

POST CABG arrival in ICU

July 2018

Thanks to Dr Luke Torre from Dept of Intensive Care Medicine
at Sir Charles Gairdner Hosp WA for sharing this case.

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 1g	
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	
		Late Diagnosis EXTEM or FIBTEM ML ≥ 5%	Excess fibrinolysis	Consider repeat dose if has lost over 1 blood volume since initial dose	

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



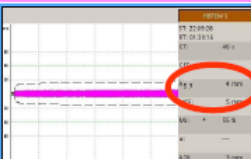
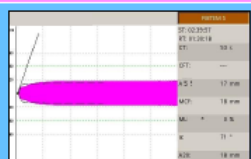
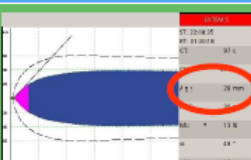
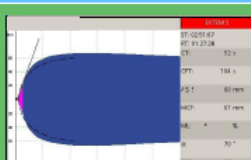

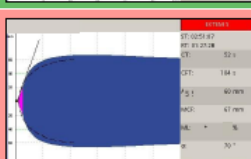
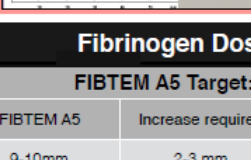
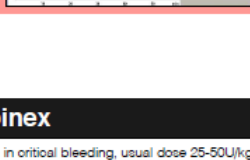
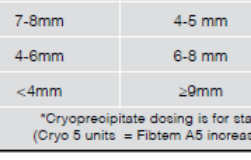
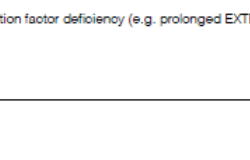
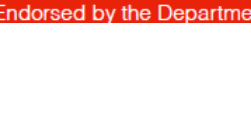
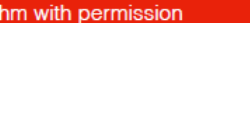
- 1 dose is equivalent to 10 whole blood units or 5 apheresis units.
- May be supplied as whole blood units or as apheresis units (or a combination) 1 apheresis unit = 2 whole blood units.
- Availability time: generally available within 10 minutes of request being made

Prothrombinex

- Haematologist approval required
- 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

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.

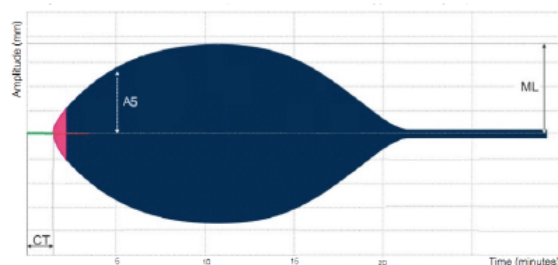
	ABNORMAL ROTEM	CRITERIA	DIAGNOSIS	INTERVENTION	CORRECTED ROTEM
FIBRINOLYSIS		Early Diagnosis EXTEM A5 ≤ 35mm or FIBTEM CT > 600s	High likelihood of excess fibrinolysis	Tranexamic acid 1g Consider repeat dose if has lost over 1 blood volume since initial dose	
		Late Diagnosis EXTEM or FIBTEM ML ≥ 5%	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 = Fibrin A5 increase of approx 2mm)

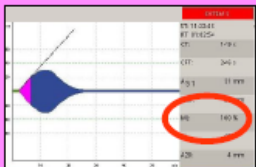
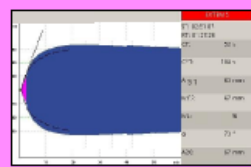
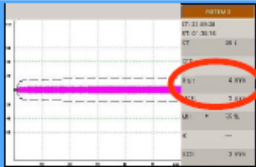
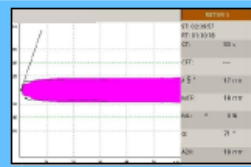
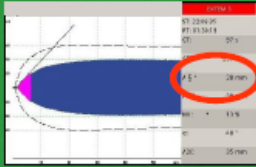
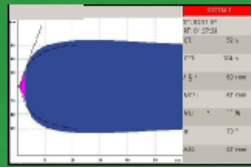
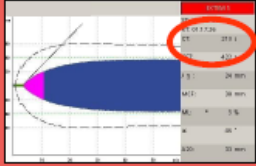
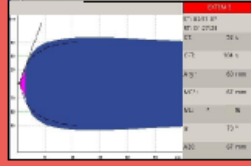


Prothrombinex

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).

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	Hyperfibrinolysis	Tranexamic acid 1g	
		Flat trace OR Maximal lysis >5%			
FIBRINOGEN		FIBTEM A5 $\leq 10\text{mm}$	Hypofibrinogenaemia	Cryoprecipitate	
PLATELETS		EXTEM A5 $\leq 35\text{mm}$ with normal fibrinogen*	Thrombocytopenia	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	

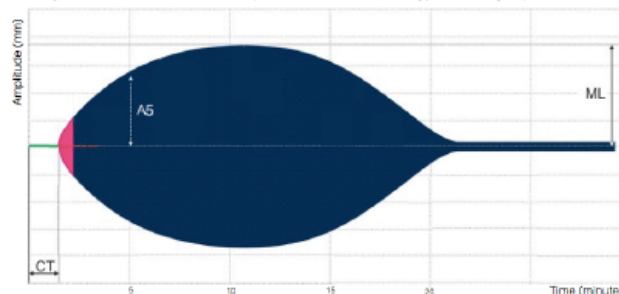
Cryoprecipitate Dosing Guide

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

One dose = five apheresis units = Fibrinogen 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

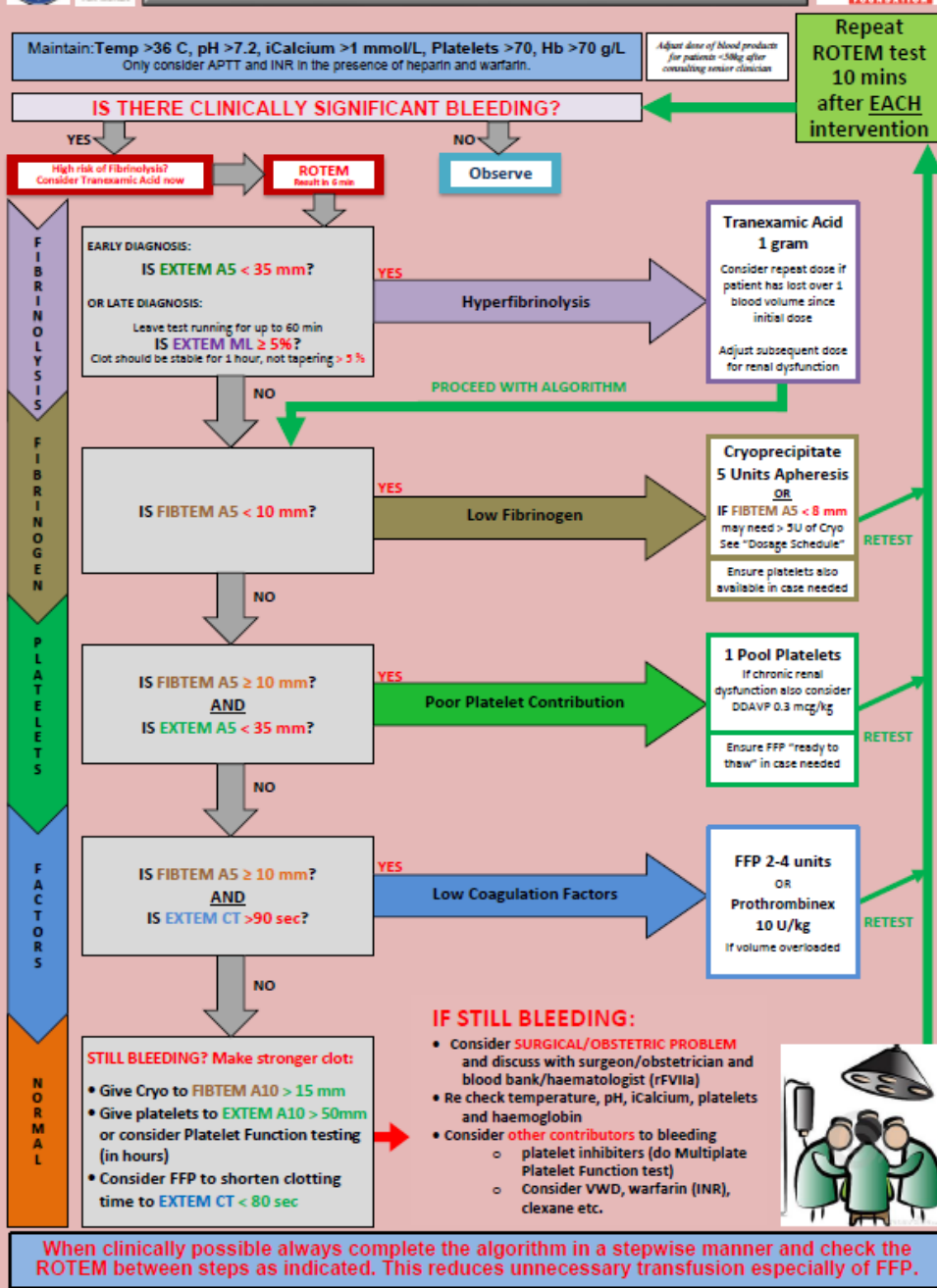


Key components

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



GENERAL SURGICAL / OBSTETRIC HAEMORRHAGE ROTEM TRANSFUSION ALGORITHM (2017)



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

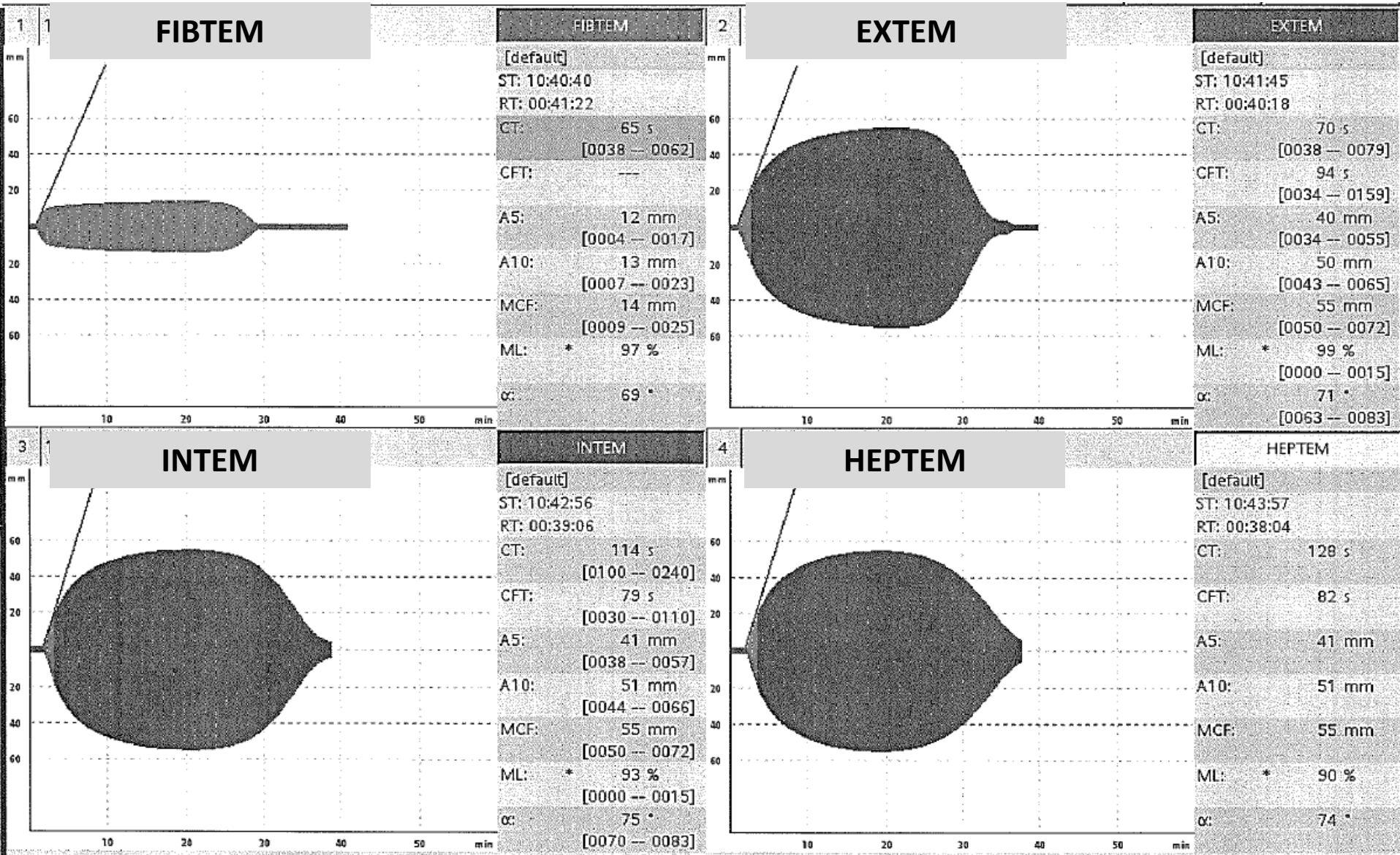
- For CARDIAC/VASCULAR start here and do all:
 INTEM CT = Below 205 / 205 & Above
 HEPTTEM CT = Below 205 / 205 & Above
- For GENERAL/OBSTETRIC start here (this section only):
 EXTEM A5 = Below 35 / 35-40 / Above 40
 FIBTEM A5 = Below 10 / 10-15 / Above 15
 EXTEM CT = Below 80 / 80-90 / Above 90
 EXTEM ML = Below 5 / 5 & Above

Management Plan:

Please stick this label in the patients progress notes

History

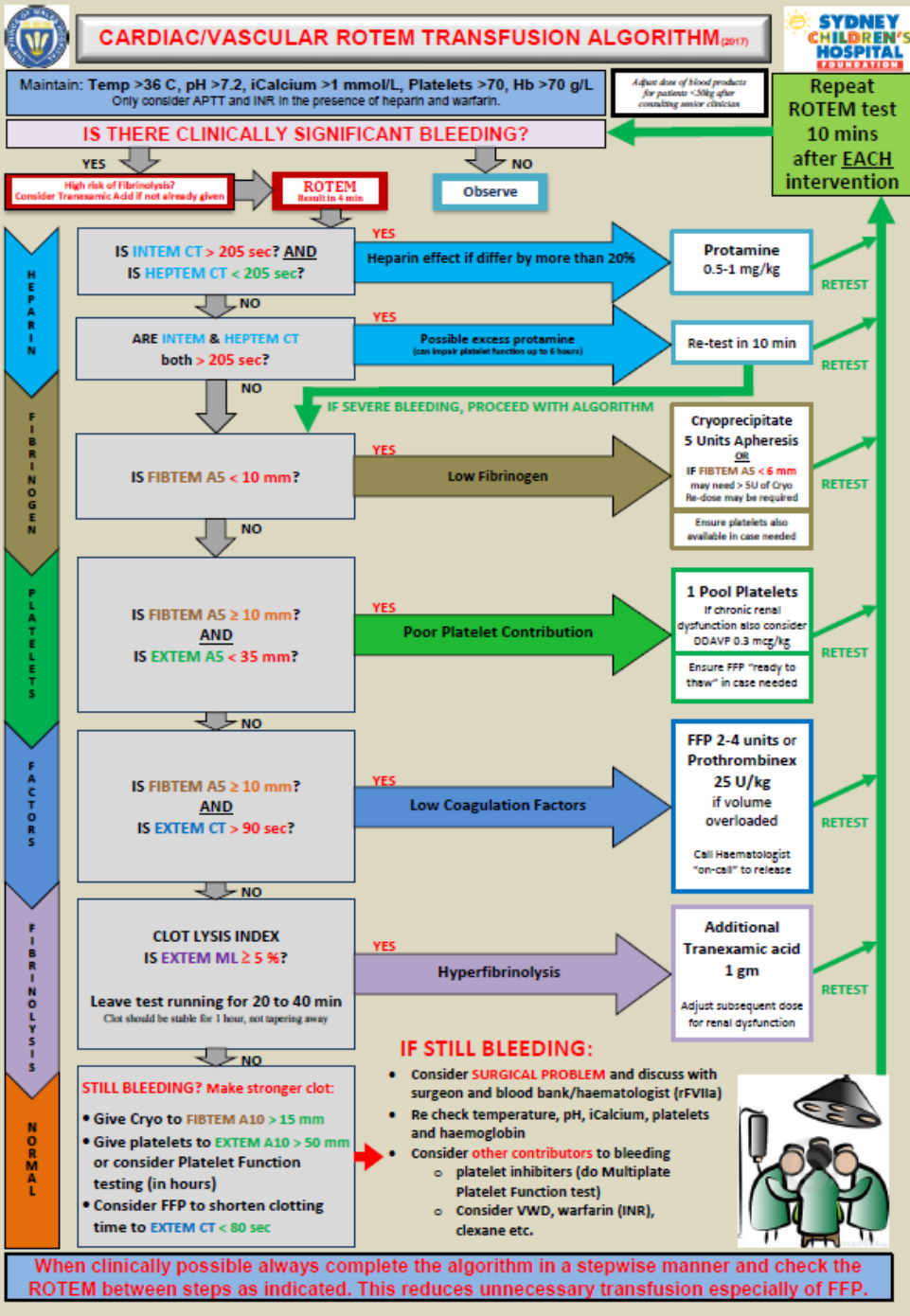
- Patient undergoes routine CABG x 2 on pump
- TXA is not used during the surgery
- On arrival in ICU a ROTEM is performed
- Not bleeding



**FIBTEM A5 = 12mm, EXTEM CT = 70s, EXTEM A5 = 40mm
INTEM CT = 114s HEPTTEM CT = 128s**

Now interpret the initial ROTEM

- Use a cardiac / vascular algorithm as this patient has been on cardiopulmonary bypass and exposed to heparin / protamine.
- The cardiac algorithm from Prince of Wales NSW on the next slide is one that would be suitable
- Thanks to Dr Catherine Downs for sharing this.



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

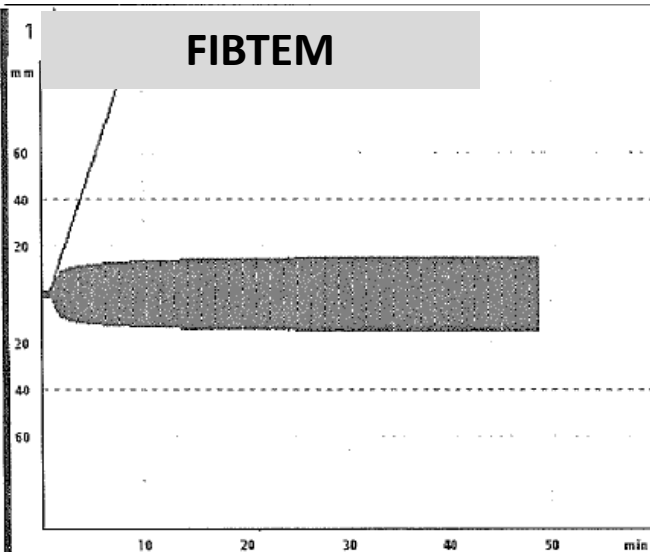
Management Plan:

Please stick this label in the patients progress notes

Treatment

- They are treated with TXA 1g and another ROTEM is performed about 1 hour later

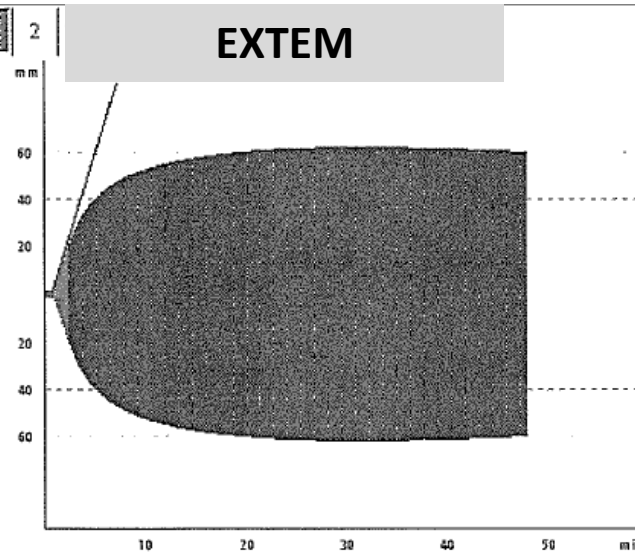
FIBTEM



FIBTEM

[default]
ST: 14:06:44
RT: 00:49:20
CT: 60 s
[0038 -- 0062]
CFT: ---
A5: 13 mm
[0004 -- 0017]
A10: 14 mm
[0007 -- 0023]
MCF: 15 mm
[0009 -- 0025]
ML: * 0 %
 α : 74 °

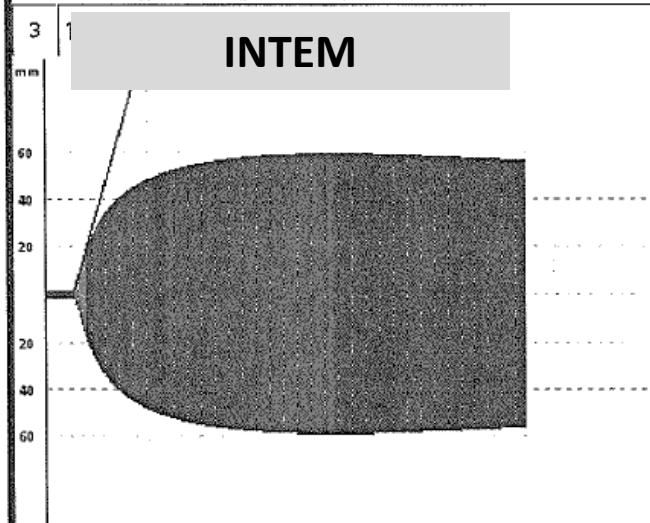
EXTEM



EXTEM

[default]
ST: 14:07:34
RT: 00:48:30
CT: 61 s
[0038 -- 0079]
CFT: 83 s
[0034 -- 0159]
A5: 44 mm
[0034 -- 0055]
A10: 54 mm
[0043 -- 0065]
MCF: 62 mm
[0050 -- 0072]
ML: * 3 %
[0000 -- 0015]
 α : 74 °
[0063 -- 0093]

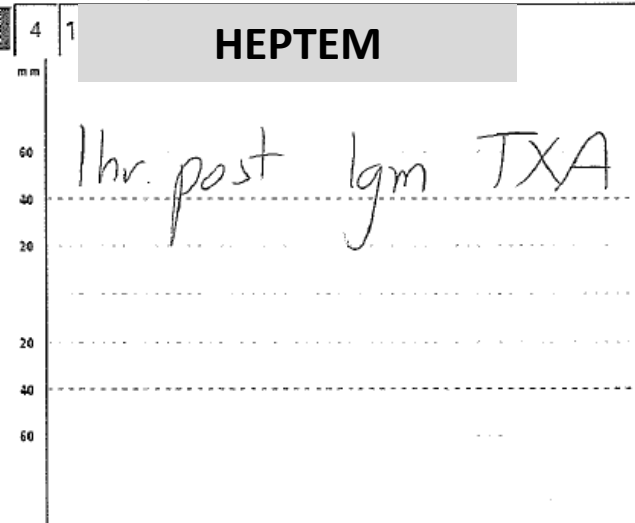
INTEM



INTEM

[default]
ST: 14:08:20
RT: 00:47:44
CT: 172 s
[0100 -- 0240]
CFT: 75 s
[0030 -- 0110]
A5: 43 mm
[0038 -- 0057]
A10: 53 mm
[0044 -- 0066]
MCF: 59 mm
[0050 -- 0072]
ML: * 5 %
[0000 -- 0015]
 α : 75 °

HEPTEM



HEPTEM

[default]
Start time
Run time
CT: ---
CFT: ---
A5: ---
A10: ---
MCF: ---
ML: ---
 α : ---

**FIBTEM A5 = 13mm, EXTEM CT = 61s, EXTEM A5 = 44mm
INTEM CT = 172s**

Now interpret this next ROTEM

- Everything is now in the normal range.
- The patient was not bleeding and no further treatments were needed

Hypothetical

- If the patient was bleeding with this ROTEM you should consider a surgical cause.
- In the context of a patient post cardiac surgery this might help you decide to take the patient back to theatre & reopen the chest.

Take Home Points

1. Traditional coagulation tests cannot detect patients with fibrinolysis
2. In patients exposed to heparin make sure you use the correct panel of ROTEM tests to also assess the effect of heparin / protamine.

Thanks again to Dr Luke Torre from the Dept of Intensive Care Medicine at Sir Charles Gairdner Hosp WA for sharing this case.