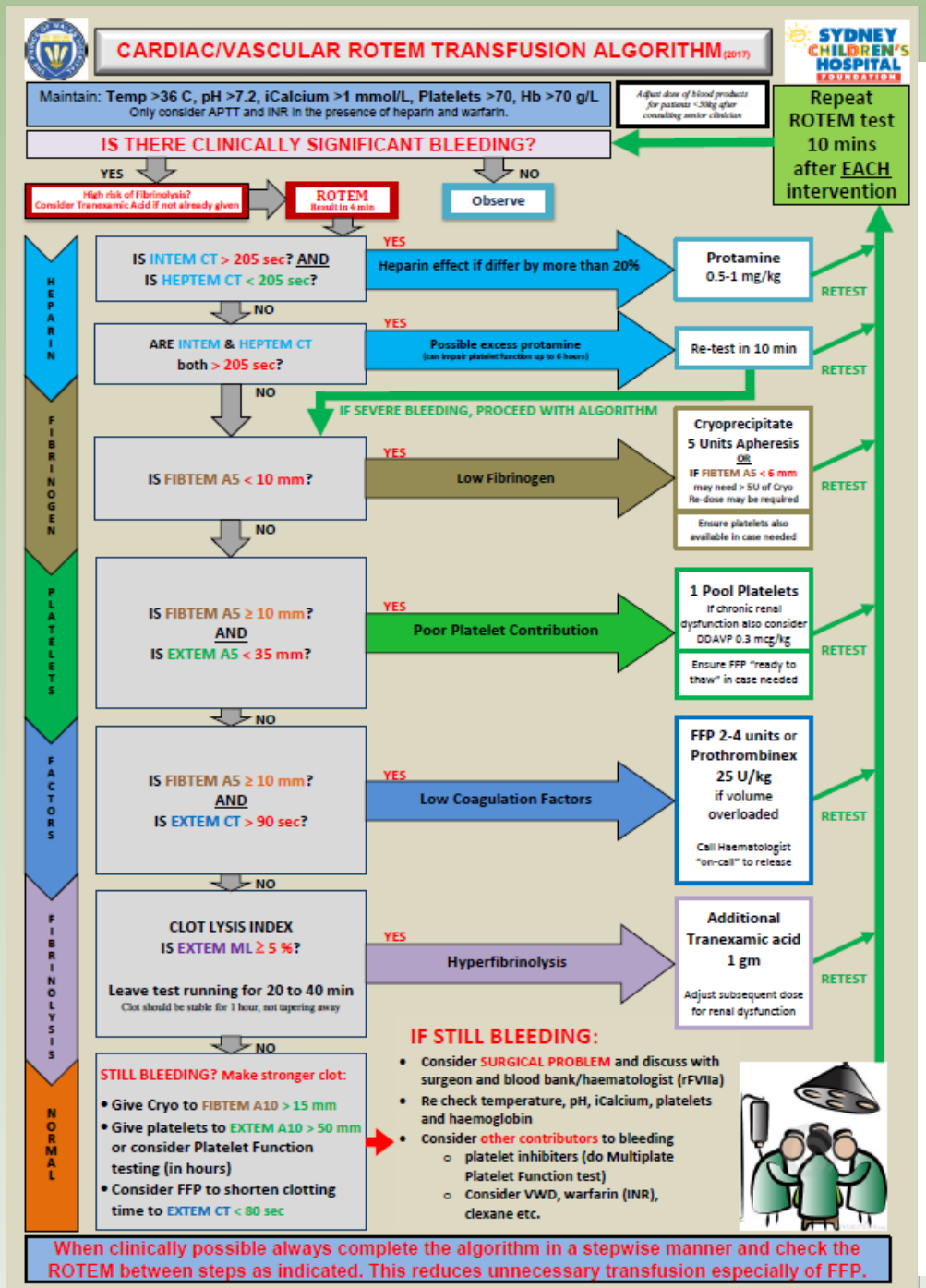
Aortic Aneurysm Repair

Feb 2019

Thanks to Dr Peter Garnett from Dept of Anaesthesia in Royal Perth Hospital for sharing this.

Disclaimer / Pre-amble

- These cases have been de-identified to protect the identity of the patient and the treating teams.
- These are all real cases and real ROTEMs. The individuals involved in these difficult cases have agreed to anonymously share these with us – thank you for your generosity.
- Successful management of the bleeding patient involves much more than just administration of blood products.
- The primary aim of these cases is to teach the use ROTEM guided blood product therapy. We have deliberately not included a lot of detail about some of the other aspects of management which might detract from this focus.



ROTEM ANALYSIS AND TREATMENT PLAN

Nurse or JMO to circle algorithm used then insert results from ROTEM Next circle range (action red range) and use algorithm to create a plan.

Date: / / Time:

ALGORITHM USED (circle one):

CARDIAC/VASCULAR or GENERAL/OBSTETRIC

- For CARDIAC/VASCULAR start here and do all:

INTEM CT = ... Below 205 / 205 & Above

HEPTEM CT = ... Below 205 / 205 & Above

- For GENERAL/OBSTETRIC start here(this section only):

EXTEM A5 = ... Below 35 / 35-40 / Above 40

FIBTEM A5 = ... Below 10 / 10-15 / Above 15

EXTEM CT =..... Below 80 / 80-90 / Above 90

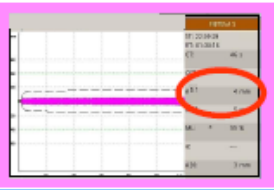
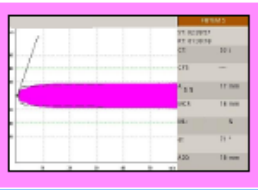
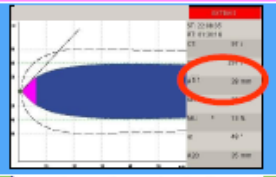
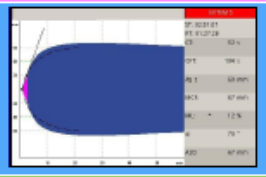
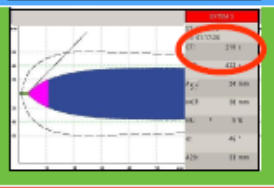
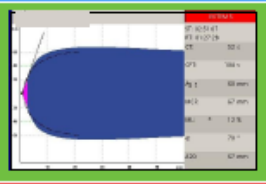
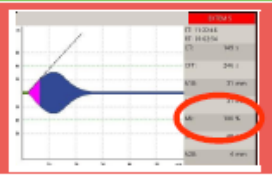
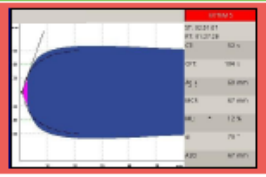
EXTEM ML =.....Below 5 / 5 & Above

Management Plan: .....

Please stick this label in the patients progress notes

KEMH ROTEM Algorithm for Critical Bleeding

Key Points: This algorithm should be used in conjunction with the KEMH Blood Product Guidelines for Major Obstetric Haemorrhage. Only treat abnormal values if active bleeding or at high risk of bleeding. Repeat ROTEM analysis 10 mins after intervention to assess response.

	ABNORMAL ROTEM	CRITERIA	DIAGNOSIS	INTERVENTION	CORRECTED ROTEM
FIBRINOGEN		**FIBTEM A5≤10mm**	**Low fibrinogen**	**Cryoprecipitate OR Fibrinogen concentrate** (see dosing guide) **AND Tranexamic acid 1 g**	
PLATELETS		**EXTEM A5 ≤35mm** and FIBTEM A5 ≥10mm	**Low platelets**	**Platelets: 1 adult dose** (correlate with platelet count)	
		EXTEM A5 ≤25mm and FIBTEM A5 ≤10mm	**Low platelets** and **Low fibrinogen**	**Platelets and fibrinogen** (correlate with platelet count)	
FACTORS		**EXTEM CT 80-140s** and FIBTEM A5 ≤10mm	**Low fibrinogen**	Correct **fibrinogen** and reassess	
		EXTEM CT >140s and FIBTEM A5 ≤10mm	**Low fibrinogen and Low coagulation factors**	**FFP 1-2U + Fibrinogen as indicated** (Consider Prothrombinex-see below)	
FIBRINOLYSIS		Early Diagnosis **EXTEM A5≤35mm** or **FIBTEM CT >600s**	**High likelihood of excess fibrinolysis**	**Tranexamic acid 1g** Consider repeat dose if has lost over 1 blood volume since initial dose	
		Late Diagnosis **EXTEM or FIBTEM ML ≥5%**	**Excess fibrinolysis**		

Fibrinogen Dosing Guide

FIBTEM A5 Target: ≥12mm

FIBTEM A5	Increase required	Cryoprecipitate	Fibrinogen Concentrate
9-10mm	2-3 mm	1-2 doses	2g*
7-8mm	4-5 mm	1-2 doses	3g*
4-6mm	6-8 mm	2 doses	4g
<4mm	≥9mm	2 doses	5g

*Outside of currently approved guidelines, must be discussed with haematologist

Fibrinogen Concentrate

Guidelines For Use

- Consultant anaesthetist or haematologist approval required.
- Patients must be experiencing life threatening haemorrhage.
- Fibrinogen concentrate may be indicated instead of, or in addition to, cryoprecipitate if the FIBTEM A5 is 6mm or below, OR there is a high suspicion of coagulopathy in a life threatening haemorrhage.
- Use at higher FIBTEM values may be appropriate in patients refusing cryoprecipitate.

Administration

- Reconstitute 1g in 50ml warm sterile water (use prepared kit in fluid warmer).
- Swirl gently and do not shake (to avoid foaming).
- Administer each 1g via syringe driver over 2-4 mins if life-threatening haemorrhage or over 10 mins if not.

Cryoprecipitate

1. 1 dose is equivalent to 10 whole blood units or 5 apheresis units.
2. May be supplied as whole blood units or as apheresis units (or a combination) 1 apheresis unit = 2 whole blood units.
3. Availability time: generally available within 10 minutes of request being made

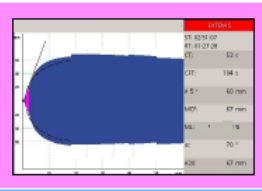
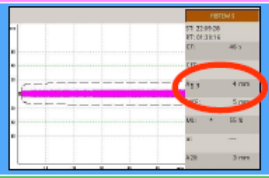
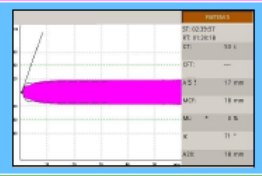
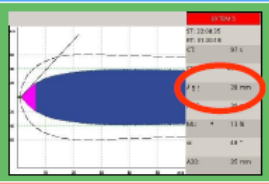
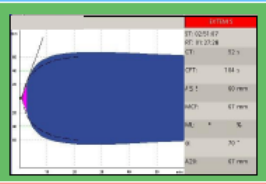
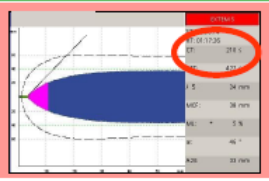
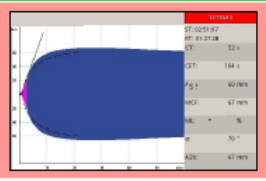
Prothrombinex

1. Haematologist approval required
2. Consider as an alternative to FFP for patients with coagulation factor deficiency (e.g. prolonged EXTEM CT see above) in the following circumstances:
   - Circulatory overload
   - Rapid correction in extreme coagulopathy

Endorsed by the Department of Anaesthesia and Pain Medicine and the Hospital Transfusion Committee on 31/05/2017

SCGH ROTEM Algorithm for Critical Bleeding

Key Points: This algorithm should be used in conjunction with the SCGH Critical Bleeding Protocol. Only treat abnormal values if active bleeding or at high risk of bleeding. Repeat ROTEM analysis 10 mins after intervention to assess response.

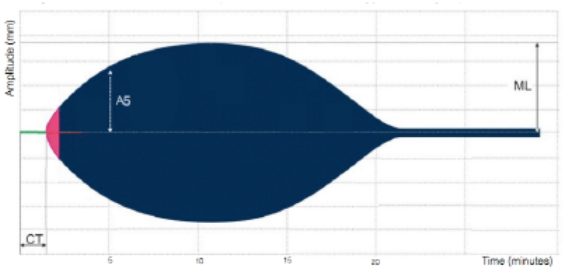
	ABNORMAL ROTEM	CRITERIA	DIAGNOSIS	INTERVENTION	CORRECTED ROTEM
FIBRINOLYSIS		Early Diagnosis **EXTEM A5≤35mm** or **FIBTEM CT >600s**	**High likelihood of excess fibrinolysis**	**Tranexamic acid 1g** Consider repeat dose if has lost over 1 blood volume since initial dose	
		Late Diagnosis **EXTEM or FIBTEM ML ≥5%**	**Excess fibrinolysis**		
FIBRINOGEN		**FIBTEM A5≤10mm**	**Low fibrinogen**	**Cryoprecipitate** (see dosing guide)	
PLATELETS		**EXTEM A5 ≤35mm** and FIBTEM A5 >10mm	**Low platelets**	**Platelets: 1 adult dose** (correlate with platelet count)	
		EXTEM A5 ≤25mm and FIBTEM A5 ≤10mm	**Low platelets** and **Low fibrinogen**	**Platelets and fibrinogen** (correlate with platelet count)	
FACTORS		**EXTEM CT 80-140s** and FIBTEM A5 ≤10mm	**Low fibrinogen**	Correct **fibrinogen** and reassess	
		EXTEM CT >80s but FIBTEM A5 >10mm	**Low coagulation factors**	**FFP 1-4U** or **Prothrombinex 10 U/kg** (+ fibrinogen if indicated)	
		EXTEM CT >140s and FIBTEM A5 ≤10mm	**Low fibrinogen and Low coagulation factors**		

Fibrinogen Dosing Guide

FIBTEM A5 Target: ≥12mm

FIBTEM A5	Increase required	Cryoprecipitate*
9-10mm	2-3 mm	10 Units
7-8mm	4-5 mm	15 Units
4-6mm	6-8 mm	20 Units
<4mm	≥9mm	20-25 Units

*Cryoprecipitate dosing is for standard adult units
(Cryo 5 units = Fibtem A5 increase of approx 2mm)



Prothrombinex

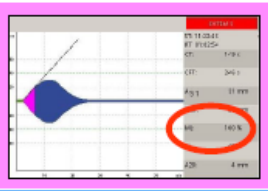
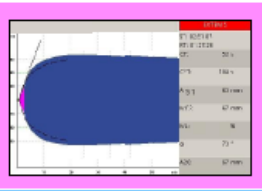
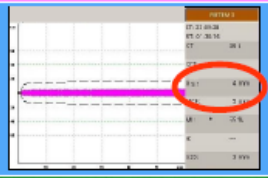
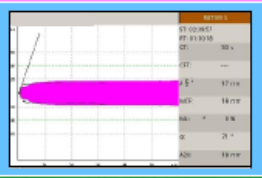
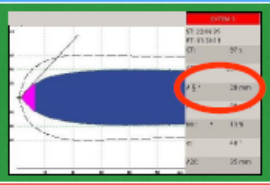
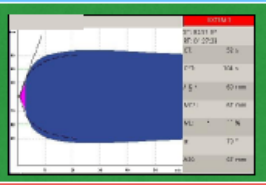
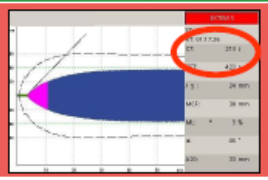
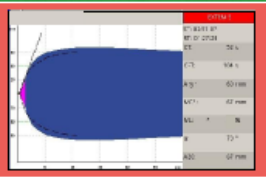
1. Warfarin Reversal: Indicated for urgent reversal of warfarin in critical bleeding, usual dose 25-50U/kg (+/- FFP) discuss with haematologist.

2. Consider as an alternative to FFP for patients with coagulation factor deficiency (e.g. prolonged EXTEM CT see above) in the following circumstances:
- Circulatory overload
- Rapid correction in extreme coagulopathy
- Consider lower dose 10U/kg (round to nearest 500U).

Endorsed by the Department of Anaesthesia and Pain Medicine and the Haematology department January 2017 Adapted from KEMH hospital algorithm with permission

FSH ROTEM Algorithm for Critical Bleeding

This algorithm should be used in conjunction with the FSH Major Haemorrhage Protocol
Treat abnormal values only if there is active bleeding or the patients is at high risk of bleeding.
Repeat ROTEM analysis 10 mins after any intervention to assess response.

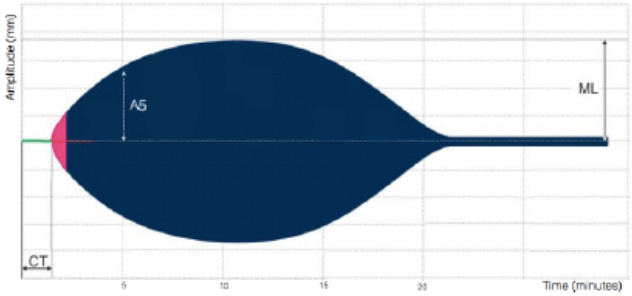
	ABNORMAL ROTEM	CRITERIA	DIAGNOSIS	INTERVENTION	CORRECTED ROTEM
FIBRINOLYSIS		Trauma (within 3hrs) OR Post partum haemorrhage	→	Tranexamic acid 1g	
		Flat trace OR Maximal lysis >5%	Hyperfibrinolysis		
FIBRINOGEN		FIBTEM A5 ≤10mm	Hypofibrinogenaemia	Cryoprecipitate	
PLATELETS		EXTEM A5 ≤35mm with normal fibrinogen*	Thrombocytopaenia	Platelets	
FACTORS		EXTEM CT 90-140sec with normal fibrinogen** OR EXTEM CT >140sec	Low coagulation factors	Fresh Frozen Plasma 2-4u OR Prothrombinex 25IU/kg	

Cryoprecipitate Dosing Guide

FIBTEM A5	Non-obstetric	Obstetric
7-10	1 dose	2 doses
<6	2 doses	3 doses

One dose = five apheresis units = Fibtem A5 increase of approximately 4mm

*If EXTEM ≤25 and FIBTEM A5 ≤10 consider replacing both factors
**Fibrinogen replacement in the context of hypofibrinogenaemia may overcome a minor prolongation of clotting time



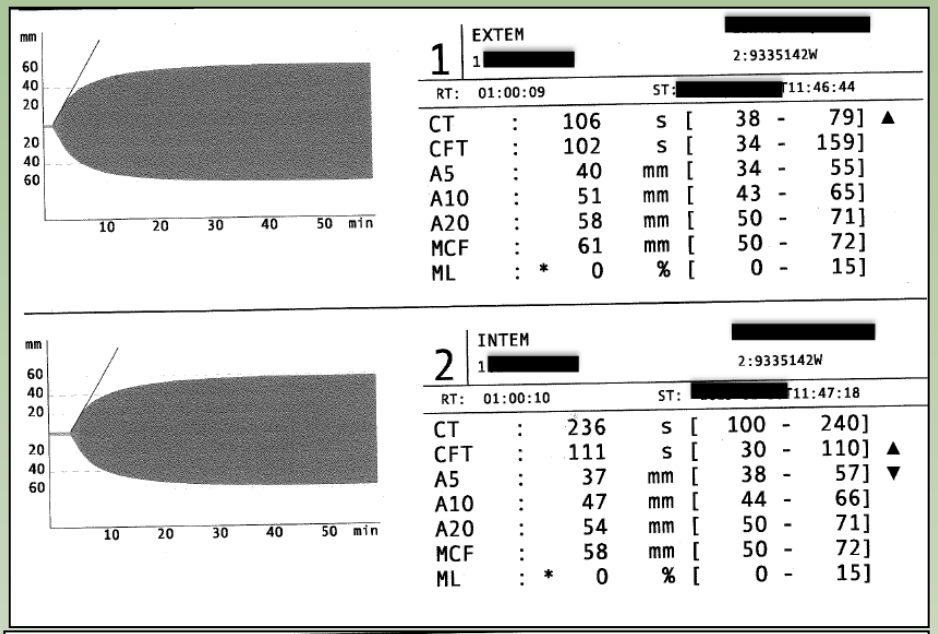
Key components	
EXTEM CT Clotting Time	Thrombin generation
EXTEM A5 Amplitude at 5 minutes	Fibrinogen and platelet concentration and function
FIBTEM A5 Amplitude at 5 minutes	Fibrinogen concentration and function
ML % Maximal lysis	Degree of fibrinolysis over temogram

Version 1.2. Endorsed by the Department of Anaesthesia and Pain Medicine and the FSH Transfusion Services Committee on 10/11/16. Adapted from the King Edward Memorial Hospital ROTEM algorithm.

History

- Elderly man for elective open AAA repair
- Complex surgery due to previous endovascular repair 15 years ago. Expected surgical time 4-6 hours.
- History of IHD, COPD, CVA and PVD.
- Mid procedure (and post heparin) the surgeons complained of “oozing”. Approximately 1L had been gradually collected by cell salvage.

ROTEM 1

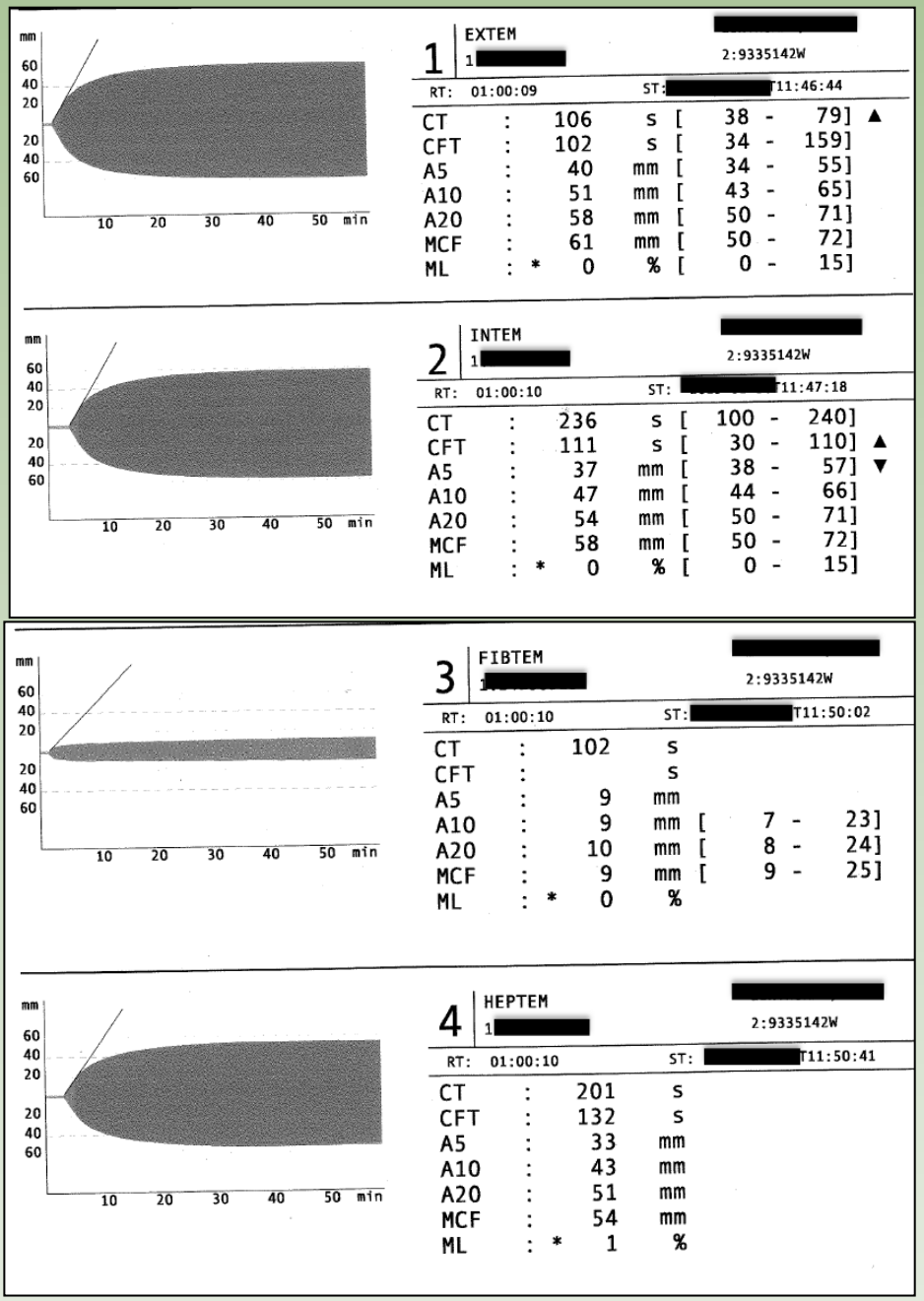


Key Findings

- Fibtem A5 = 9mm
- Extem CT = 106s
- Extem A5 = 40mm
- Intem CT = 236s
- Heptem CT = 201s

Have a go and try and interprete this one yourself!

Interpretation



Key Findings

- Fibtem A5 = 9mm
- Extem CT = 106s
- Extem A5 = 40mm
- Intem CT = 236s
- Heptem CT = 201s

Interpretation

1) No evidence of fibrinolysis but give TXA 1g
2)Fibrinogen – Fibtem A5 =9mm, this is low and only likely to get worse – treat with 1-2 adult doses of cryoprecipitate.
3) Platelets – Extem A5 >35mm Platelets not reqd
4) Extem CT = 106s slightly prolonged – could be heparin or fibrinogen deficiency
5) Intem CT = 236s upper normal – patient has had some heparin
6) Heptem CT = 201s shorter than Intem CT so there probably is a smal heparin effect.

Clinical Events

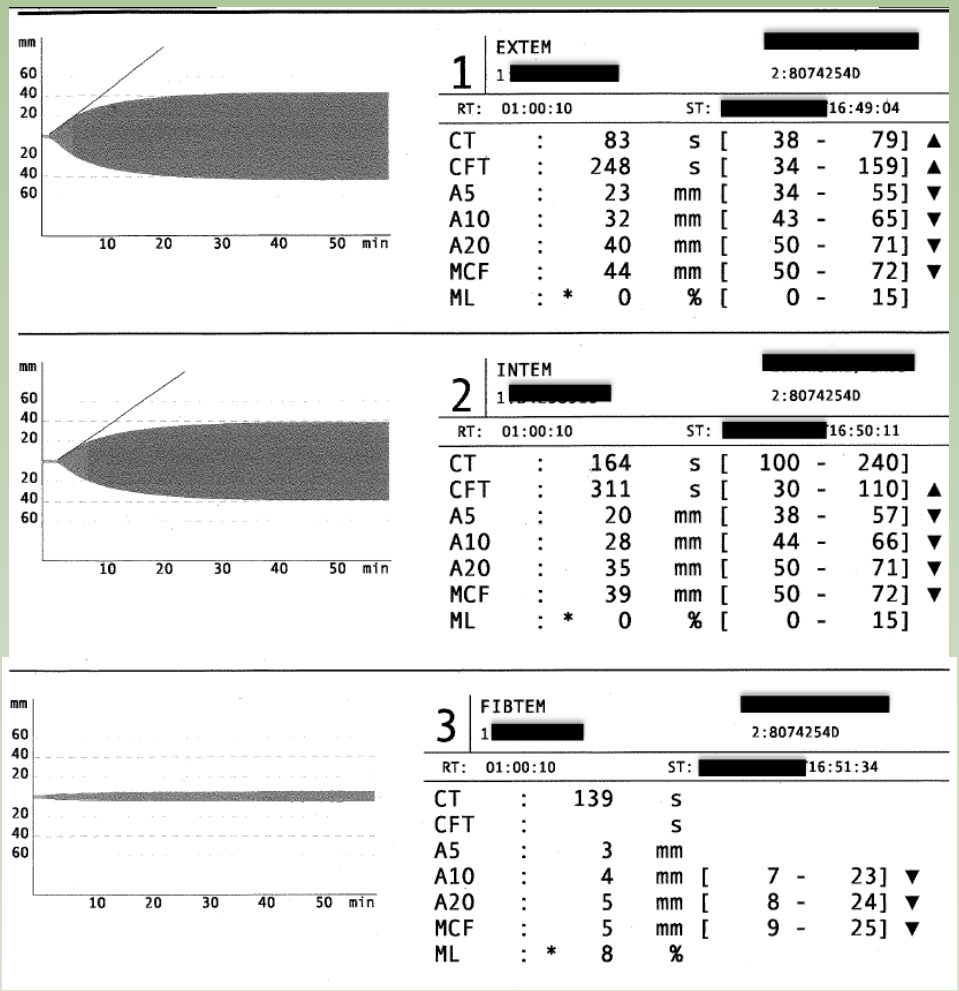
The ROTEM was interpreted as unremarkable except for mild heparin effect:

- The patient was given TXA 1g.

Clinical Events

- At the end of the procedure the patient was taken intubated to ICU.
- Estimated blood loss was 2L and haemostasis had been achieved.
- That patient receive 700ml of salvaged blood and 2 units of PRBS along with 5L of crystalloid /colloid over the 8 hours in theatre.
- No other factors were given.
- Another ROTEM was sent from ICU – (approx 5 hours after the first one).

ROTEM 2

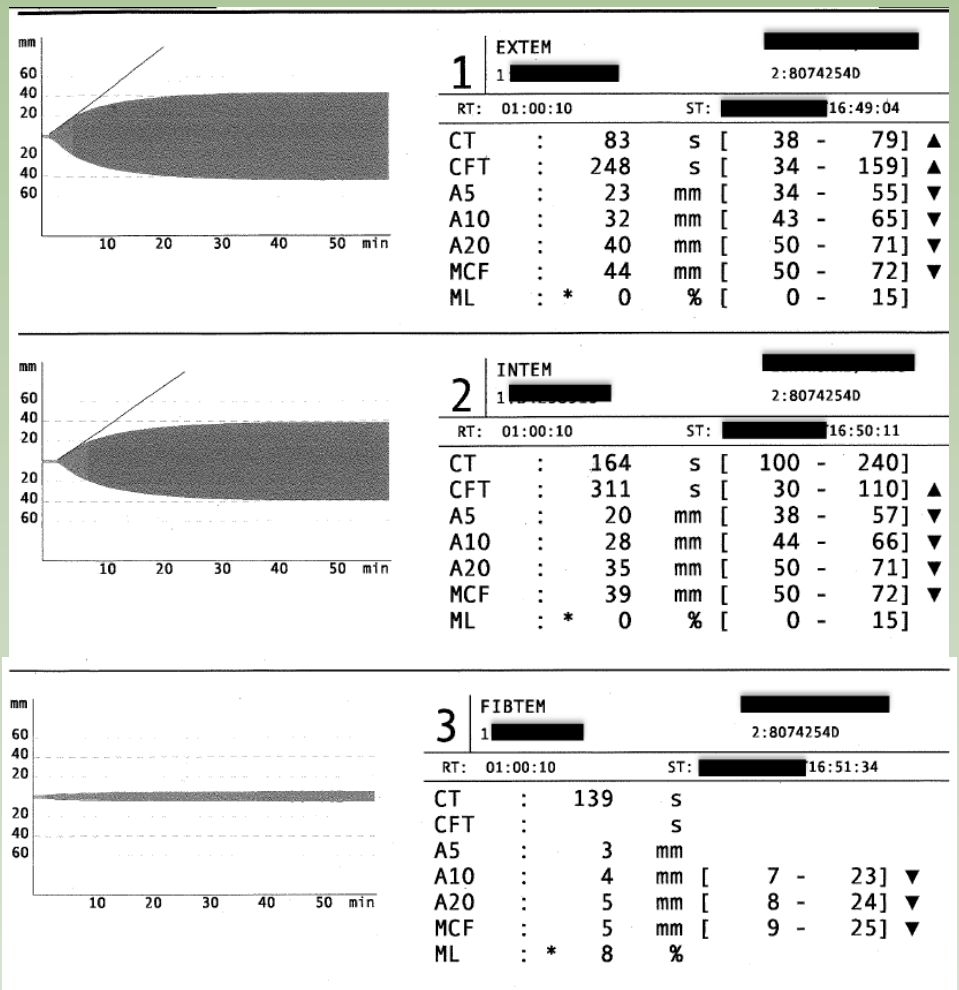


Key Findings

- Fibtem A5 = 3mm
- Extem CT = 83s
- Extem A5 = 23mm
- Intem CT = 164s

Have a go and try and interprete this one yourself!

Interpretation



Key Findings

- Fibtem A5 = 3mm
- Extem CT = 83s
- Extem A5 = 23mm
- Intem CT = 164s

Interpretation

Severe coagulopathy has now developed.

1) No evidence of fibrinolysis but consider another dose of TXA 1g (>5hours since the last dose)

2)Fibrinogen – Fibtem A5 =3mm, this is extremely low treat with 2 adult doses of cryoprecipitate or 4-5g of fibrinogen concentrate

3) Platelets – Extem A5=23mm Likely due mainly to the low fibrinogen but borderline and may benefit from dose of platelets also.

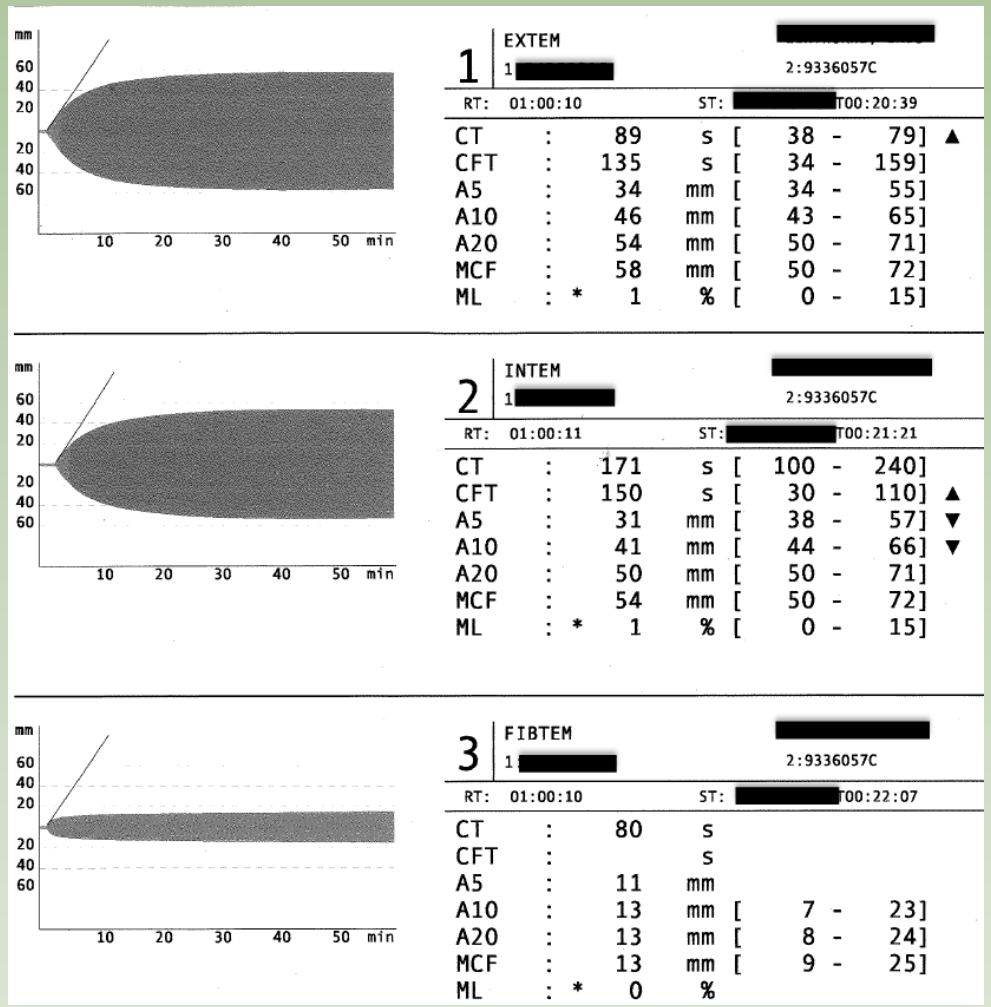
4) Extem CT = 83s normal – heparin has probably now gone.

5) Intem CT = 164s normal – heparin has probably now gone.

Clinical Events

- Following the deranged ROTEM findings and “increased drain output” the patient received Cryo 20 units, a unit of platelets and further TXA. Repeat ROTEMs attached.

ROTEM 3

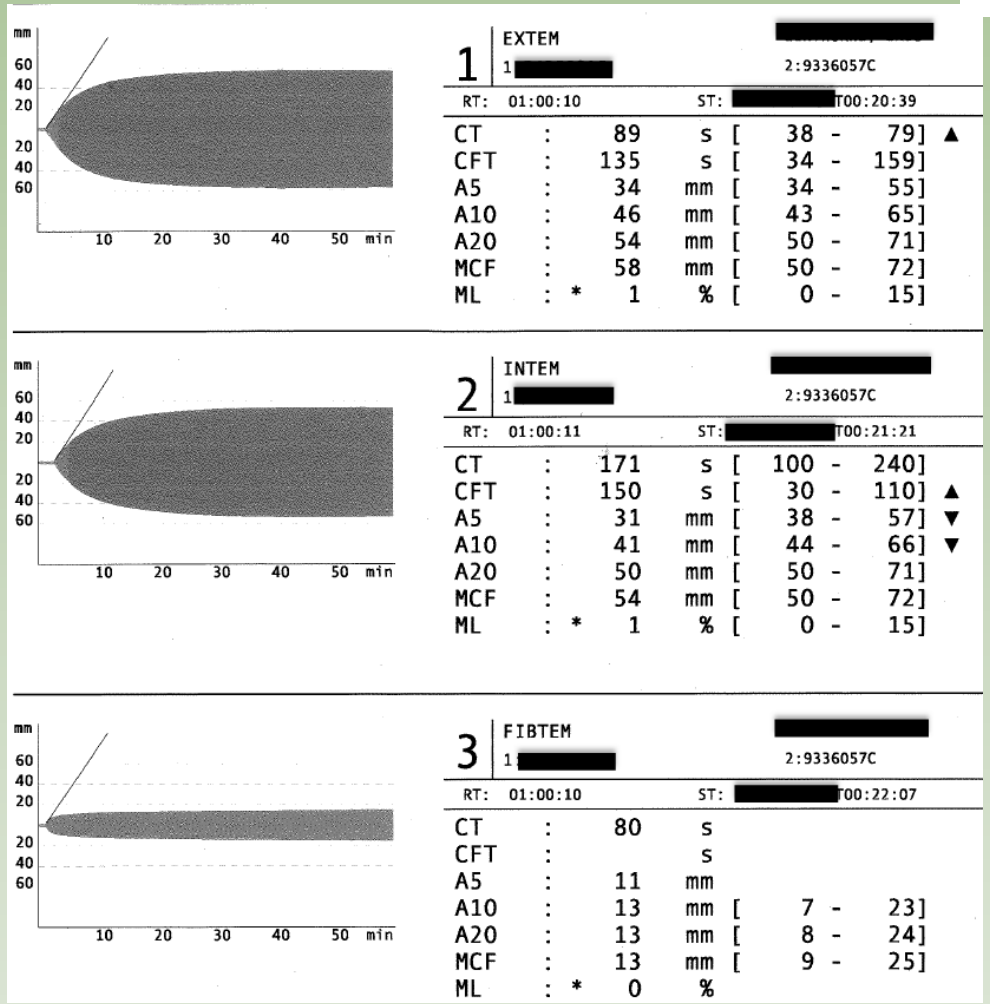


Key Findings

- Fibtem A5 = 11mm
- Extem CT = 89s
- Extem A5 = 34mm
- Intem CT = 171s

Have a go and try and interprete this one yourself!

Interpretation



Key Findings

- Fibtem A5 = 11mm
- Extem CT = 89s
- Extem A5 = 34mm
- Intem CT = 171s

Interpretation

Severe coagulopathy has now resolved.
1) No evidence of fibrinolysis
2) Fibrinogen – Fibtem A5 =11mm, this is borderline – consider further treatment if bleeding still an issue
3) Platelets – Extem A5=34mm No need for further platelets.
4) Extem CT = 89s just above normal – likely sue to lowish fibrinogen (mild heparin effect unlikely because of normal Intem CT).
5) Intem CT = 171s normal – heparin has probably now gone.

Take Home Points

- Fibrinogen deficiency is usually the first abnormality to develop during ongoing blood loss.
- Large doses of fibrinogen are required when it is really low.
- Check ROTEM regularly during ongoing blood loss – normal results can become abnormal over time.

Thanks again to Dr Peter Garnett from the Dept of Anaesthesia Royal Perth Hospital WA for sharing this case.