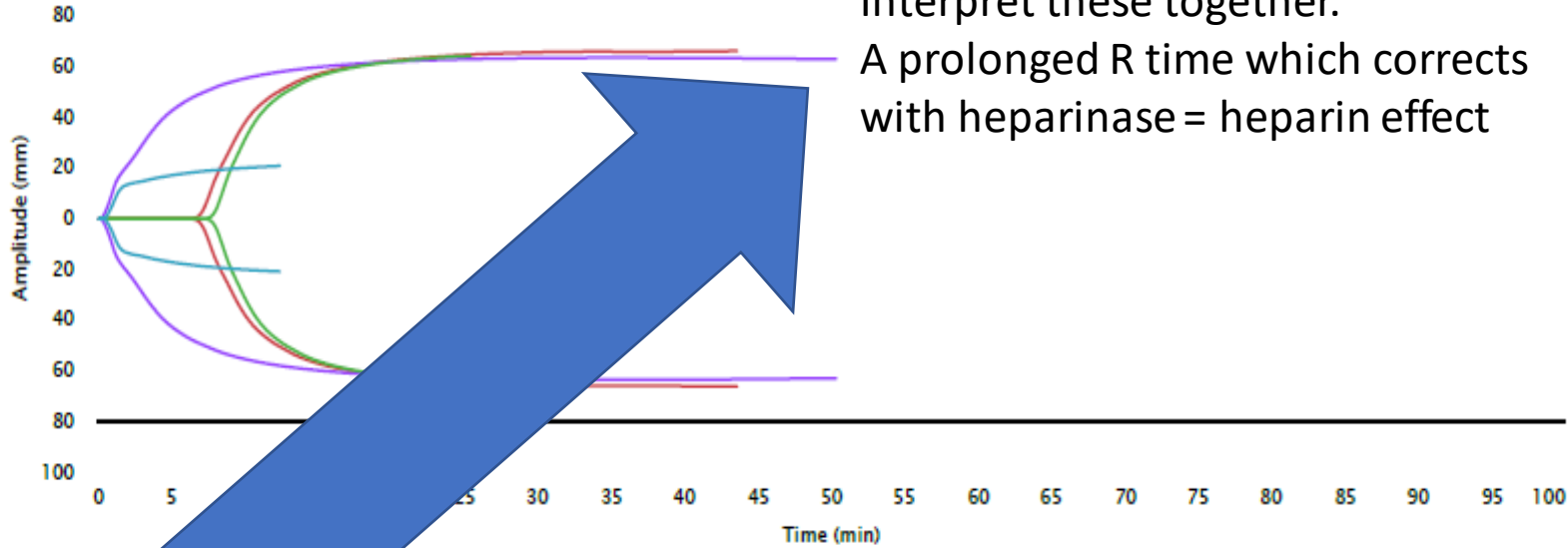
CK and CKH:

Both contain Kaolin as an activator. Similar to aPTT, assessment of the intrinsic pathway.

CKH includes heparinase.

Interpret these together.

A prolonged R time which corrects with heparinase = heparin effect



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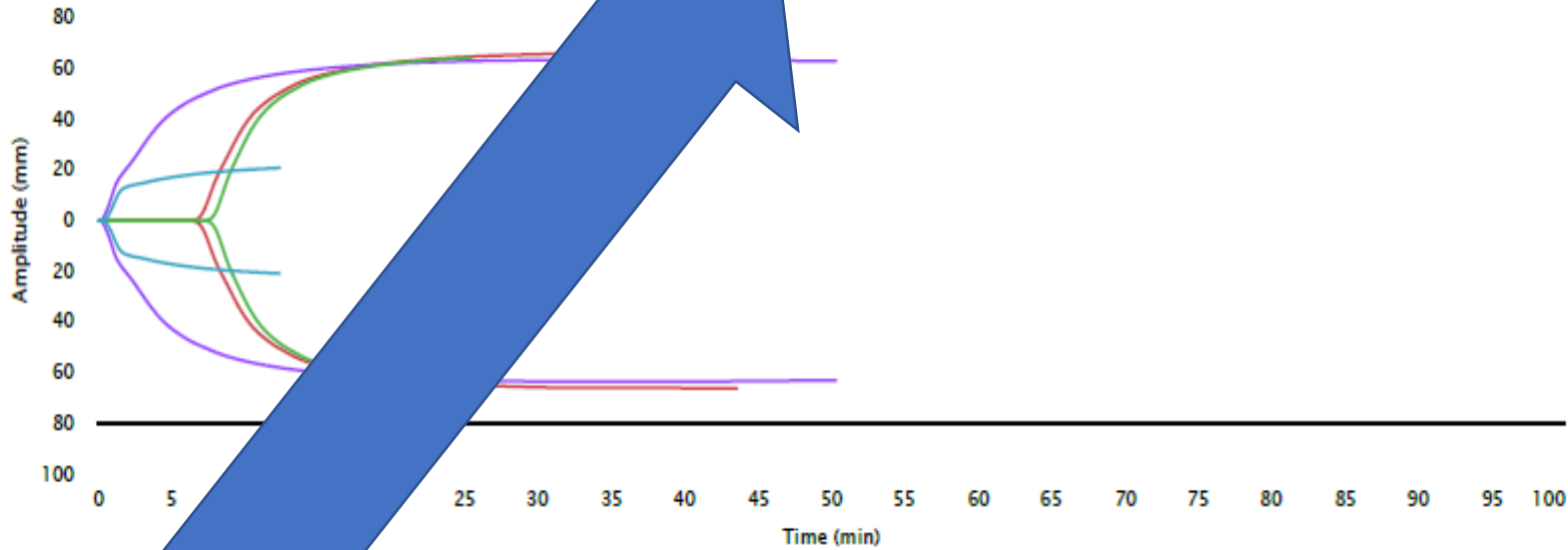
TEG

CRT:

Contains tissue factor as an activator.

MA and Lysis 30 generated faster.

R time may not be as reliable



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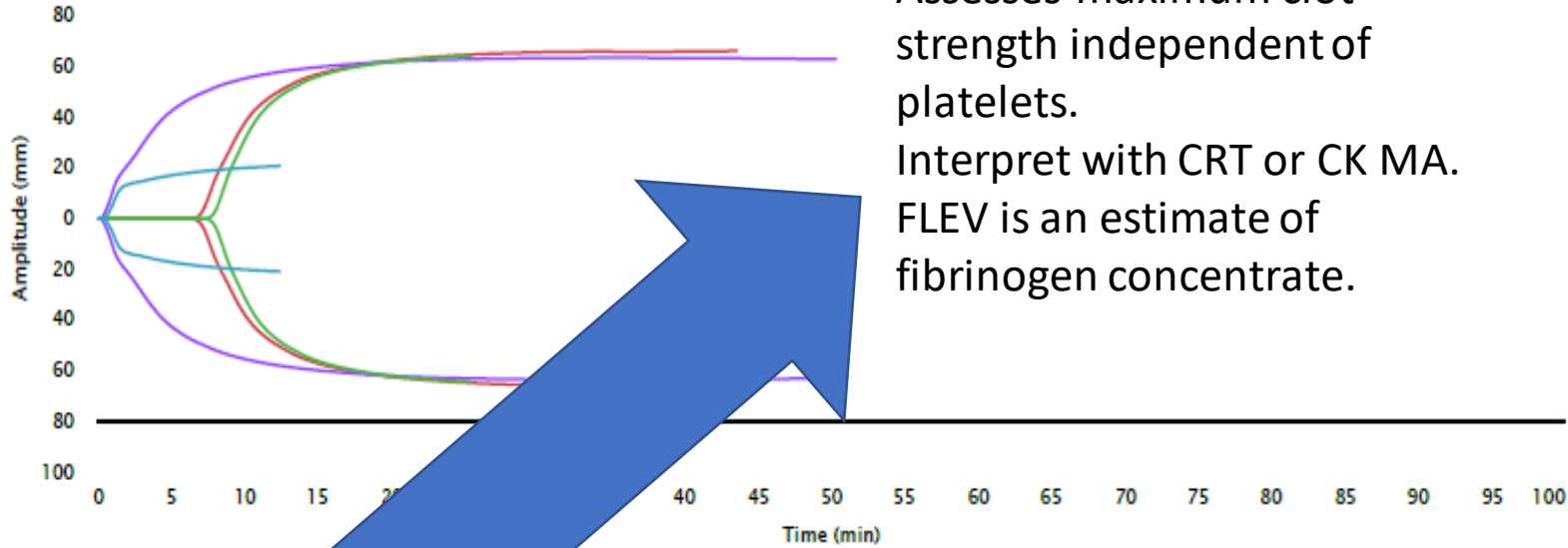
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CKH includes heparinase

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TEG



CFF:

Contains the GPIIb-IIIa antagonist Abciximab as a platelet inhibitor.

Assesses maximum clot strength independent of platelets.

Interpret with CRT or CK MA. FLEV is an estimate of fibrinogen concentrate.

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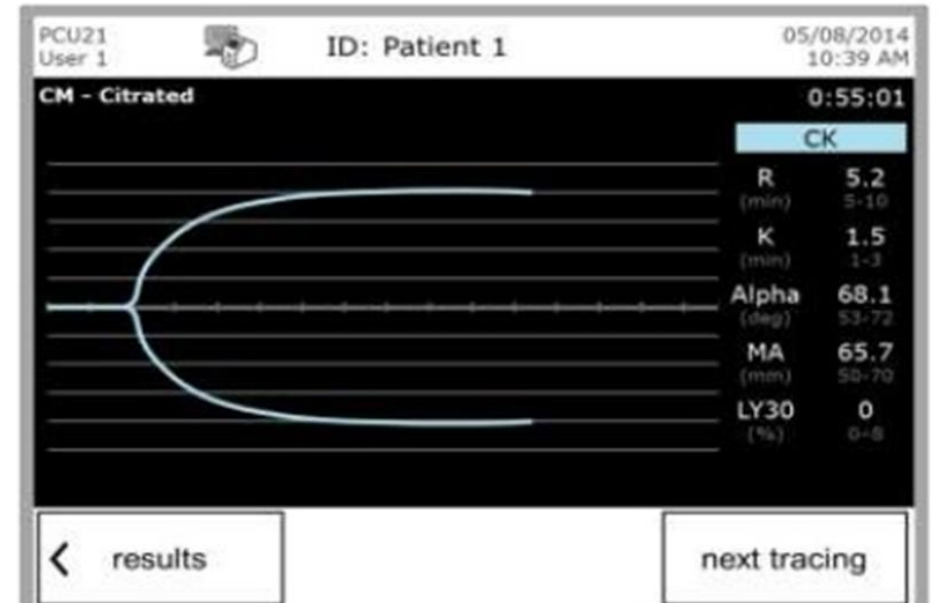
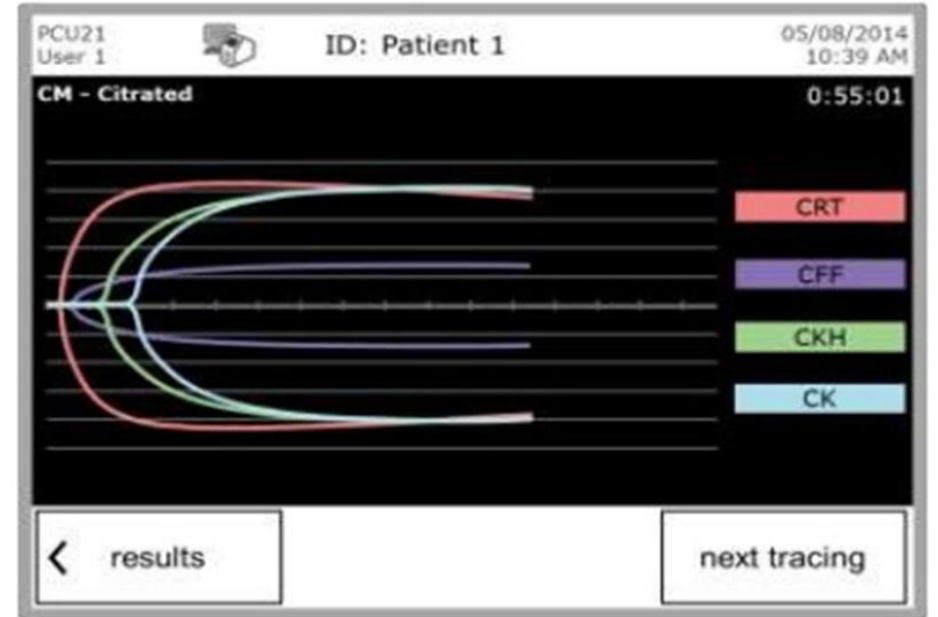
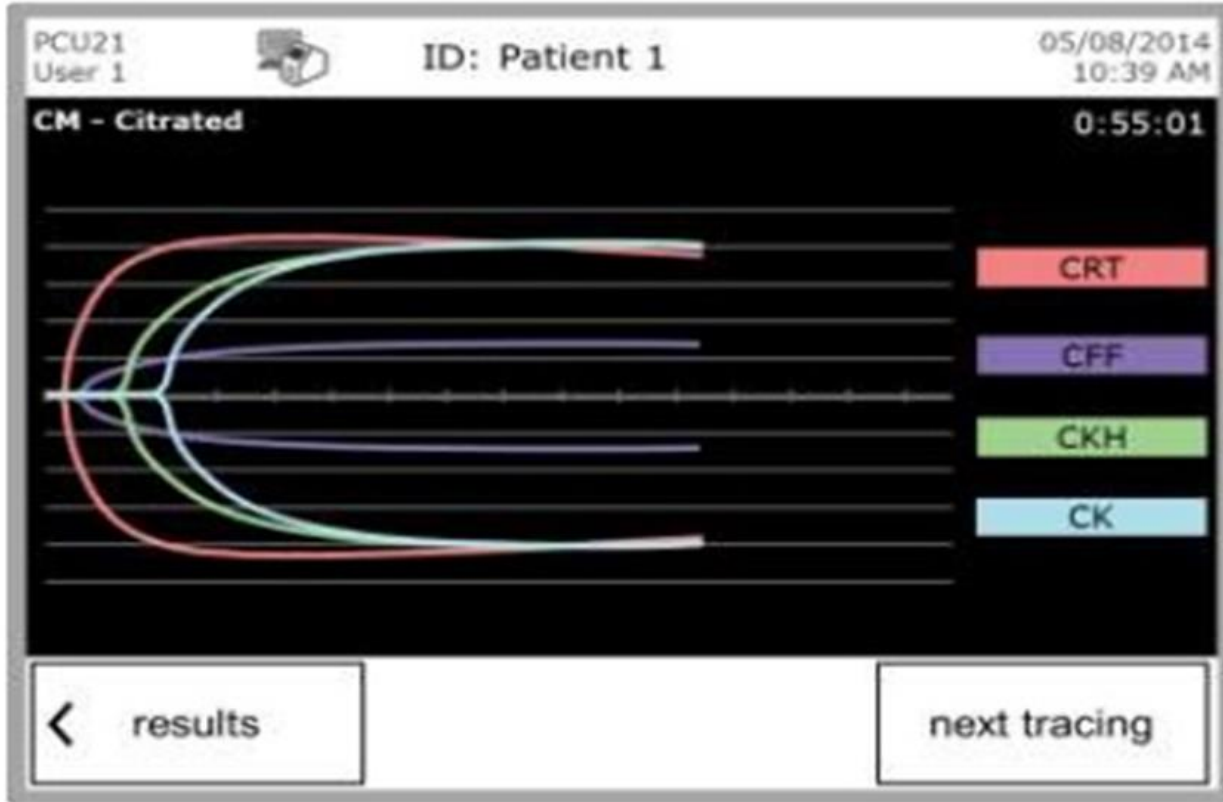
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Contains tissue factor as an activator. MA and Lysis 30 generated faster. R time may not be as reliable

TEG 6s Console Results



Practical aspects of TEG 6s: Simple!!

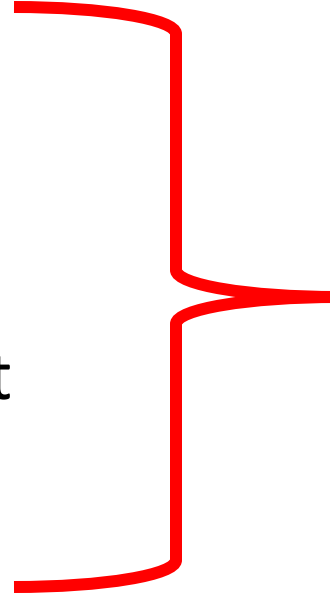
- Global TEG = Use a Citrated Coags tube (blue top)
- Platelet Mapping TEG = Use a heparinised blood gas syringe
- Need < 1mL
- Wait > 10 minutes after protamine administration
- Needs to be run within 30 minutes
- Cartridges: stored in fridge but need to be used at room temperature
- The device heats sample to 37 degrees (beware the hypothermic pt)
- Pipette blood to the cartridge line

Interpretation – Stepwise summary

1. Assess the R-time on the CK channel.
 - 1.1 If Heparin effect possible, compare this to the CKH channel.
2. Assess the MA on the CRT or CK channel
3. Assess the MA on the CFF channel
 - 3.1 If MA low on CRT but normal on CFF, need platelets
 - 3.2 If MA low on CFF but normal on CRT, need fibrinogen
 - 3.3 If MA low on both channels, need fibrinogen +/- platelets
4. Look for evidence of thrombolysis on the CRT or CK channel

INTREPRETATION: TAKE HOME MESSAGES

- R-time on CK
- MA on CRT
- MA on CFF
- R-time on CKH if heparin present
- LY-30 on CRT



**All the
information
you really
need!!**



INTERPRETATION: CAVEATS and PITFALLS

- TEG/ROTEM assess platelet “function”
 - Insensitive to thrombocytopenia > 50
- Look at the trace, not just the numbers
 - Bogus traces do occasionally occur
- Personal advice (not evidence based)
 - Caution with TEG/ROTEM results in the patient who is not bleeding
 - Caution with neuraxial techniques



TEG Platelet mapping

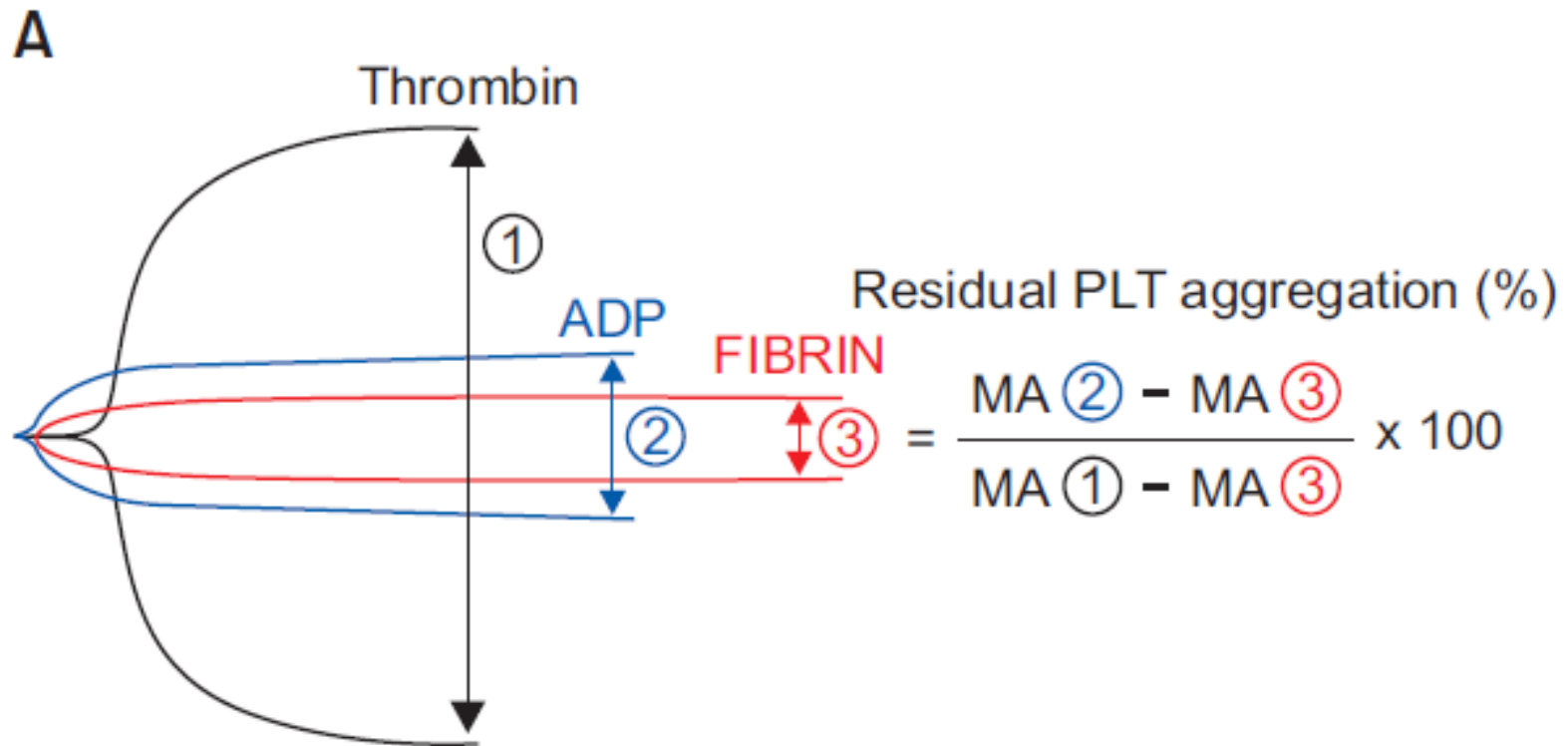
- Clopidogrel, Ticagrelor, Prasugrel frequently used
- Antagonise P2Y₁₂ receptor, preventing ADP-based platelet activation
- The effect of these drugs can be assessed using Platelet Mapping cartridge on the TEG 6s

TEG Platelet Mapping

- Blood collected in a heparinised tube
- Heparin prevents thrombin activation
- Platelets are activated by ADP
- Fibrin polymerisation (in absence of thrombin) is achieved by adding Activated Factor XIII and Reptilase
- MA of ADP channel is compared to a Heparinase-Kaolin cartridge
- % Inhibition is calculated
- > 30% inhibition is clinically meaningful



Platelet aggregation and inhibition



Platelet Mapping

- Heparin-induced thrombin inhibition = sensitive to antiplatelet agents
- Risk stratification for perioperative patients taking antiplatelets
- Can be used on Cardiopulmonary Bypass for heparinisation

TEG in transfusion algorithms

- Increasingly used
- Ideally developed locally in consultation with relevant stakeholders
- Mixed evidence for efficacy
 - Probably reduce total blood product usage
 - Reduce PRBC transfusion
 - May reduce mortality and ICU LOS
 - No clear evidence for reduced mortality
 - Studies are problematic and of limited quality

Mater Hospital Brisbane: General

TEG6S Interpretation & Action Guide for Critical Bleeding Patients



Collect blood in citrated tube/syringe - do not under or over fill the sample

Perform TEG using global haemostasis cartridge and citrated blood

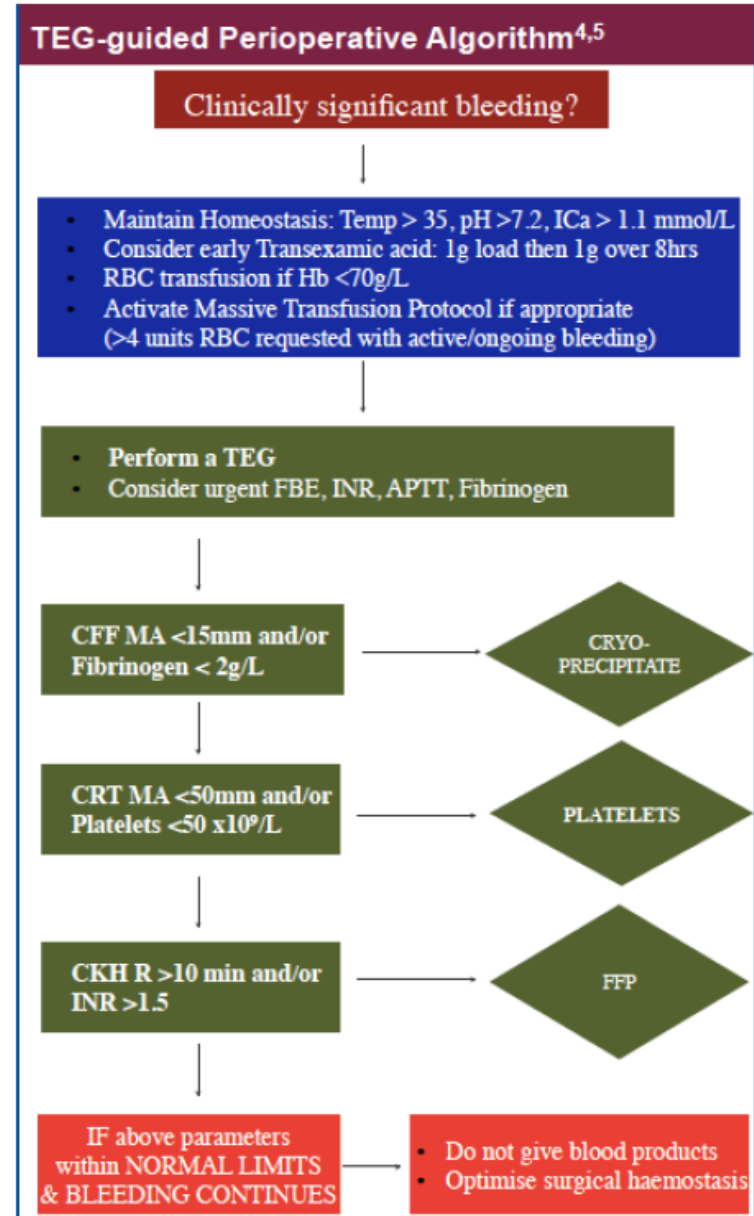
Test	Parameter	Ref range	Deficiency	Action	Dosing Guide
CK	Increased R	4.6 – 9.1 min	clotting factors*	FFP or Prothrombinex	FFP 2 units prothrombinex 25-50 units/kg
CKH	R < CK-R	4.3 – 8.3 min	heparin effect	protamine	1mg/100 units heparin (estimated effective heparin allowing for time since administered)
CFF	reduced MA	15 – 32 mm	fibrinogen	cryoprecipitate or fibrinogen concentrate	cryoprecipitate 1 unit/10kg (Issued as pooled or apheresis bags) fibrinogen concentrate 3gm stat or 25-50mg/kg when patient weighs <60kg Refer to fibrinogen concentrate guidelines below
CRT	reduced MA	52 – 70 mm	platelets**	platelets	platelets 1 dose
CRT	increased LY30	0 – 2.2%	fibrinolysis	tranexamic acid	Loading dose 1gm in 100mL over 10 minutes then infusion 1 gram in 100mL over 8 hours (12.5mL/hr)

* in presence of heparin (CK-R > CKH-R) refer to CKH-R for adequacy of clotting factors

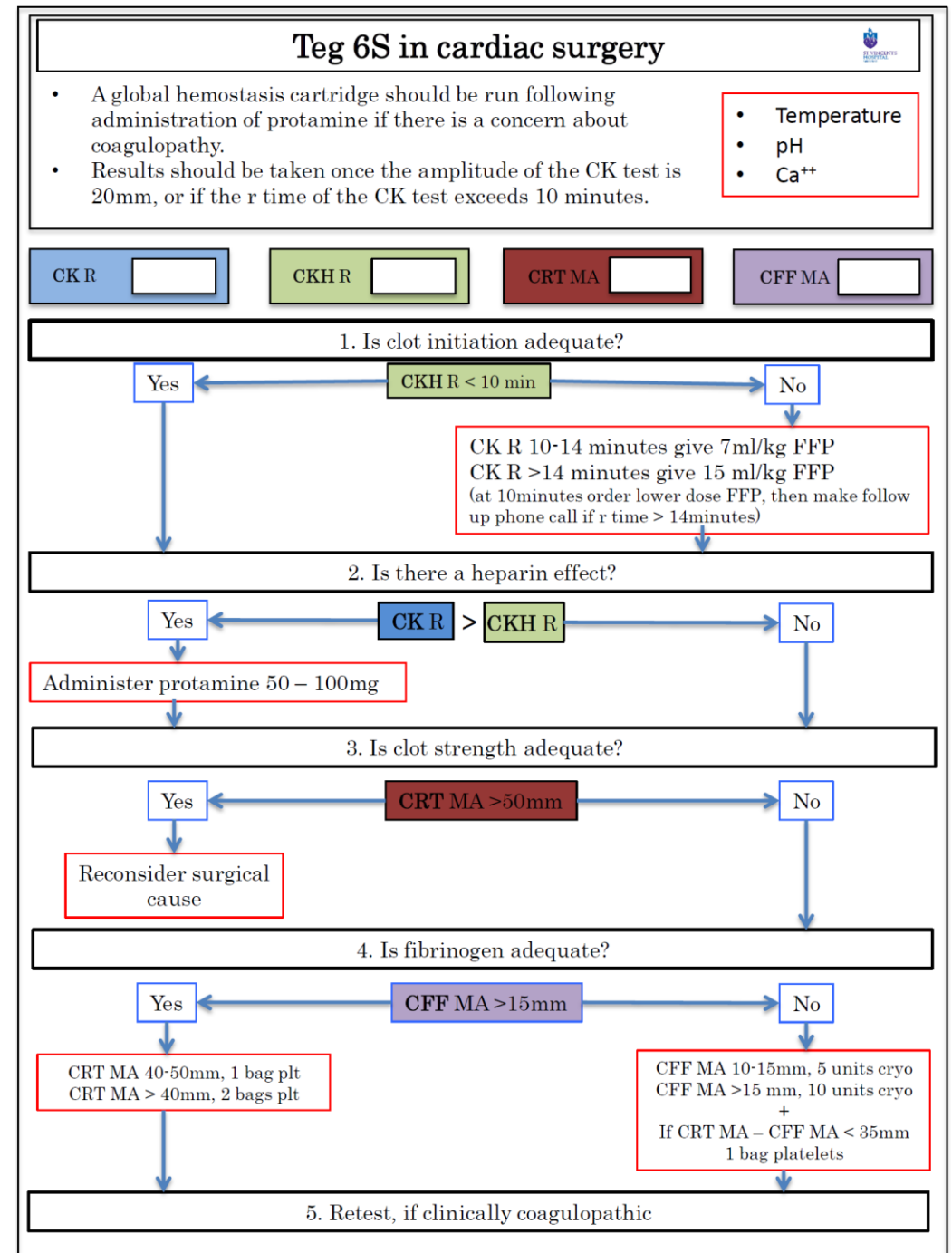
** if CFF-MA normal

Repeat TEG 10 minutes post goal directed intervention

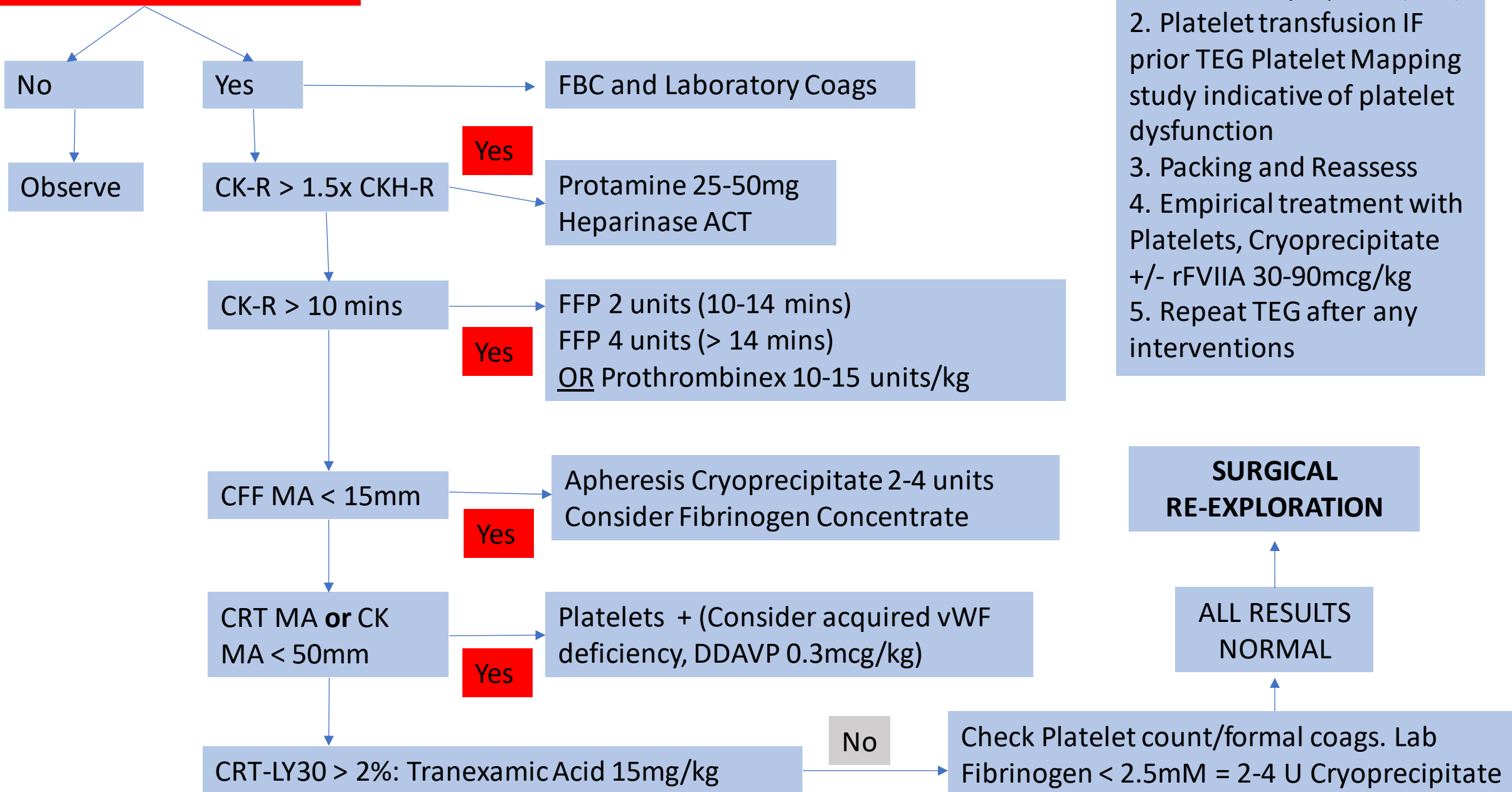
Monash



St Vincent's Cardiac



Cardiovascular Surgery and ICU Bleeding Post-Protamine



- Consider:**
1. Thrombocytopenia (FBC)
 2. Platelet transfusion IF prior TEG Platelet Mapping study indicative of platelet dysfunction
 3. Packing and Reassess
 4. Empirical treatment with Platelets, Cryoprecipitate +/- rFVIIA 30-90mcg/kg
 5. Repeat TEG after any interventions

Conclusions and Summaries

- TEG/ROTEM is an incredibly powerful perioperative device
- It provides unique data regarding clot formation
- It complements traditional laboratory tests
- Modern tests are typically multichannel assays: use them together
- Don't be overwhelmed by all the data produced
 - R-time CK, MA CRT, MA CFF provide most information needed
- Like any monitoring device, its use needs to be supported with algorithms and practice change

Personal insights: setting up a programme

- Talk to other centres and use the expertise of the suppliers
- Introduce a device as part of a Patient Blood Management Programme
 - Demonstrate a clinical and economic benefit
- Get buy-in from haematology/transfusion, surgery, critical care early
- Build local algorithms or agree to adopt pre-existing ones
 - Builds rapport with your haematology colleagues
- Audit your practice over time

Thank you

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