

Major Burns Debridement 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.

Clinical History

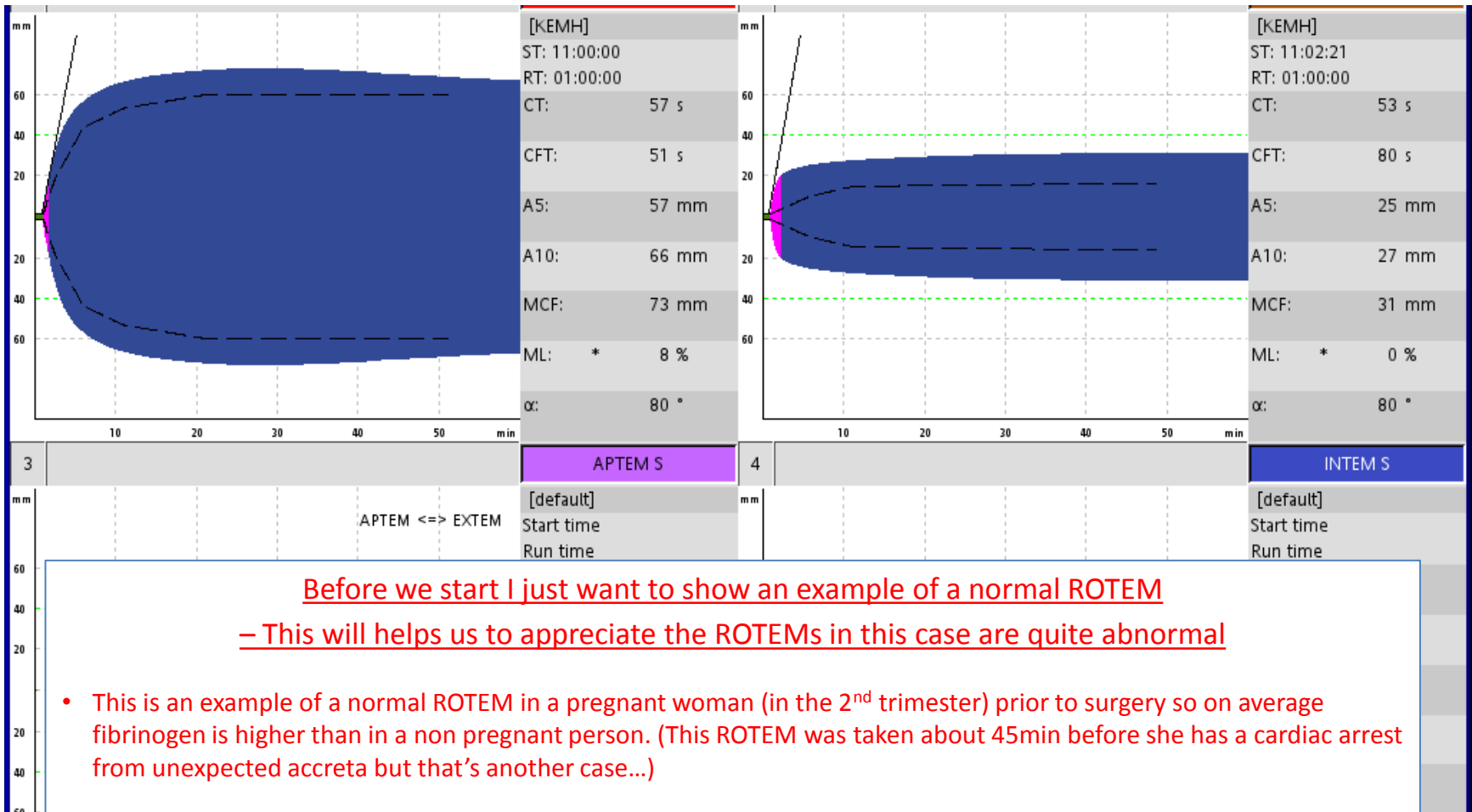
- Major burns greater than 70% body surface area after motorcycle accident
- Escharotomy carried out 2 days prior
- Now presenting to theatre for major burns debridement plus skin grafting
- Pre-op coags normal.
- Hb 164 pre op.
- Fluid balance +32 litres positive as per Parkland fluid resuscitation pre op

COMMENTS

- What fluids has he received ? Colloid / crystalloid? Blood products?
- In my subjective opinion 32 litres positive fluid balance even in the setting of 70% major burns seems ridiculously excessive and is likely to have caused major tissue oedema, as well as effects on coagulation / haemostasis.
- In the light of recent literature demonstrating much less fluid should be used for major surgery or sepsis I wonder if this holds true for burns too and is the Parkland formula an anachronism?

FBC / COAGs @ 0510

Hb 164
Plt 92
INR 1.1
APTT 38.3
Fib 5.3



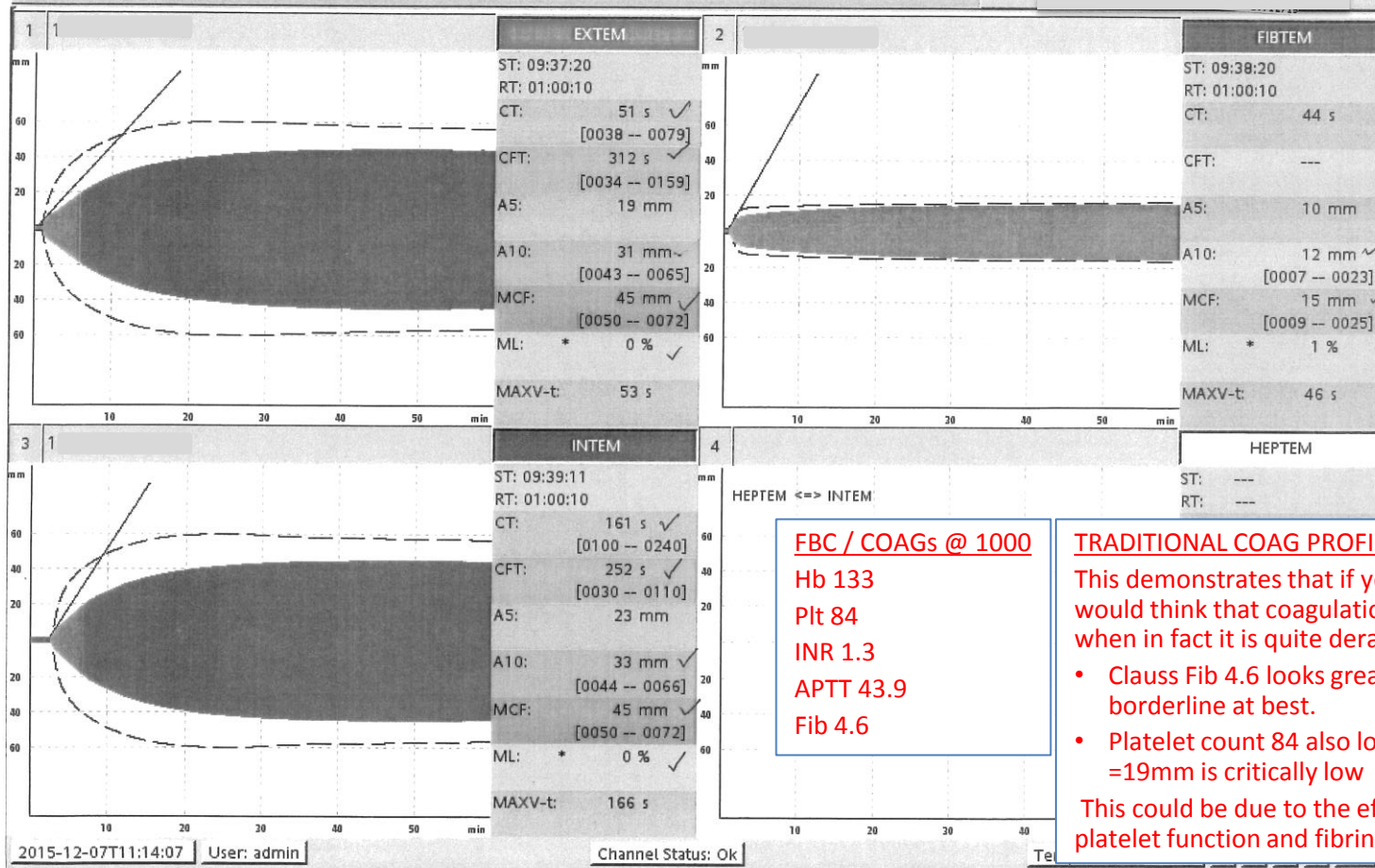
Before we start I just want to show an example of a normal ROTEM

– This will help us to appreciate the ROTEMs in this case are quite abnormal

- This is an example of a normal ROTEM in a pregnant woman (in the 2nd trimester) prior to surgery so on average fibrinogen is higher than in a non pregnant person. (This ROTEM was taken about 45min before she has a cardiac arrest from unexpected accreta but that's another case...)
- If you have 70% burns and are about to undergo a massive debridement you could argue that before the surgery starts you want to have the sort of haemostatic reserve like that you see in this ROTEM.
- When you look at this it is easier to see why the other ROTEMs for this burns patient are actually quite abnormal.

What happened clinically

- TXA bolus 2 given pre op followed by 15mg/kg/hr infusion
- 1 litre of gelofusion and 1 litre crystalloid boluses given. Hypotensive and 4mls/hr norad
- EBL 1 - 2 litres corresponding to first ROTEM taken above following debridement of posterior of torso, thighs and legs.



FBC / COAGs @ 1000

Hb 133
 Plt 84
 INR 1.3
 APTT 43.9
 Fib 4.6

TRADITIONAL COAG PROFILE MISLEADING

This demonstrates that if you didn't have ROTEM you would think that coagulation is relatively normal, when in fact it is quite deranged..

- Clauss Fib 4.6 looks great BUT fibtem A5=10mm is borderline at best.
- Platelet count 84 also looks okish BUT extem A5 =19mm is critically low

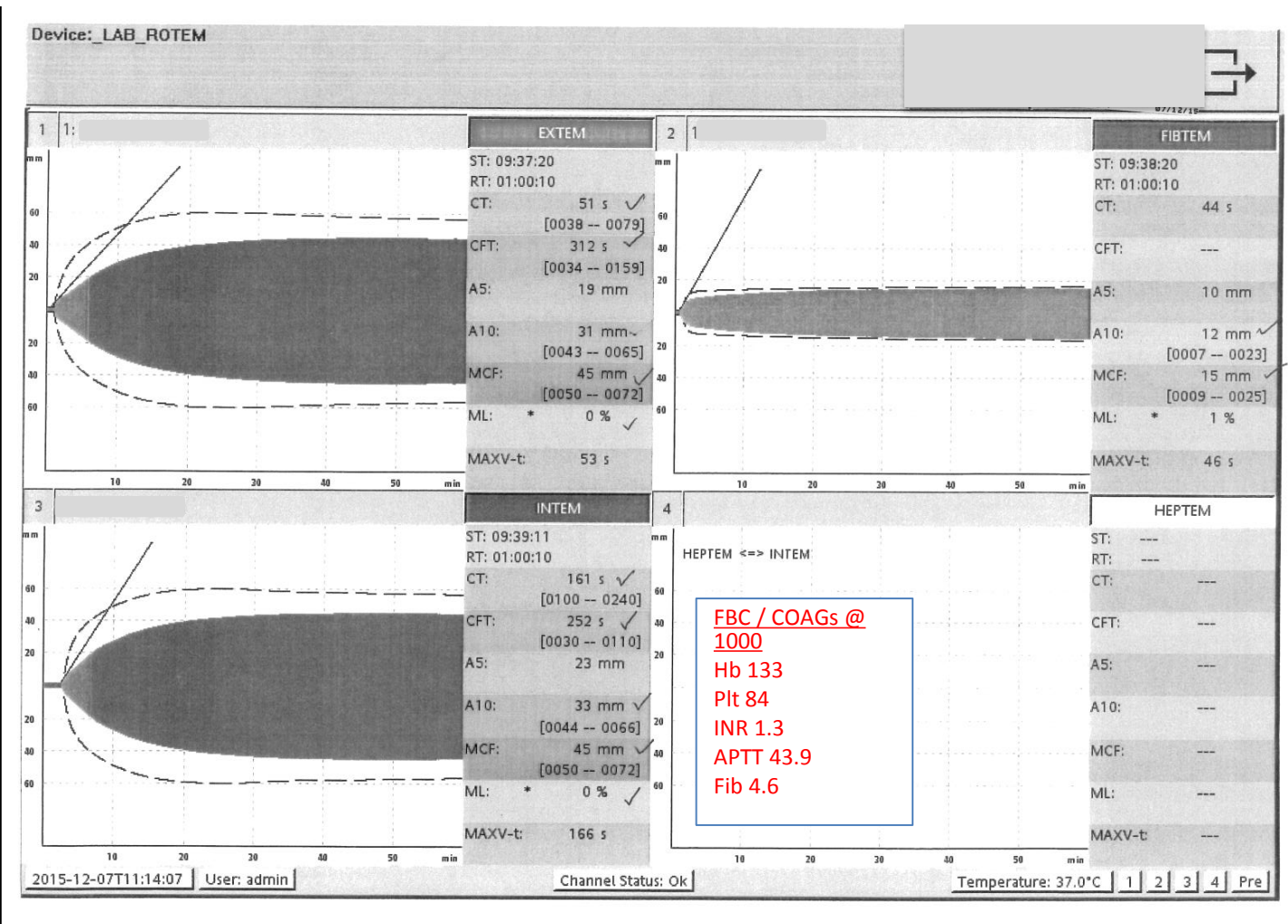
This could be due to the effect of colloid fluids on platelet function and fibrinogen polymerisation.

ROTEM 1 Comments

- This is actually a very abnormal ROTEM. (Compare it to the normal rotem on the 2nd slide), but it is not straightforward to interpret...
- Fibtem A5 = 10mm (borderline low). The normal range shown is misleading – A10 states 7-23 is normal. He only 12 if you are about to have 70% burns debrided you would want to be closer to 23mm especially in the situation where we suspect his platelet count and / or function is poor (as demonstrated by such a low Extem A5 and poor Extem CFT).
- Extem A5 = 19mm (normal is >35mm) this is very low – probably due to platelets and / or fibrinogen You definitely to increase clot strength probably by giving both.
- Extem CT = 51s Thrombin generation is normal – no need for FFP / PTX. Giving lots of FFP could further dilute the platelets / and even fibrinogen....

What happened clinically

- 1 bag of platelets and 2 units PRBC given as per haematologist recommendation
- This is a good decision and if you only looked at the platelet count you may not have made this decision (it was likely based on the low EXTEM amplitude).

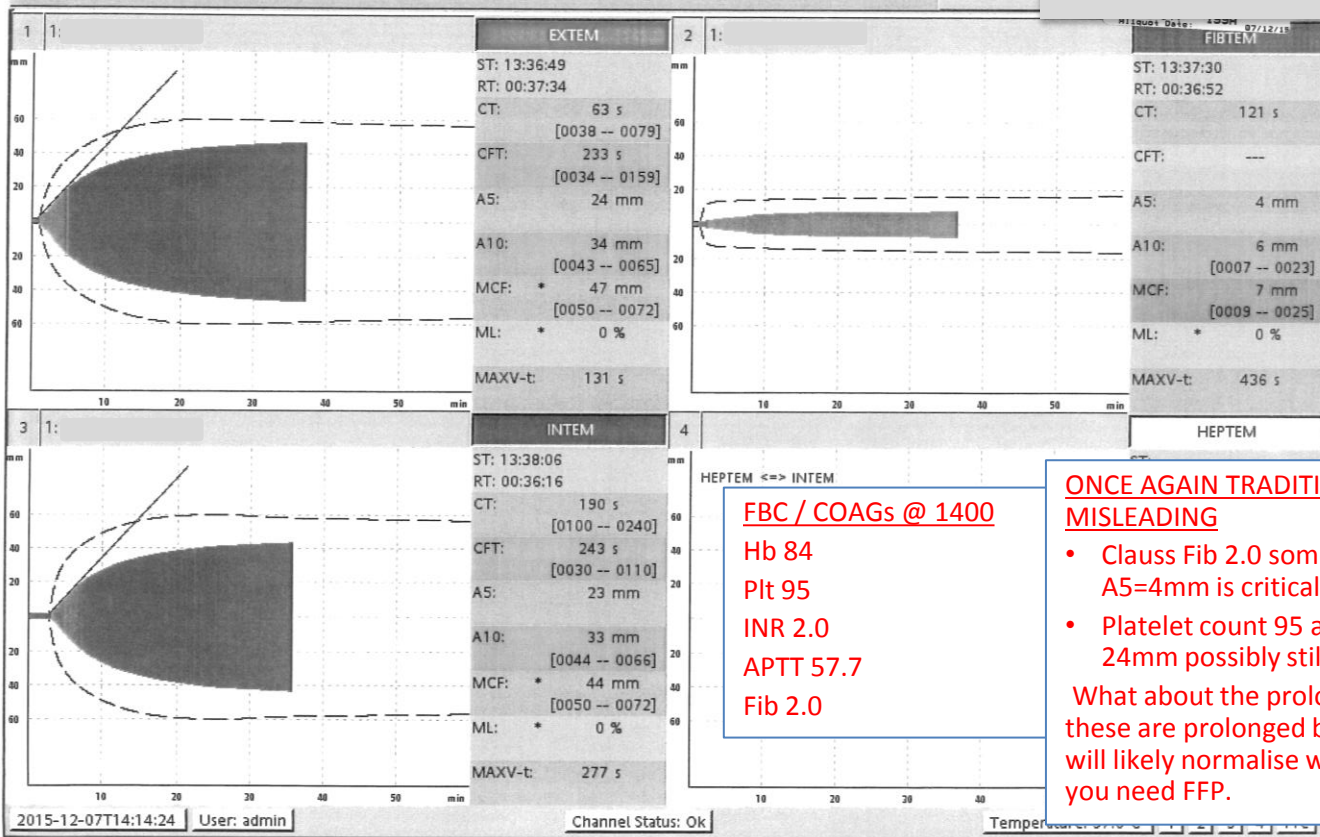


ROTEM 1 – (With the benefit of retrospect) – what I would do using the Rotem algorithm

- Why is the overall clot strength so poor even though the platelet count isn't terrible (platelet count 80-90s) and the fibtem is low normal?
- It could be the effect of colloids (see the attached papers) – they affect platelet function and fibrin polymerisation.
- Either way the treatment required is to increase clot strength. For a 100kg guy undergoing this surgery I would give:
 - 1 or 2 adult doses of platelets and cryoprecipitate 16 units (or fibrinogen concentrate 3g if you were lucky enough to have access to it)

What happened clinically

- Further 2 litres blood loss following debridement of anterior leg and arms.
- Borderline low calcium replaced with CaCl.
Temp remained > 36 degrees



ONCE AGAIN TRADITIONAL COAG PROFILE MISLEADING

- Clauss Fib 2.0 some might say this is ok BUT fibtem A5=4mm is critically low.
- Platelet count 95 also looks okish BUT extem A5 = 24mm possibly still inadequate

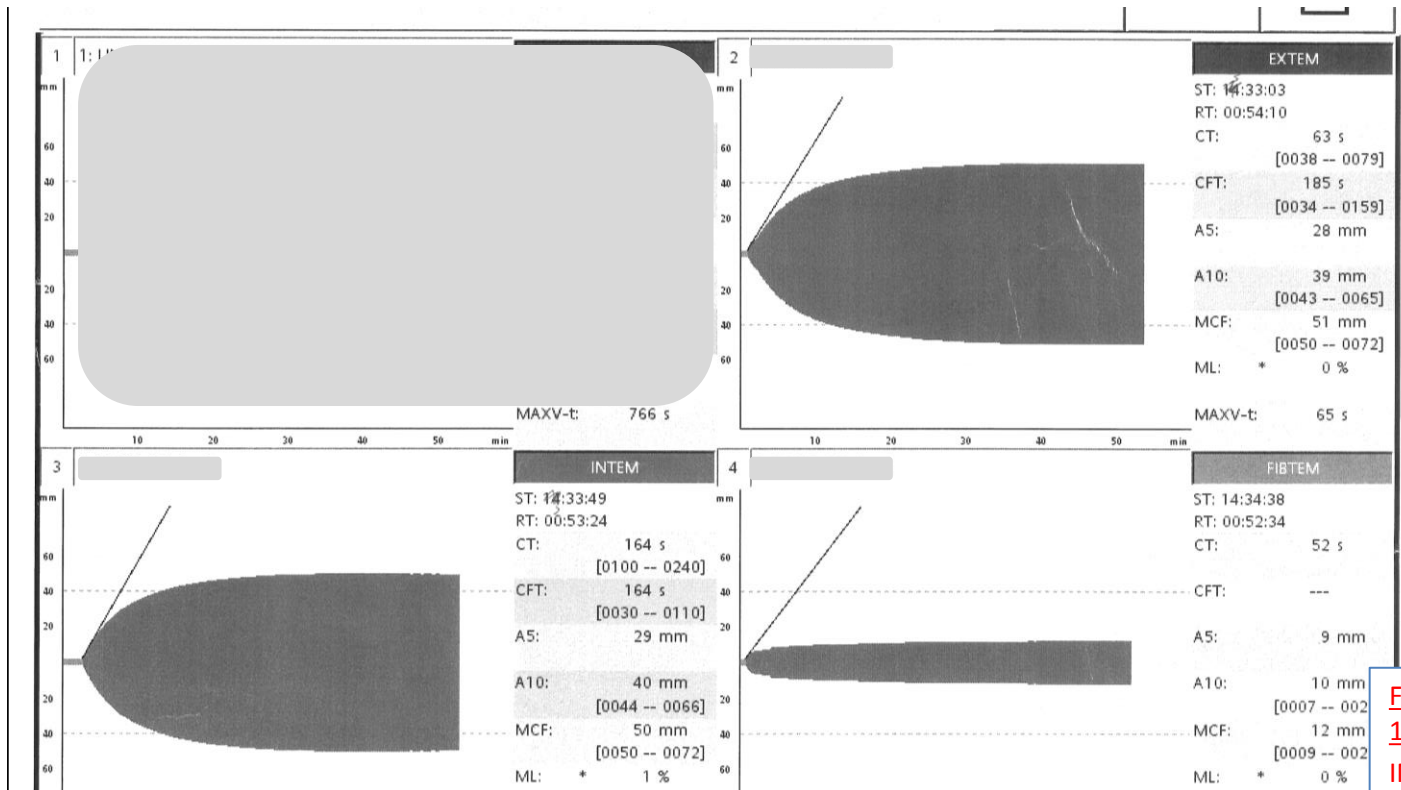
What about the prolonged APTT & INR? – Both of these are prolonged by very low fibrinogen and they will likely normalise with cryo / FC & don't mean that you need FFP.

ROTEM 2 (With the benefit of retrospect) – what I would do using the Rotem Algorithm

- Fibttem A5 = 4mm. This is critically low – you should maybe aim for a higher than normal fibttem target in a major 70% burn debridement (e.g. like A5 = 14mm as in the obstetric algorithm) – esp if you know the case is far from finished...
In 100kg guy - If you aim for target A5 = 14mm : You need a 10mm increase (to get to 14mm) would require 25-30units of cryo or 5-6g fibrinogen concentrate.
- If you aim for target A5 = 10mm : You need a 6mm increase (to get to 10mm) would require 15-20units of cryo or 3-4g fibrinogen concentrate.
- Platelets – Extem A5 is < 25mm so you should probably give another 1 dose of adult platelets
- Clotting factors – Extem CT = 63s – this is ok. No real evidence that you need FFP (or PTX). If you were going to give some (some people just feel that they have to) just give 1 unit. Large volumes will dilute your Hb / platelets and even your fibrinogen.

What happened clinically

- Further 8 units of PRBCS, 4units FFP, 1 unit platelets, and 8 units of cryoprecipitate plus 1 litre colloids and 1 litre crystalloids.
- More hypotensive and 15 mls/hr Norad infusion.
- Using the new ROTEM algorithm the patient would have been given less FFP and more cryoprecipitate but overall the situation is definitely better.



FBC / COAGs @
1527
INR 1.5

ROTEM 3 (With the benefit of retrospect) – what I would do using the Rotem Algorithm

Once again take into account the clinical situation, if there is lots of diffuse bleeding the best treatment looking at this would be to try and increase clot strength again. If there is lots of ongoing bleeding you also might anticipate that fibrinogen is going to continue to be used up quicker than anything else and try to keep ahead with it.

- Fibtem A5 = 9mm. This is still low – once again you should maybe aim for a higher than normal fibtem target in a major 70% burn debridement (e.g. like A5 = 14mm as in the obstetric algorithm)

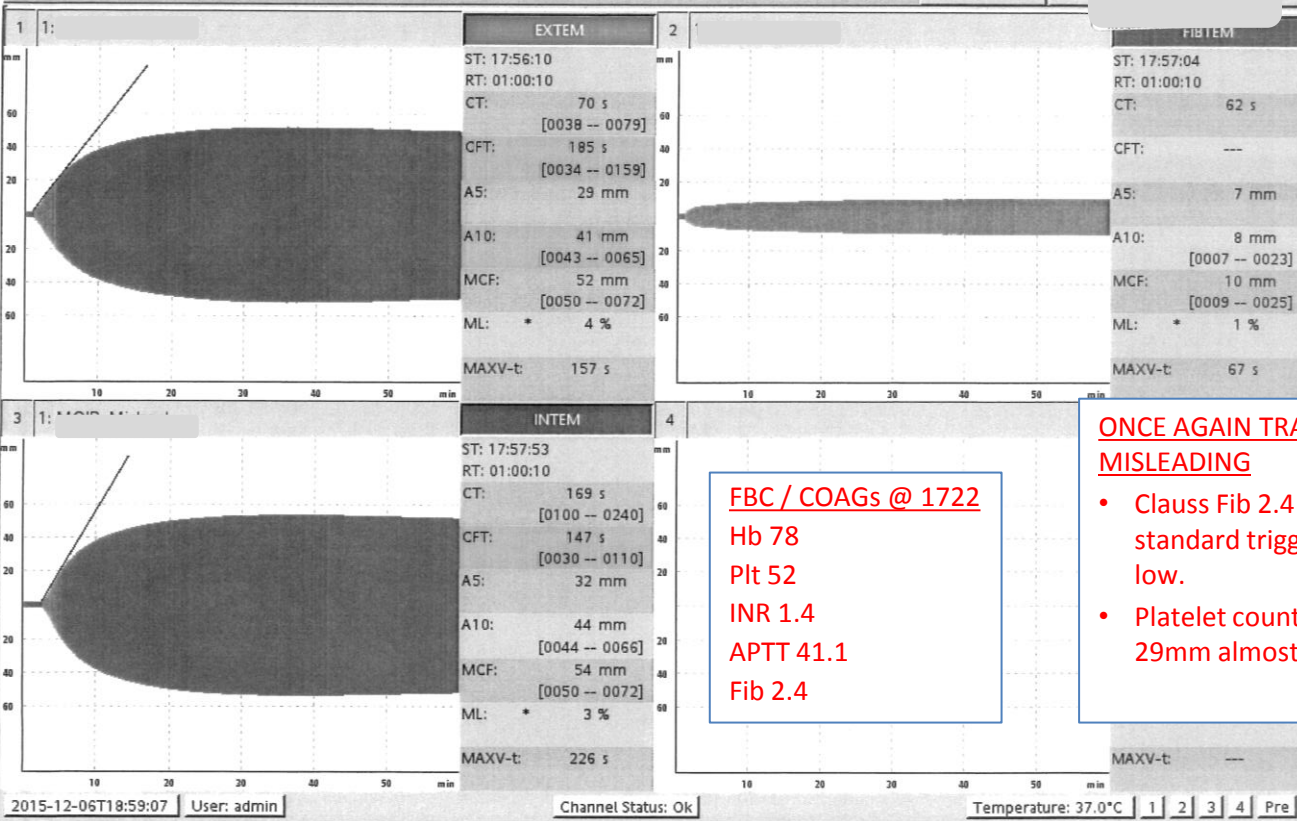
In 100kg guy - If you aim for target A5 = 14mm : You need a 5mm increase (to get to 14mm) would require 15units of cryo or 3g fibrinogen concentrate.

- Platelets – Extem A5 = 28 mm so if you give cryo / fibrinogen you probably don't need platelets
- Clotting factors – Extem CT = 63s – this is ok. No real evidence that you need FFP (or PTX). If you were going to give some (some people just feel that they have to) just give 1 unit. Large volumes will dilute your Hb / platelets and even your fibrinogen.

What happened clinically

- Despite normal EXTEM CT, INR 1.5 and surgeons complaining of diffuse ooze.
- Hypotensive and increased norad requirement. Further 1 litre colloids
- Further 2 units PRBC , 4 units FFP. HB100
- Haematologist recommended further 1 unit platelets given low EXTEM A10 and normal FIBTEM
- Diffuse ooze is a subjective description, the best option is probably to try and increase clot strength – platelets or fibrinogen (cryo / FC) will both do this. FFP probably would not help though – thrombin generation is ok and it will dilute the platelets and possibly even the fibrinogen (average conc of fibrinogen in FFP is about 2g/L).

8/12/15



ONCE AGAIN TRADITIONAL COAG PROFILE MISLEADING

- Clauss Fib 2.4 this would not get treated using standard triggers BUT fibtem A5 = 7mm is quite low.
- Platelet count 52 also looks low BUT extem A5 = 29mm almost adequate

FBC / COAGs @ 1722

Hb 78
Plt 52
INR 1.4
APTT 41.1
Fib 2.4

ROTEM 4 (With the benefit of retrospect) – what I would do using the Rotem Algorithm

Once again take into account the clinical situation, if there is lots of diffuse bleeding the best treatment looking at this would be to try and increase clot strength again. If there is lots of ongoing bleeding you also might anticipate that fibrinogen is going to continue to be used up quicker than anything else and keep ahead with it.

- Fibtem A5 = 7mm. This is still low – once again you should maybe aim for a higher than normal fibtem target in a major 70% burn debridement (e.g. like A5 = 14mm as in the obstetric algorithm)

In 100kg guy - If you aim for target A5 = 14mm : You need a 7mm increase (to get to 14mm) would require 20 - 25 units of cryo or 4-5g fibrinogen concentrate.

- Extem ML = 4% - this could be very mild late fibrinolysis (or clot retraction). If clinically indicated consider another dose of TXA
- Platelets – Extem A5 = 29 mm so if you give enough cryo / fibrinogen you probably don't need platelets
- Clotting factors – Extem CT = 62s – this is ok. No real evidence that you need FFP (or PTX). If you were going to give some (some people just feel that they have to) just give 1 unit. Large volumes will dilute your Hb / platelets and even your fibrinogen.

What happened clinically

- Further 8 units cryoprecipitate given low Fitem.
- Temp dropped to below 36 (35.8 nadir despite theatre temp 35 degrees and maximal warming measures)
- Weaned off norad infusion. Hypotension settled and t/f to ICU
- In total - 14 u PRBC, 2 units platelets, 8 FFP, 16 units cryo
- Overall I think this patient was managed very well and the use of ROTEM definitely ensured both platelets and cryo were given at times when if using traditional coag profiles to guide treatment they wouldn't have been.
- What if we had used the newer ROTEM algorithm (which uses higher fibrinogen target values and recognises that 8units of cryo is too small usually)? We would have calculated doses which would have led to larger and more aggressive fibrinogen dosing:
 - this may have led to less blood loss
 - It would have definitely led to less FFP use
 - Possibly less platelets (probably not though)