Obstetric Haemorrhage

Jan 2019

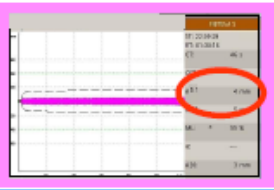
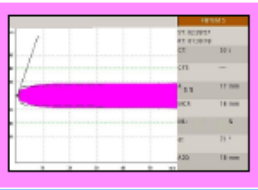
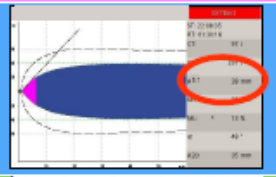
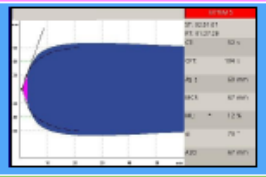
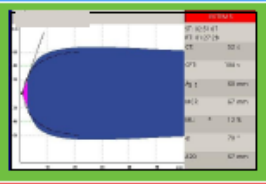
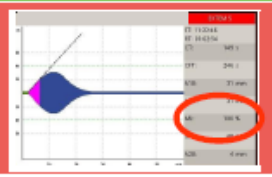
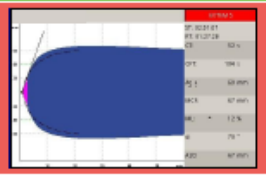
Thanks to Dr Natalie Akl & Dr David Hoppe from Dept of Anaesthesia Fiona Stanley Hospital for sharing this.

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.

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

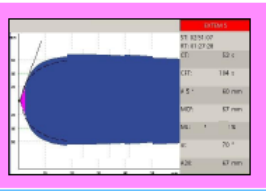
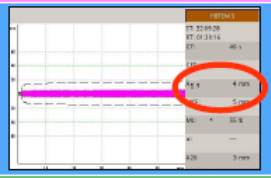
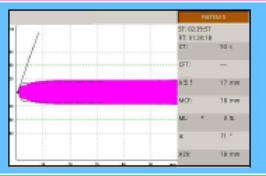
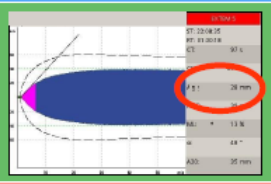
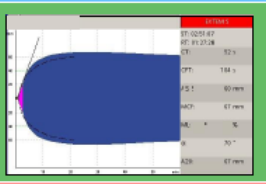
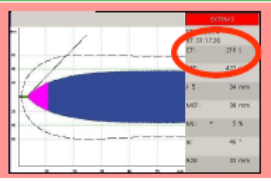
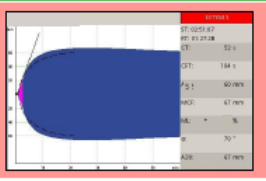
Prothrombinex

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.

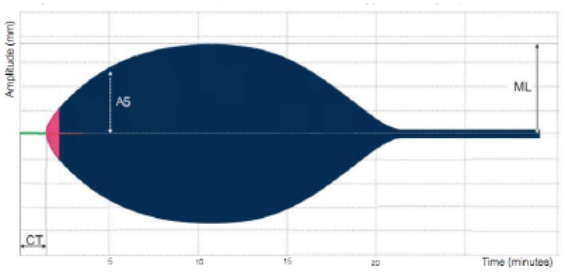
	ABNORMAL ROTEM	CRITERIA	DIAGNOSIS	INTERVENTION	CORRECTED ROTEM
FIBRINOLYSIS		Early Diagnosis **EXTEM A5≤35mm** or **FIBTEM CT >600s**	**High likelihood of excess fibrinolysis**	**Tranexamic acid 1g** Consider repeat dose if has lost over 1 blood volume since initial dose	
		Late Diagnosis **EXTEM or 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

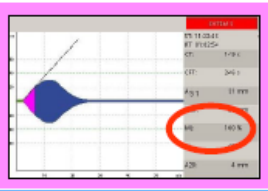
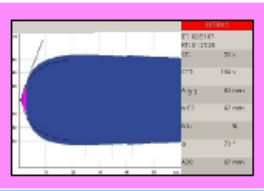
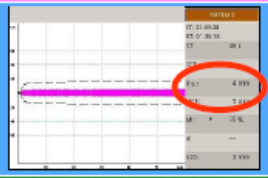
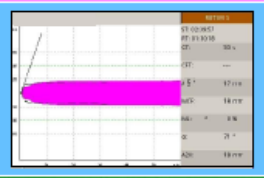
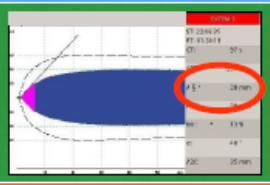
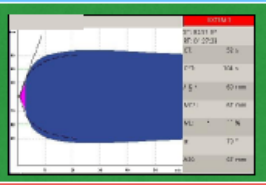
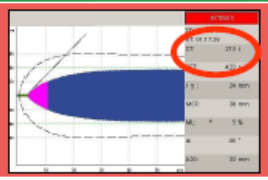
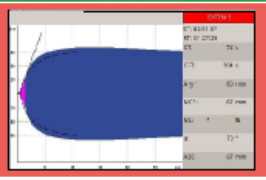
1. Warfarin Reversal: Indicated for urgent reversal of warfarin in critical bleeding, usual dose 25-50U/kg (+/- FFP) discuss with haematologist.

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.

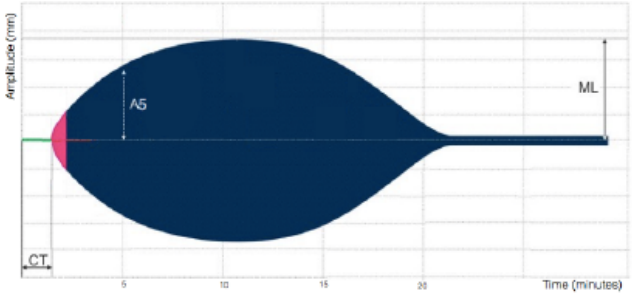
	ABNORMAL ROTEM	CRITERIA	DIAGNOSIS	INTERVENTION	CORRECTED ROTEM
FIBRINOLYSIS		Trauma (within 3hrs) OR Post partum haemorrhage Flat trace OR Maximal lysis >5%	→ Hyperfibrinolysis	Tranexamic acid 1g	
FIBRINOGEN		FIBTEM A5 ≤10mm	Hypofibrinogenaemia	Cryoprecipitate	
PLATELETS		EXTEM A5 ≤35mm with normal fibrinogen*	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.

GENERAL SURGICAL / OBSTETRIC HAEMORRHAGE ROTEM TRANSFUSION ALGORITHM (2017)

Maintain: Temp >36 C, pH >7.2, iCalcium >1 mmol/L, Platelets >70, Hb >70 g/L
Only consider APTT and INR in the presence of heparin and warfarin.

Adjust dose of blood products for patients <50kg after consulting senior clinician

Repeat ROTEM test 10 mins after EACH intervention

IS THERE CLINICALLY SIGNIFICANT BLEEDING?

YES

High risk of Fibrinolysis? Consider Tranexamic Acid now

ROTEM Result in 6 min

NO

Observe

FIBRINOLYSIS

EARLY DIAGNOSIS:
IS EXTEM A5 < 35 mm?

OR LATE DIAGNOSIS:
Leave test running for up to 60 min
IS EXTEM ML ≥ 5%?
Clot should be stable for 1 hour, not tapering > 5 %

YES → Hyperfibrinolysis → **Tranexamic Acid 1 gram**
Consider repeat dose if patient has lost over 1 blood volume since initial dose
Adjust subsequent dose for renal dysfunction

NO → PROCEED WITH ALGORITHM

FIBRINOGEN

IS FIBTEM A5 < 10 mm?

YES → Low Fibrinogen → **Cryoprecipitate 5 Units Apheresis**
OR
IF FIBTEM A5 < 8 mm may need > 5U of Cryo See "Dosage Schedule"
Ensure platelets also available in case needed
RETEST

NO

PLATELETS

IS FIBTEM A5 ≥ 10 mm?
AND
IS EXTEM A5 < 35 mm?

YES → Poor Platelet Contribution → **1 Pool Platelets**
If chronic renal dysfunction also consider DDAVP 0.3 mcg/kg
Ensure FFP "ready to thaw" in case needed
RETEST

NO

FACTORS

IS FIBTEM A5 ≥ 10 mm?
AND
IS EXTEM CT >90 sec?

YES → Low Coagulation Factors → **FFP 2-4 units**
OR
Prothrombinex 10 U/kg
If volume overloaded
RETEST

NO

NORMAL

STILL BLEEDING? Make stronger clot:
- Give Cryo to FIBTEM A10 > 15 mm
- Give platelets to EXTEM A10 > 50mm or consider Platelet Function testing (in hours)
- Consider FFP to shorten clotting time to EXTEM CT < 80 sec

IF STILL BLEEDING:
- Consider SURGICAL/OBSTETRIC PROBLEM and discuss with surgeon/obstetrician and blood bank/haematologist (rFVIIa)
- Re check temperature, pH, iCalcium, platelets and haemoglobin
- Consider other contributors to bleeding
  - platelet inhibiters (do Multiplate Platelet Function test)
  - Consider VWD, warfarin (INR), clexane etc.

When clinically possible always complete the algorithm in a stepwise manner and check the ROTEM between steps as indicated. This reduces unnecessary transfusion especially of FFP.

Please stick this label in the patients progress notes

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: .....

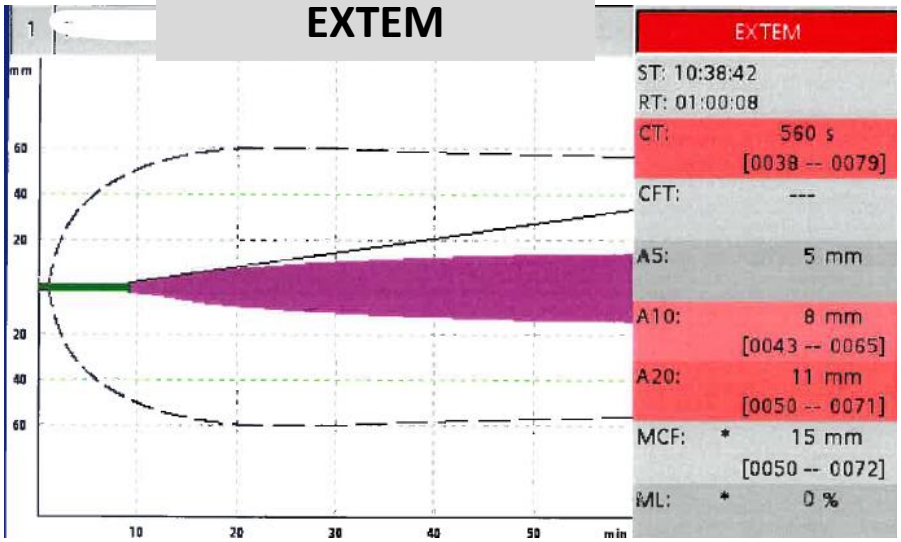
Please stick this label in the patients progress notes

History

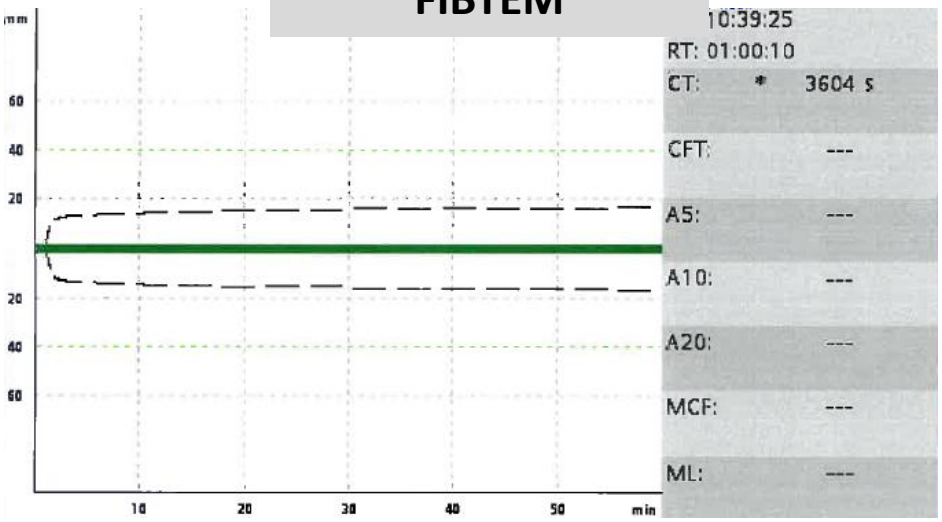
- Stillbirth and possible fetal death in utero
- Ongoing PPH – estimated blood loss 1.5L
- Bloods sent on arrival.

ROTEM 1

EXTEM



FIBTEM



FIBTEM A5 = 0mm!, EXTEM CT = 560s, EXTEM A5 = 5mm

What treatments would you give? Use the FSH algorithm or better your hospital's if it has one.

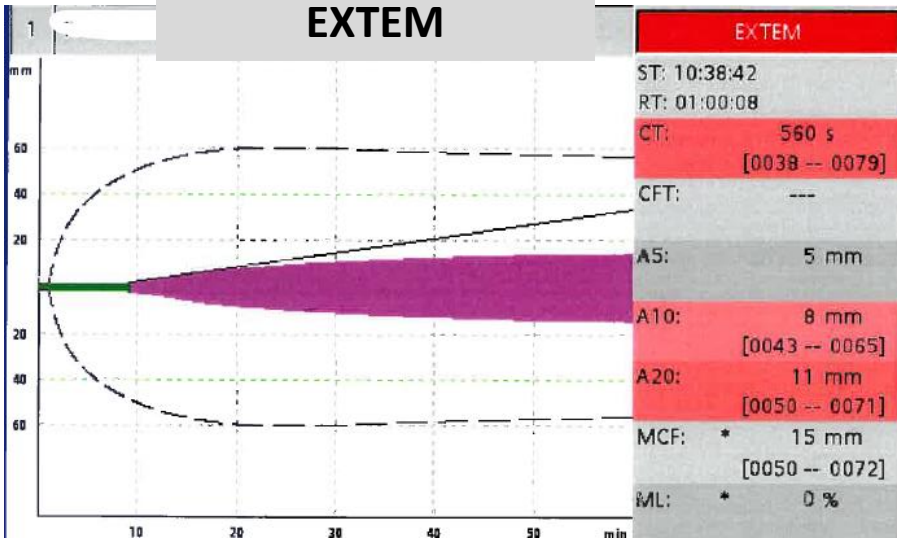
FBC/COAGS

- Hb 131
- Plt 73
- INR 3.2
- APTT 47.3
- Fib 0.2

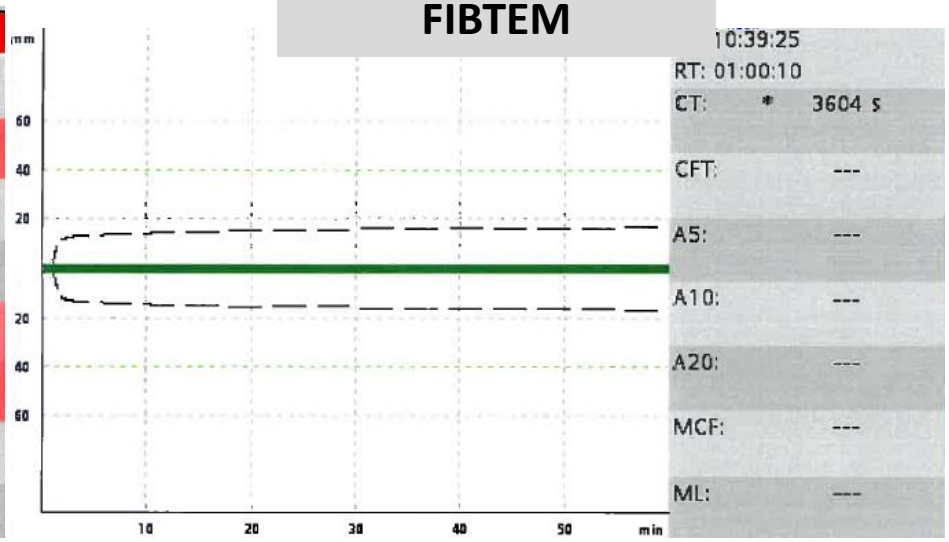
* These would usually not be available in the first 30 min

ROTEM 1

EXTEM



FIBTEM



FIBTEM A5 = 0mm!, EXTEM CT = 560s, EXTEM A5 = 5mm

INTERPRETATION

<u>Treatment if following FSH algorithm:</u>

FIBRINOLYSIS: Severe coagulopathy just give TXA 1-2g!

FIBRINOGEN: Fibtem A5 = 0mm – <u>very low</u> give a large dose of fibrinogen – e.g. 2-3 adult doses of cryoprecipitate (20-30 units of whole blood cryo OR 10-15 units of apheresis cryo) OR fibrinogen concentrate 4-6g

PLATELETS: Extem A5 = 5mm – indicative of fibrinogen <u>and</u> platelet deficiency. Also give platelets.

FACTORS: Extem CT = 560s – very long might correct with fibrinogen / platelets but consider FFP or prothrombinex.

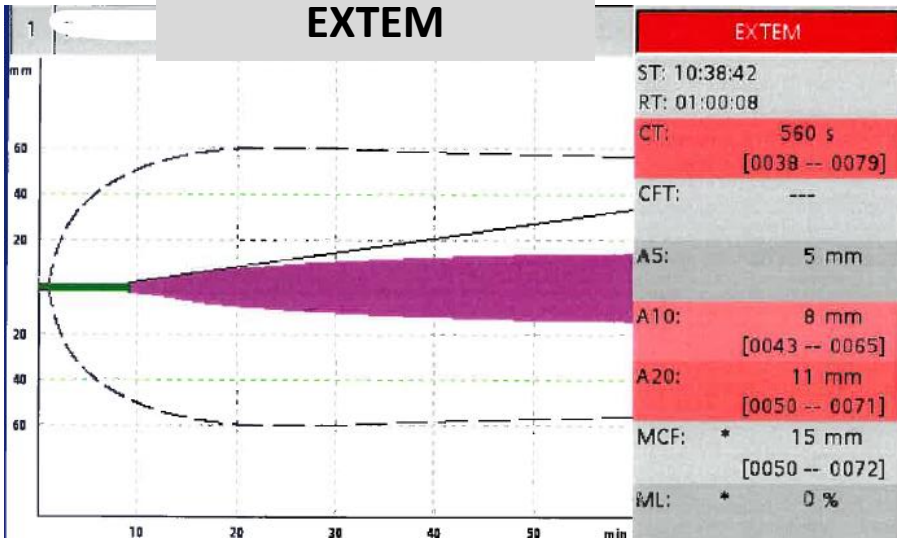
<u>FBC/COAGS</u>

- Hb 131
- Plt 73
- INR 3.2
- Fib 0.2
- APTT 47.3

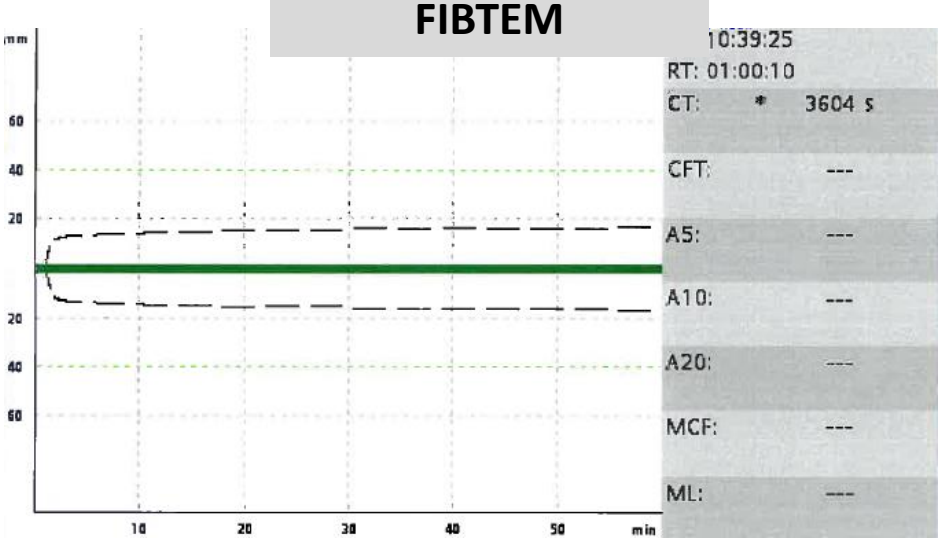
* These would usually not be available in the first 30 min

ROTEM 1

EXTEM



FIBTEM



FIBTEM A5 = 0mm!, EXTEM CT = 560s, EXTEM A5 = 5mm

INTERPRETATION

FBC/COAGS

- Hb 131
- Plt 73
- INR 3.2
- Fib 0.2
- APTT 47.3

* These would usually not be available in the first 30 min

PLATELET COUNT vs ROTEM

Note the discrepancy between the platelet count of 73 – this is over 50 and in many centres would not trigger treatment with platelets. Whereas the EXTEM which is directly assessing clot strength indicates a severe deficit (an A5 of 5mm cannot be due to fibrinogen deficiency alone) and correctly alerts the clinician to the need for a platelet transfusion.

History

She was given:

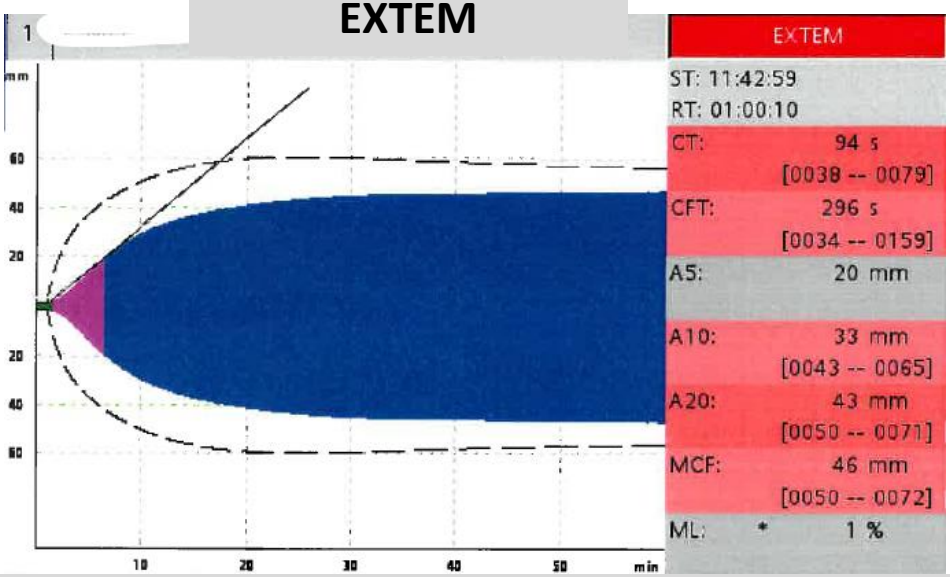
- TXA 1g
- 2 adult doses of cryoprecipitate (20units)
- 1 adult dose of platelets

She also had:

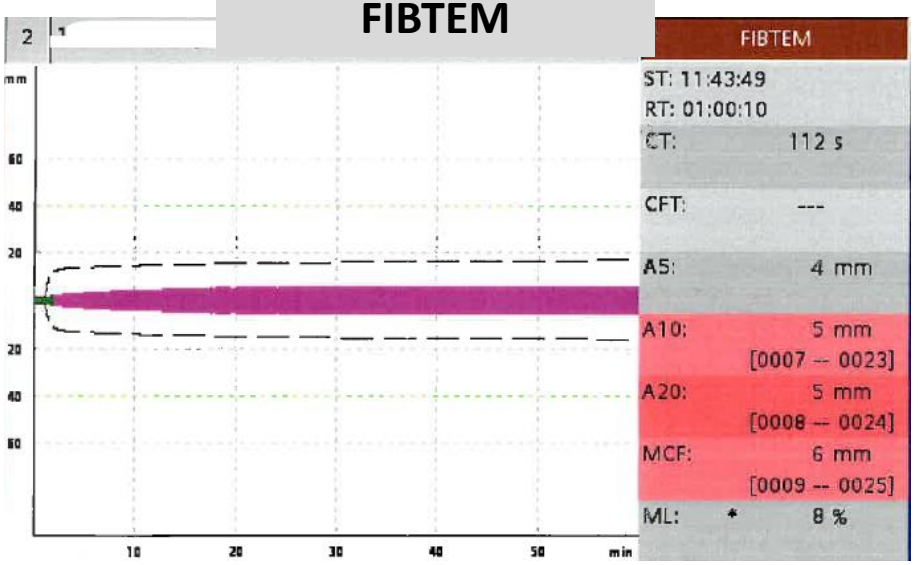
- Oxytocin / ergometrine
- Bakri balloon
- Bleeding settled estimated total blood loss 2.2Litres
- Her blood tests were repeated.

ROTEM 2

EXTEM



FIBTEM



FIBTEM A5 = 4mm!, EXTEM CT = 94s, EXTEM A5 = 20mm

What treatments would you give? Use the FSH ROTEM algorithm or better your hospital's if it has one.

What treatments would you give if you only had traditional coags and how would this differ?

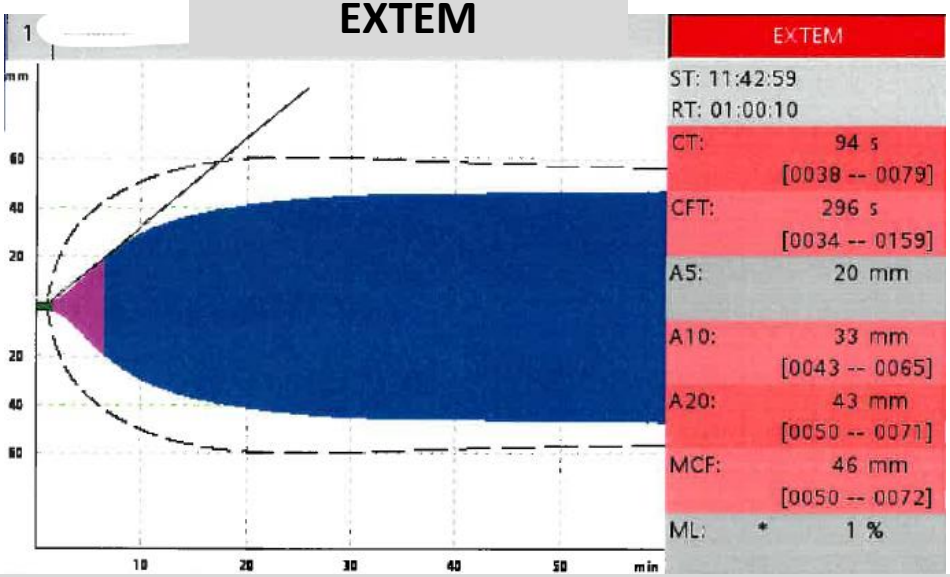
FBC/COAGS

- Hb 90
- INR 1.4
- APTT 37
- Fib 1.7

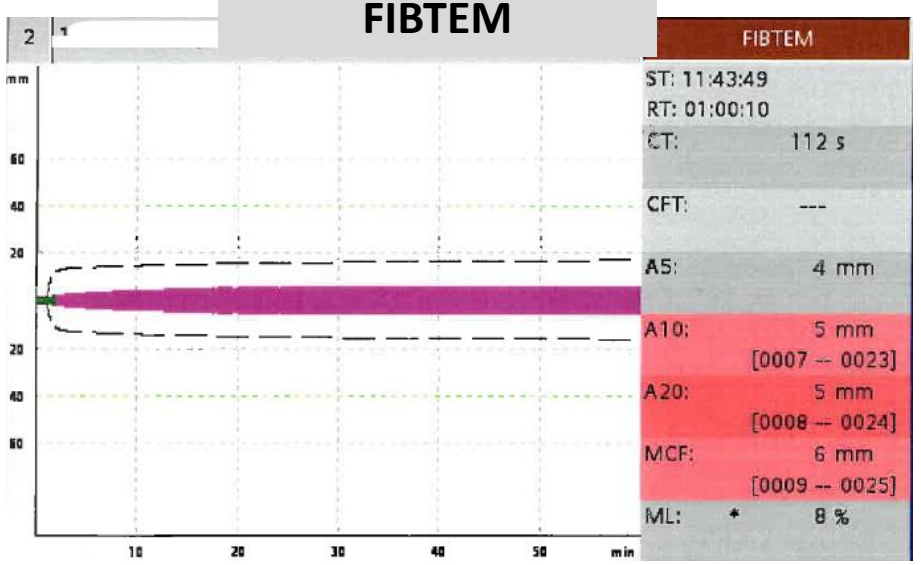
* These would usually not be available in the first 30 min

ROTEM 2

EXTEM



FIBTEM



FIBTEM A5 = 4mm!, EXTEM CT = 94s, EXTEM A5 = 20mm

INTERPRETATION

<u>Treatment if following FSH algorithm:</u>

FIBRINOLYSIS: TXA already given.

FIBRINOGEN: Fibtem A5 = 4mm – despite the very large dose already given still <u>very low</u> give another large dose of fibrinogen – e.g. 2-3 adult doses of cryoprecipitate (20-30 units of whole blood cryo OR 10-15 units of apheresis cryo) OR fibrinogen concentrate 4-6g

PLATELETS: Extem A5 = 20mm – less than 25mm indicative of some ongoing platelet deficiency. Consider more platelets.

FACTORS: Extem CT = 94s – note almost normal without any FFP or PTX.

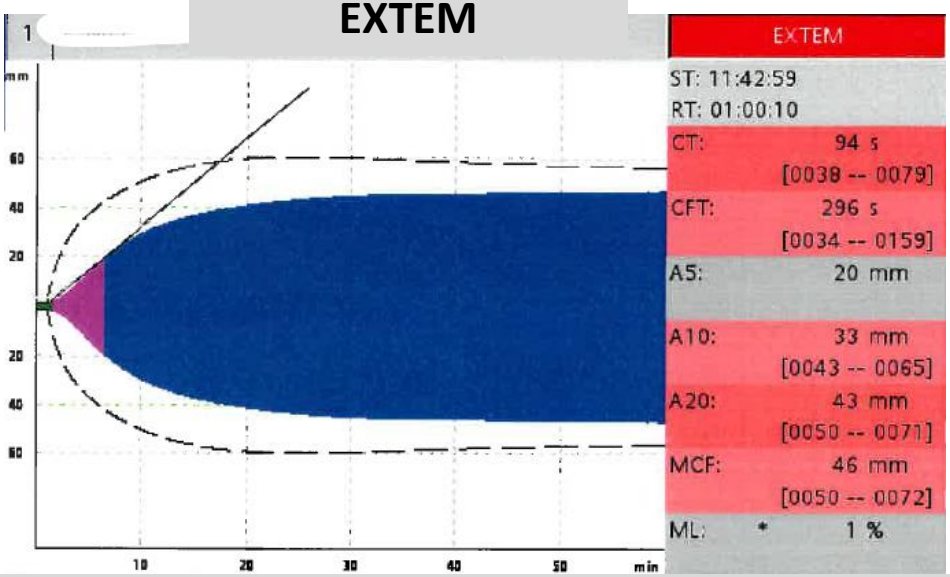
<u>FBC/COAGS</u>

- Hb 90
- INR 1.4
- APTT 37
- Fib 1.7

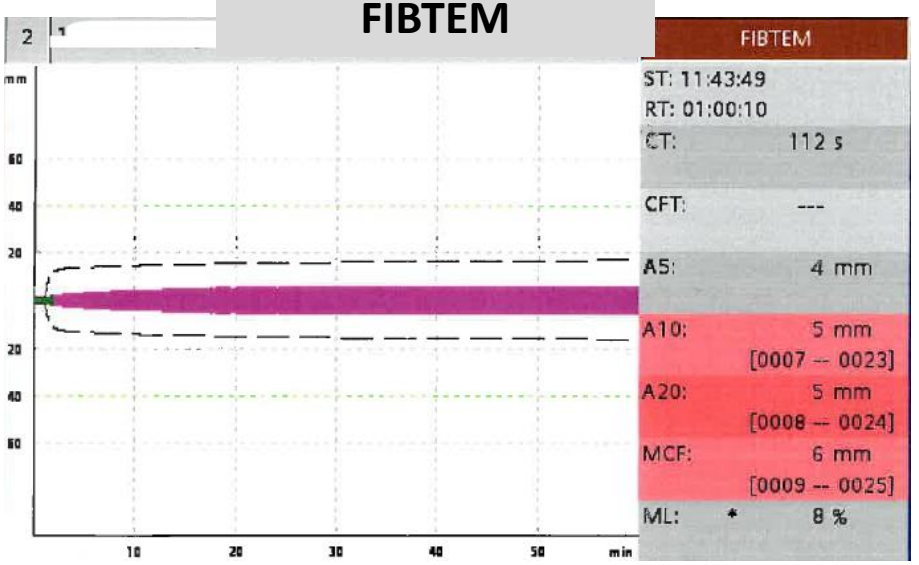
* These would usually not be available in the first 30 min

ROTEM 2

EXTEM



FIBTEM



FIBTEM A5 = 4mm!, EXTEM CT = 94s, EXTEM A5 = 20mm

INTERPRETATION

COAG versus ROTEM

Note the discrepancy between the COAG results which could almost be considered normal (usually targets are fib > 2g/L and normal INR / APTT). Whereas the ROTEM (which is assessing actual clot strength), demonstrates there is still a severe functional coagulopathy present.

FBC/COAGS

- Hb 90
- INR 1.4
- APTT 37
- Fib 1.7

* These would usually not be available in the first 30 min

History

Patient now no longer bleeding and in PACU.

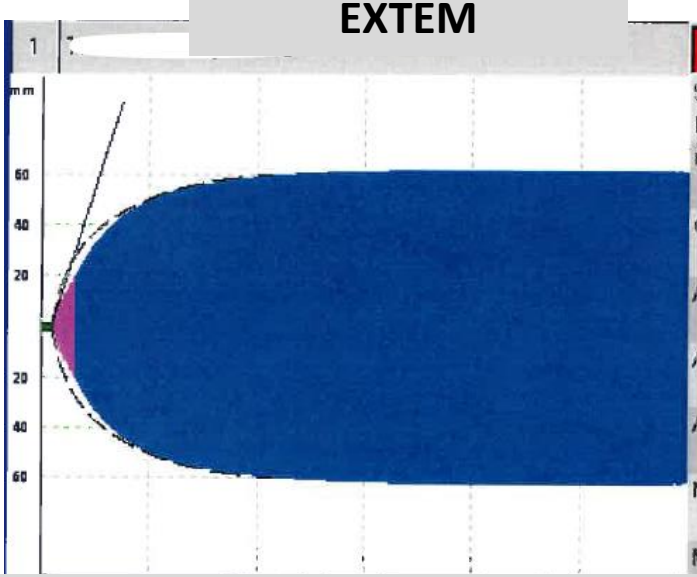
She was given another:

- 2 adult doses of cryoprecipitate (20units)
- 1 adult dose of platelets

Bloods repeated about 2 hours later in HDU

ROTEM 3

EXTEM

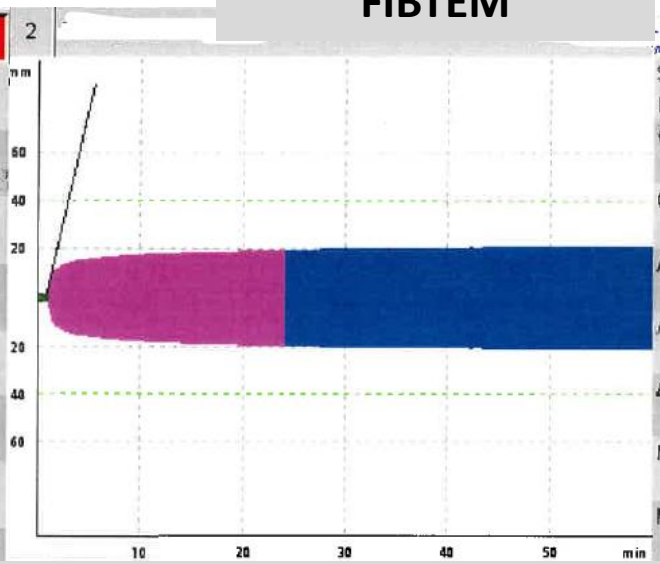


EXTEM

ST: 14:44:54
RT: 01:00:10

CT:	71 s	[0038 -- 0079]
CFT:	115 s	[0034 -- 0159]
A5:	39 mm	
A10:	52 mm	[0043 -- 0065]
A20:	60 mm	[0050 -- 0071]
MCF:	63 mm	[0050 -- 0072]
ML: *	1 %	

FIBTEM



ST: 14:45:42
RT: 01:00:10

CT:	59 s	
CFT:	1384 s	
A5:	17 mm	
A10:	18 mm	[0007 -- 0023]
A20:	20 mm	[0008 -- 0024]
MCF:	21 mm	[0009 -- 0025]
ML: *	0 %	

FIBTEM A5 = 17mm, EXTEM CT = 71s, EXTEM A5 = 39mm

FBC/COAGS

- Hb 76
- Plt 83
- INR 1.2
- APTT 30.8
- Fib 3.7

History

Stable overnight in HDU.

Transfused 2 units red cells.

SUMMARY

Total Blood Loss – 2.2 litres
Severe Coagulopathy

TXA 1g
Red cells x 2 units
Cryoprecipitate 4 adult doses (40units)
Platelets 2 adult doses

TAKE HOME POINTS

1. Patients with a very low fibrinogen will need a very large dose.

Traditional doses of cryoprecipitate (8-10 units for example) are not adequate. Use of a dosing table and much larger initial doses of cryoprecipitate or fibrinogen concentrate is a sensible strategy.

2. Traditional tests including PLT count and COAG profile can often be misleading and are not as useful as viscoelastic tests which directly assess functional clot strength.

Thanks again to Dr Natalie Akl & Dr David Hoppe from Dept of Anaesthesia, Fiona Stanley Hospital WA.