Management of Major Haemorrhage

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EXAMINATION PROCEDURES Must include all of the template headings. Where headings are not required, they should have 'n/a' written against them.
POLICIES AND SOPS NOT REGARDING EXAMINATIONS may use headings as appropriate to that document.

AMENDMENT HISTORY

Amendment		Amendment detail *(Include page numbers and/or section headings where the changes have occurred)*
Issue No.	Date	
1.0	15/07/20	New
2.0	21/07/21	Remove appendix 3 and replace appendix 2 with new amalgamated algorithm. Code pack A packaged in 2 transport boxes. Include ACRT & theatre coordinator in Code red call group. Update Appendix 3
3.0	08/09/21	Minor change on Appendix 3, paperwork to go with blood in a box, communication with ward re blood to location or fridge, Fibrinogen concentrate given only if ROTEM used.
4.0	07/11/23	Remove reference to BTRA 002 as amalgamated with BTRA 001 Remove Code red from title Change in functionality / test sets in IPS to TCLE. Change in “BUZZ|” word for major haemorrhage teams – Code red no longer used. Appendix 1 new; appendix 2 & 6 updated.
5.0	02/01/24	GRH Theatre Emergency Co-Ordinator added to CGH call group Include pathway for GRH Theatre Emergency Co-ordinator Include pathway for Logistics of Running ROTEM at CGH Change in Title
6.0	15/01/24	Inclusion of 3rd anaesthetist on call in adult call group at CGH
7.0	06/05/24	Remove 3rd Anaesthetist role and replace with DCC resident doctor and DCC on call consultant. Update Appendix 1
8.0	21/08/24	Include action card for when haemorrhage is at CGH when CGH lab closed
9.0	05/03/25	ROTEM algorithm revised and separate obstetric and non-obstetric algorithm created. Paediatric Major haemorrhage pathway revised.

LOCATION
Blood Transfusion GRH and CGH
Clinical area GRH and CGH

GRADE
State registered BMS and clinical registered practitioners

PURPOSE OF EXAMINATION
Excessive blood loss can jeopardise the survival of patients in many clinical settings. The provision of blood for life threatening haemorrhages therefore requires a rapid and focused approach. Early recognition of major blood loss and immediate effective interventions are vital to avoid hypovolaemic shock and its consequences. One such action is the rapid provision of blood and blood components, for which effective communication between all personnel involved in the provision and transportation of blood is key.

PRINCIPLE AND METHOD
The ROTEM Sigma is a point of care testing device for rapid, whole blood diagnosis of coagulopathies to optimize patient blood management in major surgeries and traumatic bleeding.

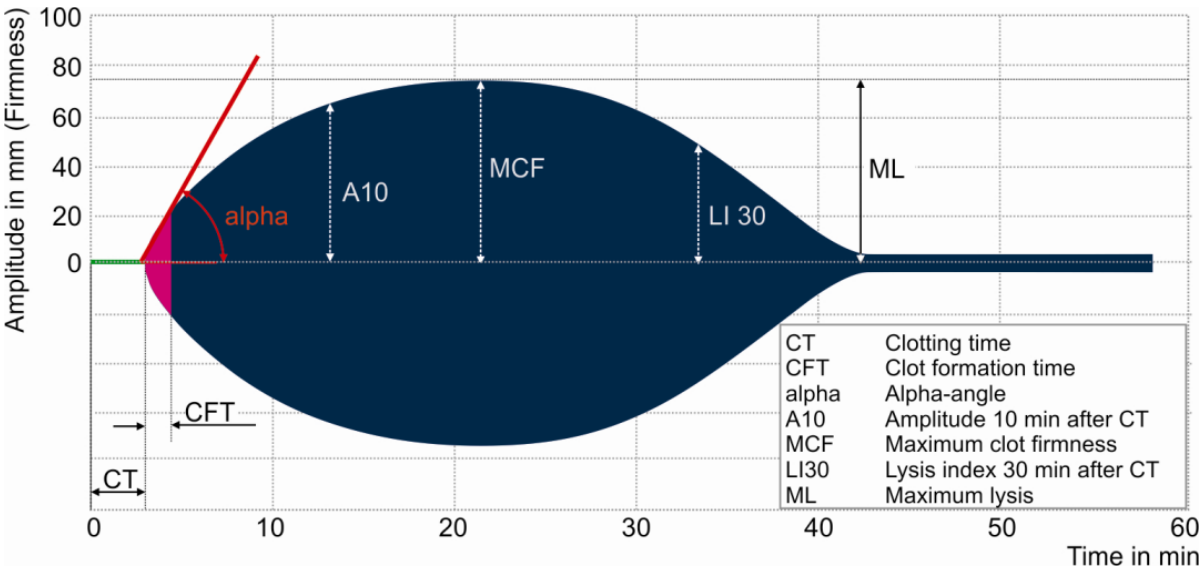
Viscoelastometric point-of-care testing is intended for use:

- During surgery to identify the probable cause of intraoperative bleeding by discriminating between poor platelet function and poor clotting. The results allow the clinician to select the correct therapy.
- In the immediate post-operative period to help control haemostasis and help guide the clinician to determine whether bleeding is a result of a coagulopathy or a surgical bleed.

The ROTEM Sigma is based on viscoelastic testing. Once the blood sample is placed on the pin in the first cuvette, the blood will enter each of the other 4 cuvettes. A cylindrical pin is then immersed and is oscillated by a spring to the right and the left. The movement of the pin is unrestricted as long as the blood is liquid but encounters resistance as the blood begins to clot. The clot increasingly restricts the rotation of the pin with rising clot firmness. The results are calculated by an integrated computer and reproduced in graphical format (figure 1). The device produces a graph of coagulation against a time axis. A prolonged clotting time can indicate a coagulation disorder. The first results are available within 5-10 minutes for quick therapy decisions and full qualitative results are available in 20 minutes.

The ROTEM sigma measures:

- Thrombin generation
- Fibrinogen
- Platelets
- Fibrinolysis



Haemostasis is a term used to describe the process of blood clotting and the subsequent dissolution of the clot, following repair of the injured tissue. During haemostasis four steps occur in a rapid sequence;

- Vascular constriction is the first response as the blood vessels constrict to allow less blood to be lost.
- In the second step, platelets become activated by thrombin and aggregate at the site of injury, forming a temporary, loose platelet plug. The protein fibrinogen is primarily responsible for stimulating platelet clumping. Platelets clump by binding to collagen, which becomes exposed following rupture of the endothelial lining of vessels, and cover the break in the vessel wall.
- The third step is called coagulation or blood clotting. Coagulation reinforces the platelet plug with fibrin threads that act as a “molecular glue”.
- Finally, the clot must be dissolved in order for normal blood flow to resume following tissue repair. The dissolution of the clot occurs through the action of plasmin.

Platelets are a large factor in the haemostatic process. They allow for the creation of the “platelet plug” that forms almost directly after a blood vessel has been ruptured. Within seconds of a blood vessel’s epithelial wall being disrupted platelets begin to adhere to the sub-endothelium surface. It takes approximately sixty seconds until the first fibrin strands begin to intersperse among the wound. After several minutes the platelet plug is completely formed by fibrin.

Fibrinogen Concentrate (Fibryga 1g) can quickly be reconstituted and administered to replace human fibrinogen.

PERFORMANCE CHARACTERISTICS

N/A

TYPE OF SAMPLE

Blood

PATIENT PREPARATION

N/A

TYPE OF CONTAINER AND ADDITIVES

For Laboratory:

- Blood Transfusion EDTA (pink) x 2
- FBC (purple)
- Coagulation screen (PT, APTT, Fibrinogen) (Blue)
- U&Es (Ochre)

For POCT:

- ROTEM (blue) **Must be filled to line**
- VBG for iCa, lactate, Hb

REQUIRED REAGENTS

N/A

REQUIRED EQUIPMENT

ROTEM point of care device – to be used by Recovery, ODP or Anaesthetist only
The maintenance and quality control of the ROTEM is the responsibility of the Blood Conservation Co-Ordinator or Transfusion Practitioner.

ENVIRONMENTAL AND SAFETY CONTROLS

Refer to BTRA 001 Blood Transfusion Risk Assessment

CALIBRATION PROCEDURES

N/A

PROCEDURAL STEPS

1. Pre-Alert Call

In some other circumstances, you may receive a **pre-alert** call informing you that a patient with major haemorrhage is on their way to ED.

- Obtain any patient details, if available
- Request that the Major Haemorrhage call is activated **once the patient has arrived and has been assessed.**
- Ascertain estimated time of arrival.
- In cases where the criteria for Trauma Major Haemorrhage or if the clinician requests, start thawing 4 units Group A or AB FFP

2. Activation of Haemorrhage Call

2.1 The Major Haemorrhage Protocol, which includes Haematology BMS, Acute Care Response Team member, Emergency Theatre Co-ordinator, Medical Registrar and Porter for the respective site, should be initiated in the following circumstances:

Trauma (ED)
Major trauma and 2 or more of following:
- Systolic BP < 100 mmHg
- Heart rate > 100bpm with major bleeding
- Penetrating injury

Or at discretion of Trauma Team Leader (TTL)

Non-Trauma
- Acute blood loss > 1500ml and suspected active bleeding
- Bleeding > 150 ml/min
- Loss of half circulating blood volume in less than 2 hrs
- Rapid blood loss with poor response to fluid resuscitation

Paediatric
- Acute blood loss >40ml/kg and suspected active bleeding
- +/- Clinical signs of hypovolemic shock
- +/- Poor response to fluid resuscitation

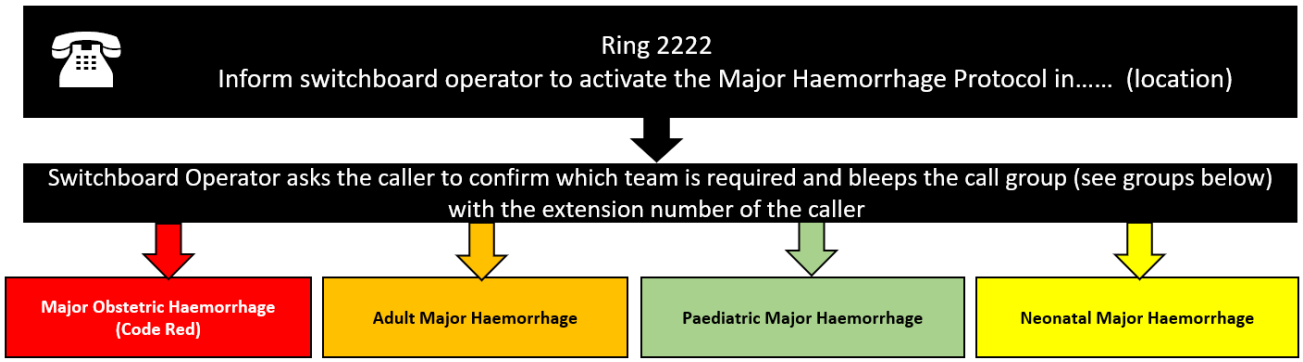
NB A Neonatal Major Haemorrhage call also includes Maternity CDS Midwife

An Adult major haemorrhage call at CGH also includes Site Team and DCC Resident Doctor

2.2 The Team Leader will call 2222 and declare Major Haemorrhage in the location (where the patient is currently in).

2.3 Switchboard will then ask the caller to confirm which team is required (Refer to Appendix 1), and will bleep the relevant call group with the extension number of the caller. The communication from switchboard will be one of the following:

- Major Obstetric Haemorrhage (Code Red)
- Adult Major Haemorrhage
- Paediatric Major Haemorrhage
- Neonatal Major Haemorrhage



2.4 The nominated Communications Lead in the Clinical area **should** contact you to inform you of:

- Patient's details (full name, identification number and date of birth or minimum acceptable identifiers if patient unknown)
- contact number
- the degree of urgency i.e. whether emergency group O red cells required / already used or whether group compatible blood is required (15-20min)
- patient's weight if patient < 40 Kg, type of injuries/ nature of bleed, abnormal bleeding

2.6 Major Haemorrhage pathway is activated (Appendix 2)

3. Action for staff included in Major Haemorrhage

3.1 Porter

Refer to Appendix 7 Porters Action on Receipt of Haemorrhage call

- The porter will collect the bloods samples from the clinical area, if not already sent. There will be samples for the laboratory (Transfusion, Full blood count, coagulation screen and fibrinogen, U&Es), which must be taken directly to the laboratory. There will also be a sample for testing on the ROTEM. This sample must be taken to Main Theatre, GRH or General Theatre Recovery, CGH.

- The porter or deputy will collect either the EMERGENCY Group O red cells (O Positive for males, O Negative for females) from the blood fridge or the issued blood from the laboratory, as directed by BMS, and take to the location.

3.2 Theatre Emergency Co-Ordinator

Refer to **Appendix 8 GRH Emergency Theatre Co-Ordinator Action Card**

- At GRH, there are resident theatre staff available 24/7
- At CGH, normal working hours are 08:00 – 22:00 Monday – Friday, and 08:00 – 13:00 Sat – Sun. Outside these times there will be a non-resident on call provision for return to theatres or emergency cases.
- On receipt of Adult Major Haemorrhage call at a CGH location, the GRH Theatre Emergency Co-Ordinator must call in the non-resident on call team **immediately**, as there is a maximum 30 minute travel time. The DCC resident doctor will contact the DCC Consultant to discuss the need for the CGH theatre on call team and make a decision to stand down if required.

3.3 Consultant Haematologist

The Consultant Haematologist will be available to offer clinical advice.

3.4 Team Leader

The Anaesthetist on call or most senior clinician will go to location to co-ordinate haemorrhage event, unless trauma call, in which the Trauma Team Leader will co-ordinate the event.

3.5 Recovery / ODP / Anaesthetist / Site Team CGH

- Recovery / ODP / Theatre staff / anaesthetist or a member of site team at CGH, who has been trained and assessed as competent, will run the citrate sample on the ROTEM on receipt.
- Refer to BTN 130 Guide to Running a Patient Sample on the ROTEM
- The Anaesthetist will be responsible for interpreting the ROTEM results and requesting blood components / products based on the ROTEM and/or laboratory results

3.6 Acute Care Response Team (ACRT) (Bleep 1700 CGH; 2700 GRH)

Refer to **Appendix 9 CGH ACRT and Site Team Action Card**

- There is usually one ACRT member on each site 24/7. On the occasion where only one member available overnight, they will be located at GRH but contactable on **Bleep 1700 CGH.**
- The ACRT will communicate requirements with the laboratory and ensure the laboratory samples and a sample for the ROTEM are taken, and samples are repeated at least hourly.
- In the event the ROTEM analyser downtime, consider requesting FFP early and sending the sample to GRH via pathology for testing.
- The ACRT will ensure the Haemorrhage protocol is followed.

3.7 Site Team

Refer to **Appendix 9 CGH ACRT and Site Team Action Card**

- The Site Team at CGH are responsible for starting to run the sample on the ROTEM **out of hours**.
- Once the samples have been taken, a member of the Site Team must take one of the citrate samples to Recovery in General Theatre and run the sample on the ROTEM.
- The Site Team must follow BTN 130 Guide to Running a Patient Sample on the ROTEM
- The Site Team are responsible for ensuring any new staff working at CGH are trained in how to run a ROTEM test.

3.8 CGH Medical Reg / CGH DCC Resident Doctor

- Consider if onsite laboratory services required at CGH, and if so, inform laboratory BMS

3.9 DCC Resident Doctor CGH (CGH calls only)

- The DCC Resident Doctor at CGH to contact the on-call DCC Consultant to inform of major haemorrhage at CGH.
- The DCC Consultant will assess the needs for CGH on call teams continued support i.e Anaesthetic and Theatre Team and make decisions to stand down if required.

3.10 Laboratory BMS

- If the clinical location has not contacted you within 5 minutes with any details, then **YOU must phone the location immediately (using the second phone line in transfusion Ex 5280 (GRH) or Ex 3270 (CGH)) to minimise any delay in the provision of blood and blood components, and obtain patient details, nature of haemorrhage, contact name and number. If no response, contact the ACRT.**

- If the major haemorrhage is at CGH and is when the lab is closed ie overnight, the BMS must follow **Appendix 5 Out of Hours CGH Haemorrhage Action Card**. The Medical Registrar and ACRT will be managing the haemorrhage but also feeling quite vulnerable whilst waiting for clinical support and back up teams to arrive. They will need assurance of the timely provision of blood and other blood components. The BMS must:

  - On discussion with the Medical Registrar, determine if there is a requirement to go to CGH and open the lab or if the haemorrhage can be managed from GRH
  - Remind them that there are 8 units Group O blood; 2 O+ and 2 O- in both GT and OT fridges. This is enough blood to manage the initial resuscitation and to give enough time for further products to be prepared and received.
  - If the patient is female and > 51 years, then O+ blood can be used.

- The BMS must check LIMS to review previous transfusion history and establish if blood group already known.

- Group O red cells should be used in the emergency situation until the patient's ABO group is known. Females < 51 years should receive O Negative K- red cells. Consider group O Positive red cells in males and women > 51 years.

- On receipt of transfusion sample, perform a Biovue Rapid Group (BRG) and issue **Code Pack A** (4 red units red cells) using test set Emergency Red Cell Issue (ERCU).

  Refer to Appendix 6 for the 2- sample rule and tests to be requested

  Check with the location, if the blood is required in the clinical area or to go straight to the satellite blood fridge. If 2 or 4 units are required in the clinical area, these must be packaged in a transport box, but ONLY **Package 2 units of red cells maximum in a transport box i.e 2 per box, as this will minimise wastage in the clinical area and seal with a security tag.**

  Complete a transport form to go to the clinical area. The transport form serves as the audit trail in the absence of Blood360

  Refer to BTSOP 142 Transport of Blood within Gloucestershire

- A full blood group and antibody screen AND retrospective crossmatch must be performed.

- Once completed enter “Blood crossmatched retrospectively and units compatible by IAT”, and inform the clinical team. In the event that any units are incompatible, you must contact the senior clinician immediately to inform, and recall the units if possible. Inform a senior member of staff.

  (Refer to Appendix 3 for tests to be requested based on number of times patient has had a group and screen)

- Inform haematology with details of major haemorrhage so that FBC and coagulation screen plus fibrinogen can be processed urgently and the results phoned through to Communication Lead.

- Depending upon the situation, communicate to the Porter of the need and time to return to collect further components, if required.

- Login in to ROTEM LIVE (Login rotem; password Rotem123) to review the ROTEM results and to confirm further requests for components, as the Team Leader will move to goal directed therapy based on these results. Refer to ROTEM Algorithm (Appendix 4).

- If the team have been unable to maintain a BP 100, then they may ask for **CODE PACK B**. This consists of:

  - 2 x Cryoprecipitate (or less if patient < 40 Kg) or Fibrinogen Concentrate
  - 2 x FFP (or less if patient < 40 Kg).
  - 1 x Platelets
  - 2 x red cells

- **Request for platelets will depend upon clinical situation and laboratory results**. If platelets are required before the blood group of the patient is known, Group A should be used. Rh D negative platelets should be used in females < 50 years, but if not available, then Rh D positive platelets may be given, but in conjunction with 500iu anti-D. These may be requested when platelet count falls < 100 x 10^9/l and should be transfused when platelet count < 75 x 10^9/l.

- **Request for Cryoprecipitate will depend upon the fibrinogen result and the availability of Fibrinogen Concentrate**. Fibrinogen needs to be replaced when fibrinogen < 1.5 g/l or < 2g/l in obstetrics.
  For non-obstetric patients:

Fibrinogen dosing guide		
FIBTEM A5 target ≥10mm		
FIBTEM A5	**Cryoprecipitate**	**Fibrinogen concentrate**
7-10mm	1-2 TD doses	2g

≤6mm	2 TD doses	4g

For Obstetric Patients:

Fibrinogen dosing guide		
FIBTEM A5 target ≥10mm		
FIBTEM A5	**Cryoprecipitate**	**Fibrinogen concentrate**
5-8mm	1-2 TD doses	4g
≤5mm	2 TD doses	6g

The dose given will depend upon if the patient is an obstetric patient or not, and the FIBTEM A5 value.

Fibrinogen concentrate must only be given if the ROTEM has been used; if not, then cryoprecipitate should be issued instead.

The administration of Fibrinogen concentrate **must** be approved by Consultant Anaesthetist.

There is 4g Fibrinogen Concentrate stored in Theatre Fibrinogen Fridge/Incubator at GRH and 2g Fibrinogen Concentrate stored in Recovery POCT Fridge at CGH. If used, the BMS must replace the stock immediately.

- The BMS **must** ring the clinical area and speak to the Communication Lead to inform when blood components are ready
- Repeat Full blood counts and coagulation screens as required, and issue blood and blood components following further communication from the Communication Lead in the Clinical Area.
- Remember to Replace the Emergency Group O blood in the satellite Blood Fridge

3.11 Stand down

- The Communication Lead / Senior clinician should inform the laboratory when to “stand down”.
- If the major haemorrhage is at CGH out of hours, the Site Team need to inform the Emergency Theatre Co-Ordinator at GRH that the non-resident theatre team have been stood down and when, following discussion with DCC Resident Doctor (bleep 1100).

- Any unused blood components must be recalled to the laboratory to ensure that the cold chain is maintained. Refer to BTSOP124 on Recall of blood components and products
- The Major Haemorrhage review form (BTCH 105) must be completed.
- Traceability audit trail must be completed as soon as possible including the return of any tags of emergency group O given and Fibrinogen concentrate.

QUALITY CONTROL PROCEDURES
N/A

INTERFERENCES AND CROSS REACTIONS
N/A

PRINCIPLE OF PROCEDURE FOR CALCULATING RESULTS (Including, where relevant, the measurement uncertainty of measured quantity values).
N/A

BIOLOGICAL REFERENCE INTERVALS / CLINICAL DECISION VALUES
Refer to ROTEM algorithm (Appendix 4)

REPORTING OF RESULTS
Refer to Appendix 2 and 3 for tests to be requested depending upon 2-sample rule criteria.

REPORTABLE INTERVAL OF EXAMINATION RESULTS
N/A

INSTRUCTIONS FOR DETERMINING QUANTITATIVE RESULTS WHEN A RESULT IS NOT WITHIN THE MEASURED INTERVAL
N/A

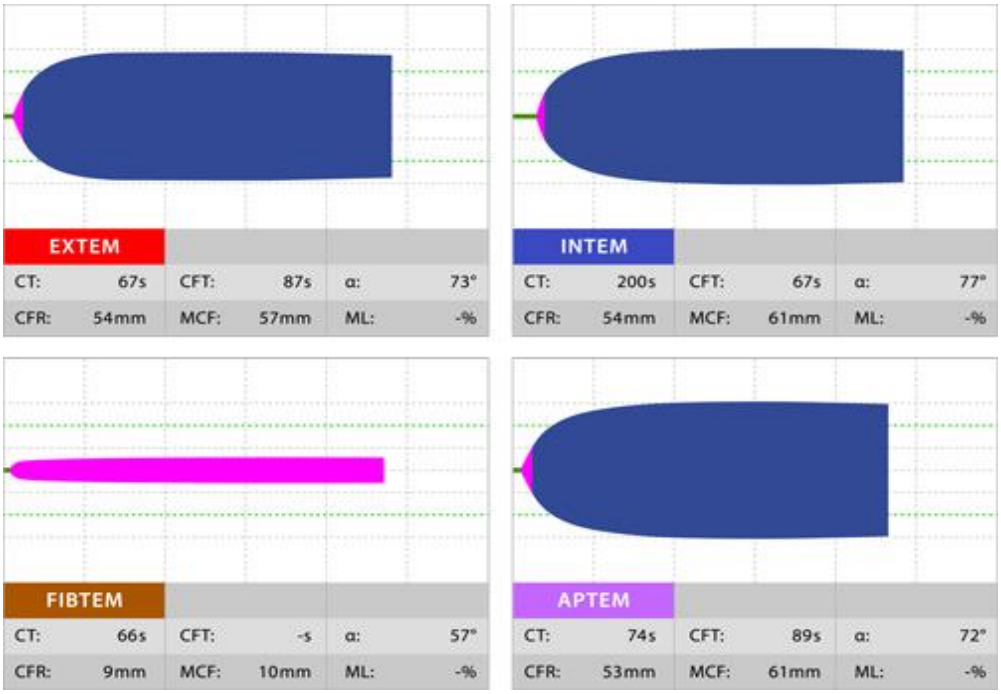
ALERT / CRITICAL VALUES
- In the event of any incompatibility or antibody in patients' plasma identified retrospectively, the BMS must contact the Team Leader to inform and establish what has been transfused.
- Hb < 70g/l
- Platelets < 75 x 10^9/l
- PT ratio > 1.5 or 18 seconds
- APTT ratio > 1.5 or 40 seconds
- Fibrinogen < 1.5g/l or 2g/l in obstetrics

LABORATORY CLINICAL INTERPRETATION

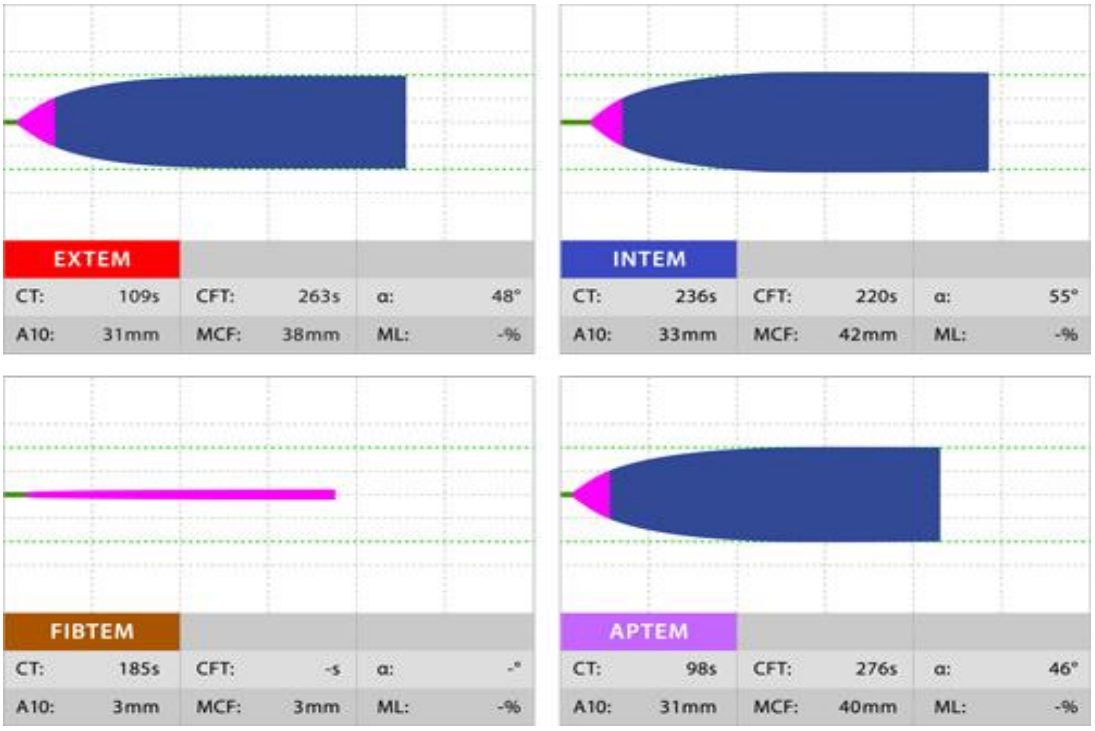
Refer to ROTEM algorithm (Appendix 4)

The Clot formation rate (CFR) / amplitude (A) of the clot can be measured at 5, 10, 20, or 30 mins. We use the Amplitude at 5 minutes (A5) as this allows earlier intervention.

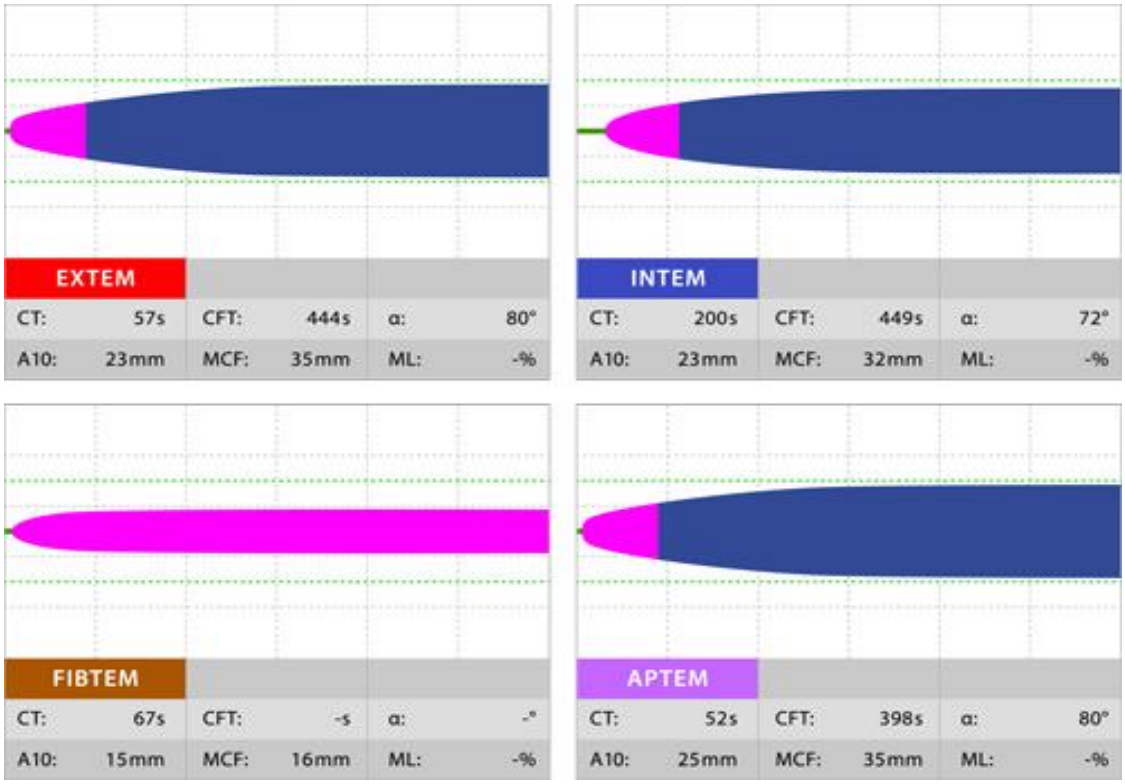
1. Normal or Surgical Bleeding



2. Fibrinogen Deficiency



3. Platelet Deficiency



POTENTIAL SOURCES OF VARIATION

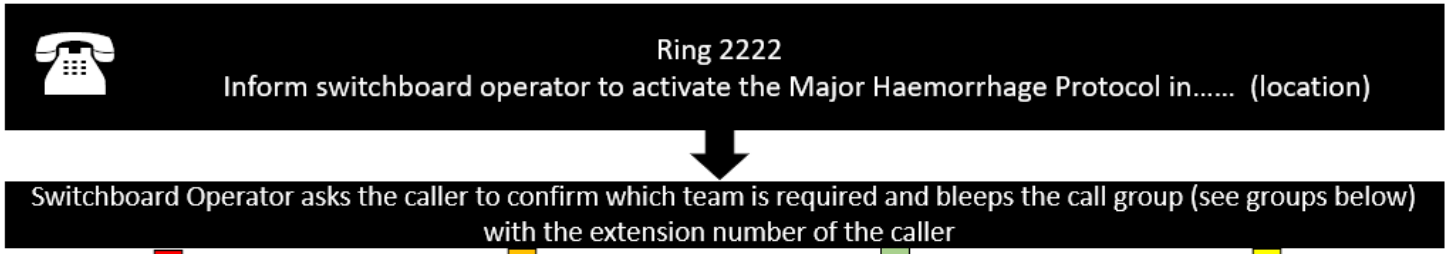
In the event ROTEM is not available, consider requesting FFP earlier.

REFERENCES AND FURTHER READING:

Document name/number	Version	Location
Blood Safety and Quality Regulations	2005	http://www.opsi.gov.uk/si/si2005/20050050.htm
A practical guideline for the haematological management of major haemorrhage	2015	http://onlinelibrary.wiley.com/doi/10.1111/bjh.13580/full
Blood Transfusion and the Anaesthetist	2010	www.aagbi.org
NPSA Rapid Response Report The transfusion of blood and blood components in an emergency	NPSA/2010/RRR017	http://www.nrls.npsa.nhs.uk/resources/type/alerts/?entryid45=83659
BSH Haematological management of major haemorrhage: A British Society for Haematology Guideline	2022	https://onlinelibrary.wiley.com/doi/epdf/10.1111/bjh.18275
Acute traumatic coagulopathy:pathophysiology and resuscitation	2016	British Journal of Anaesthesia, 117 (S3):iii31-iii43

NICE Viscoelastometric point-of-care testing (ROTEM, TEG and Sonoclot systems) to assist with detecting, managing and monitoring of haemostasis	2013	https://www.nice.org.uk/guidance/dg13/documents/viscoelastometric-pointofcare-testing-rotem-teg-and-sonoclot-systems-to-assist-with-detecting-managing-and-monitoring-of-haemostasis-final-scope2
Early viscoelastic guided fibrinogen replacement combined with escalation of clinical care reduces progression in postpartum haemorrhage: a comparison of outcomes from two prospective observational studies.	2024	https://www.sciencedirect.com/science/article/abs/pii/S0959289X24000505
Relationship between the dual platelet-inhibited ROTEM Sigma FIBTEM assay and Clauss fibrinogen during postpartum haemorrhage	2024	https://associationofanaesthetists-publications.onlinelibrary.wiley.com/doi/10.1111/anae.16455
Blood Transfusion Action Card AC15		Trust Intranet
Blood Transfusion Action Card AC16		Trust Intranet
BTCH 105 Major Haemorrhage Review Template		QPULSE
BTSOP 142 Transport of Blood within Gloucestershire		QPULSE
BTN 130 Guide to Running a Patient Sample on the ROTEM		QPULSE
BTRA 001 Blood Transfusion Risk Assessment		QPULSE
BTSOP124 on Recall of blood components and products		QPULSE

Appendix 1 Major Haemorrhage Call Groups



Major Obstetric Haemorrhage (Code Red)

Obstetric & Gynae Reg	5525
Obstetric Consultant	2232
Gynae Reg	5524
Delivery Suite Co-ordinator	2424
Anaesthetic Reg	2012
3rd Anaesthetist on call	1144
Anaesthetic Nurse	2129
Scrub Nurse	2487
Theatre Emergency Co-ordinator	2600
Blood Conservation Co-ordinator	1888
Blood Bank Laboratory	2502
Porter - GRH	2302

Adult Major Haemorrhage

GRH	
Blood Bank Laboratory	2502
Porter	2302
Acute Care Response Team	2700
Theatre Emergency Co-ordinator	2600
Blood Conservation Co-ordinator	1888
Medical SpR	1225

CGH	
Blood Bank Laboratory	1551
Porter	1600
Acute Care Response Team	1700
Theatre Co-ordinator	1199
GRH Theatre Emergency Co-Ordinator	2600
Blood Conservation Co-ordinator	1888
ITU Anaesthetist SpR	1100
Site team	1343
Medical SpR	1689

Paediatric Major Haemorrhage

Nurse Co-ordinator	2425
Paediatric SHO (Wards)	2402
Paediatric SpR (Wards)	2352
Paediatric SpR (PAU)	1107
Paediatric Consultant (PAU)	1133
Paediatric Consultant (Wards)	2254
Blood Conservation Co-ordinator	1888
Blood Bank Laboratory	2502
Porter - GRH	2302

Neonatal Major Haemorrhage

Neonatal Consultant	2428
Neonatal SpR	2403
Neonatal SHO	2404
Neonatal Nurse in Charge	2477
Neonatal Nurse Emergency Bleep Holder	2405
Delivery Suite Co-ordinator	2424
Blood Conservation Co-ordinator	1888
Blood Bank Laboratory	2502
Porter - GRH	2302

Appendix 2

Major Haemorrhage – Adult

Trauma (ED)

Major trauma and 2 or more of the following;

- Systolic BP <100mmHg
- Heart rate >100bpm with bleeding
- Penetrating injury

If above criteria satisfied, ring Blood Bank to request FFP directly after receiving pre-alert - FFP needs 30mins to thaw

Or at the discretion of the clinical lead

Non-Trauma

Acute blood loss >1500ml and suspected active bleeding

- Bleeding >150ml/min
- Loss of half circulating blood volume in less than 2 hours
- Rapid blood loss with poor response to fluid resuscitation

Activation

- Ring 2222. State 'Major Haemorrhage Protocol' and location of patient. Confirm which team / group is needed; Obstetric, Adult, Paediatric or Neonate
- Ring Blood Bank (GRH 5244, CGH 4062). Give patient details and clinical details
- If Emergency group O blood needed, instruct porter to collect immediately
- If Trauma Major Haemorrhage and meets above criteria, request 4 x FFP

Access

- Secure access
- Give 1g Tranexamic Acid (if not already or if contraindicated)
- Allocate roles

Take Bloods

- Lab: G&S + Cross match (x2), Coagulation screen, FBC, U&E's
- POCT: ROTEM (1 x Coag screen bottle), Blood Gas for Lactate, iCa, Haemacue for Hb

Delivery

- Give Red Cells; Code Pack A (4 x Red Cells) or Emergency Group O through rapid infuser
- Order FFP (if required) and/or ROTEM unavailable
- Re-assess after every unit aiming for a systolic of >100

MOVE TO GOAL DIRECTED THERAPY BASED ON ROTEM RESULTS

Ongoing Bleeding

- Maintain temperature > 35°C
- Give 10mls Ca Gluconate slowly before every 4th unit to keep iCa>1mmol/l

Damage Control Surgery

- Move to theatres / endoscopy / interventional radiology
- Consider cell salvage.
- If BP unachievable / severe ongoing haemorrhage contact Blood Bank and ask for Code Pack B (IF ROTEM UNAVAILABLE)

Ongoing Bleeding

•Code Pack B (IF ROTEM UNAVAILABLE):	Give Cryo	x 2	or Fib Conc. Reassess
	Give FFP	x 2	Reassess
	Give Platelets	x 1	Reassess
•REPEAT BLOODS FOR LAB AND ROTEM	Give Red Cells	x 2	Reassess

MOVE TO GOAL DIRECTED THERAPY BASED ON ROTEM RESULTS OR
If severe ongoing bleeding before ROTEM available, use 2nd CODE PACK B

Appendix 3 Paediatric Major Haemorrhage Protocol < 40 Kg

MANAGEMENT OF PAEDIATRIC MAJOR HAEMORRHAGE < 40Kg

TEAM LEADER TO CALL 2222 AND DECLARE 'MAJOR HAEMORRHAGE' IF:

- High mechanism / Pre hospital activation / Penetrating injury – request FFP early (30mins thaw time)
- Acute blood loss >40ml/kg and suspected active bleeding
- Loss of radial/brachial pulses

CONTACT BLOOD BANK (GRH Ext 5244 or CGH Ext 4062) WITH PATIENT DETAILS & PATIENT WEIGHT

- Estimate weight – Broslow tape or (Age + 4) x2

Medical Management

- **Give 15mg/Kg TXA bolus** (if not given pre-hospital) Max dose 1000mg (66Kg)
- Consider **0.2ml/kg 10% calcium chloride** to keep iCa>1mmol/L
- Consider cell salvage
- Maintain temperature > 36°C
- Prevent and reverse acidosis
- Consider discussing with haematologist

Laboratory Support (PATIENT DETAILS & WEIGHT REQUIRED)

Request immediately from lab:

- Code Pack A (Red Cells): dose / amount = 20mLs / Kg
- **REQUEST FFP EARLY IN TRAUMA (30 MINS THAW TIME)** Dose / amount = 20mLs / Kg
- See table at the end of algorithm for further guidance on volume

Send to lab:

- FBC, Clotting Screen, U+Es, 2 Cross match requests (2 samples with 2 forms and separate phlebotomy events by 2 different members of staff)

POCT

- Consider ABG, HemoCues (for Hb)

Give blood components and assess response clinically with hourly blood tests

- Give Red cells for named patient OR if group compatible blood not yet available give **Emergency O RhD Negative Blood available on both sites – instruct porters to collect**

If bleeding continuing be guided by clinical picture and blood results. Are results available?

NO

Be guided by clinical picture
Request **Additional Blood Components based on Laboratory results AND Weight of patient**

- Consider FFP 20ml/kg
- Consider platelets 15ml/kg
- Consider cryoprecipitate 10ml/kg

YES – Aims of Treatment

Transfusion targets

- Hb 70 - 90 g/L
- Plts > 75 x 10^9/L
- PT ratio < 1.5
- APTT ratio < 1.5
- Fib > 1.5 g/L

Other targets

- Systolic Age x 2 + 70 until bleeding controlled
- pH > 7.35
- Lactate < 2
- Ca^{2+} > 1mmol/L (ABG)
- Temp > 36°C
- Monitor K+

Stand Down

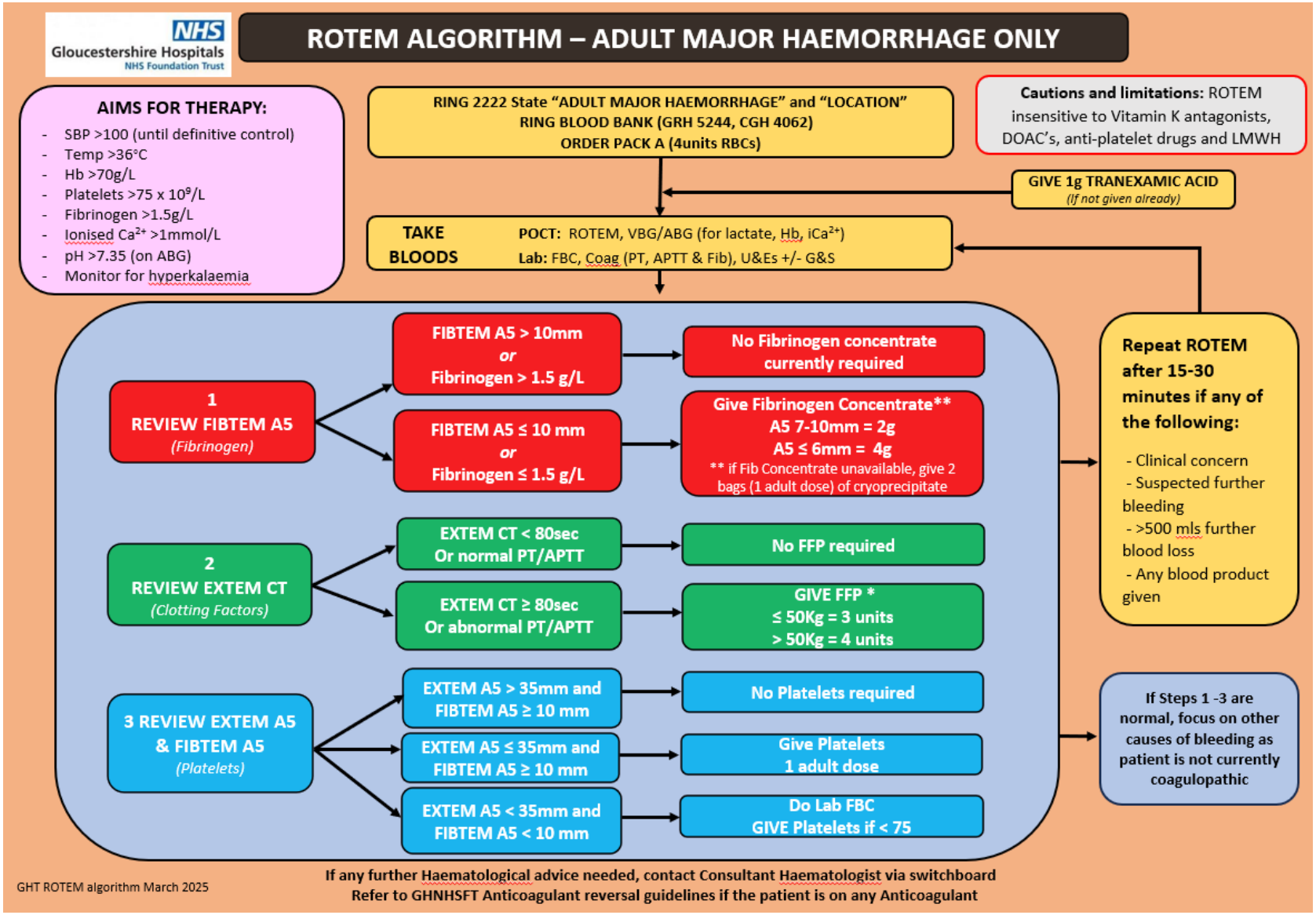
Inform Blood Transfusion, return unused blood components to the laboratory, fate units transfused, debrief

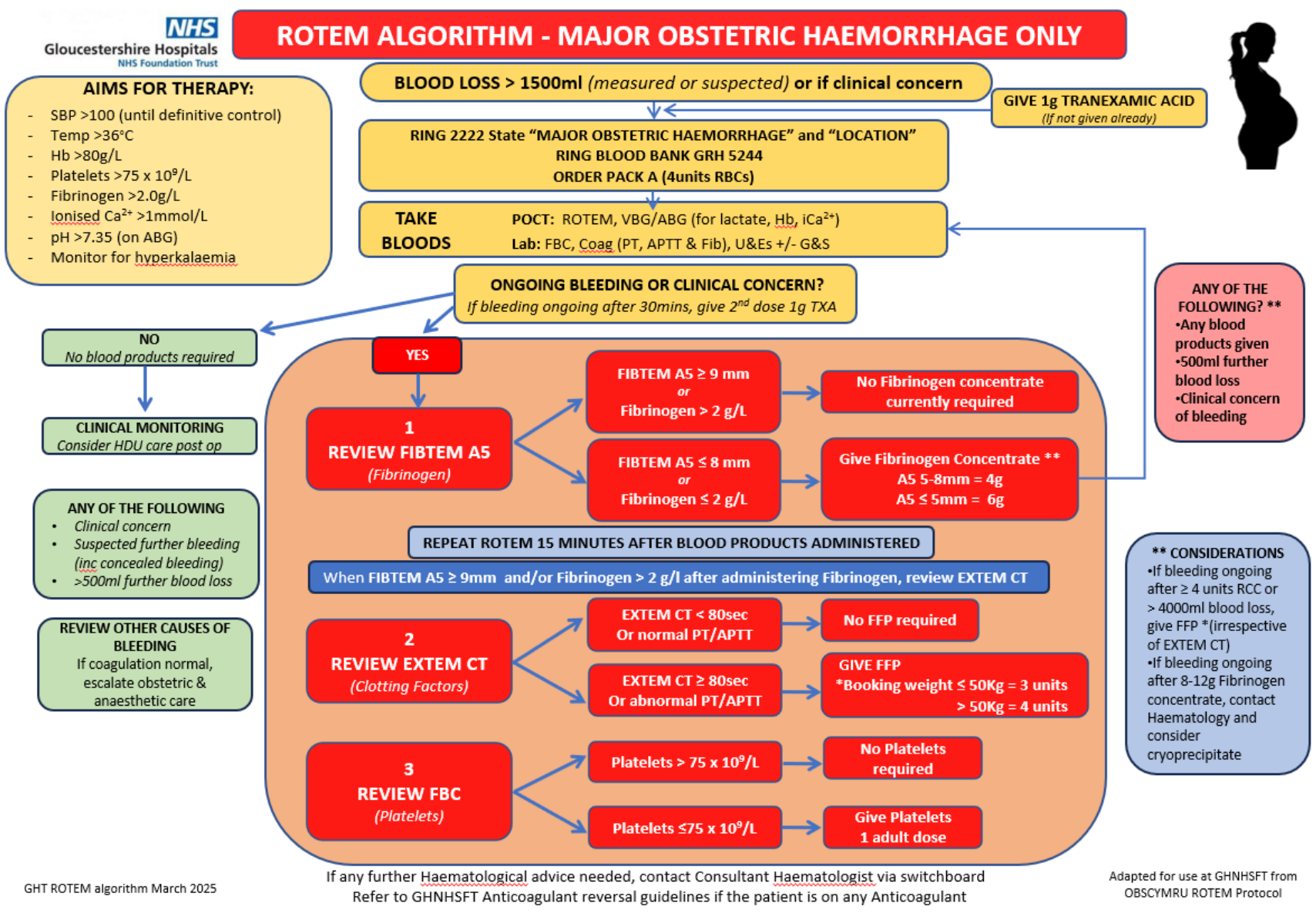
Guide for therapeutic doses (TD) in Paediatrics

Weight	Red Cells *(20mls/Kg)*	FFP *(20mls/Kg)*	Cryoprecipitate *(10mls/Kg)*	Platelets *(15mls/Kg)*
<5Kg	<100mls (1-3 Neonate packs)	<100mls (1-3 Neonate packs)	<50mls 1 single donor unit	<75mls *1 neonatal unit
5-9 Kg	100 – 180mls (1 unit)	100 – 180mls (1 unit)	50 – 90 mls 2 single donor units	75 – 135mls *2 neonatal units
10-19 Kg	200 – 380mls (1 – 2 units)	200 – 380mls (1 – 2 units)	100 – 190mls 1 pool / bag	1 adult unit (max 1 ATD)
20-40 Kg	400 – 800mls (2 – 3 units)	400 – 800mls (2 – 3 units)	200 – 400mls 1 – 2 pools / bags	1 adult unit (max 1 ATD)

*neonatal/paediatric platelets are not stocked routinely, therefore an adult unit must be used to prevent delay/harm

Appendix 4


NHS
Gloucestershire Hospitals
NHS Foundation Trust
ROTEM ALGORITHM – ADULT MAJOR HAEMORRHAGE ONLY
AIMS FOR THERAPY:
- SBP >100 (until definitive control)
- Temp >36°C
- Hb >70g/L
- Platelets >75 x 10⁹/L
- Fibrinogen >1.5g/L
- Ionised Ca²⁺ >1mmol/L
- pH >7.35 (on ABG)
- Monitor for hyperkalaemia
RING 2222 State "ADULT MAJOR HAEMORRHAGE" and "LOCATION"
RING BLOOD BANK (GRH 5244, CGH 4062)
ORDER PACK A (4units RBCs)
Cautions and limitations: ROTEM insensitive to Vitamin K antagonists, DOAC's, anti-platelet drugs and LMWH
GIVE 1g TRANEXAMIC ACID
(If not given already)
TAKE BLOODS
POCT: ROTEM, VBG/ABG (for lactate, Hb, iCa²⁺)
Lab: FBC, Coag (PT, APTT & Fib), U&Es +/- G&S
1 REVIEW FIBTEM A5
(Fibrinogen)
FIBTEM A5 > 10mm
or
Fibrinogen > 1.5 g/L
No Fibrinogen concentrate currently required
FIBTEM A5 ≤ 10 mm
or
Fibrinogen ≤ 1.5 g/L
Give Fibrinogen Concentrate**
A5 7-10mm = 2g
A5 ≤ 6mm = 4g
** if Fib Concentrate unavailable, give 2 bags (1 adult dose) of cryoprecipitate
2 REVIEW EXTEM CT
(Clotting Factors)
EXTEM CT < 80sec
Or normal PT/APTT
No FFP required
EXTEM CT ≥ 80sec
Or abnormal PT/APTT
GIVE FFP *
≤ 50Kg = 3 units
> 50Kg = 4 units
3 REVIEW EXTEM A5 & FIBTEM A5
(Platelets)
EXTEM A5 > 35mm and FIBTEM A5 ≥ 10 mm
No Platelets required
EXTEM A5 ≤ 35mm and FIBTEM A5 ≥ 10 mm
Give Platelets
1 adult dose
EXTEM A5 < 35mm and FIBTEM A5 < 10 mm
Do Lab FBC
GIVE Platelets if < 75
Repeat ROTEM after 15-30 minutes if any of the following:
- Clinical concern
- Suspected further bleeding
- >500 mls further blood loss
- Any blood product given
If Steps 1 -3 are normal, focus on other causes of bleeding as patient is not currently coagulopathic
GHT ROTEM algorithm March 2025
If any further Haematological advice needed, contact Consultant Haematologist via switchboard
Refer to GHNHSFT Anticoagulant reversal guidelines if the patient is on any Anticoagulant


NHS
Gloucestershire Hospitals
NHS Foundation Trust
ROTEM ALGORITHM - MAJOR OBSTETRIC HAEMORRHAGE ONLY
AIMS FOR THERAPY:
- SBP >100 (until definitive control)
- Temp >36°C
- Hb >80g/L
- Platelets >75 x 10⁹/L
- Fibrinogen >2.0g/L
- Ionised Ca²⁺ >1mmol/L
- pH >7.35 (on ABG)
- Monitor for hyperkalaemia
BLOOD LOSS > 1500ml (measured or suspected) or if clinical concern
GIVE 1g TRANEXAMIC ACID
(If not given already)
RING 2222 State "MAJOR OBSTETRIC HAEMORRHAGE" and "LOCATION"
RING BLOOD BANK GRH 5244
ORDER PACK A (4units RBCs)
TAKE BLOODS
POCT: ROTEM, VBG/ABG (for lactate, Hb, iCa²⁺)
Lab: FBC, Coag (PT, APTT & Fib), U&Es +/- G&S
ONGOING BLEEDING OR CLINICAL CONCERN?
If bleeding ongoing after 30mins, give 2nd dose 1g TXA
ANY OF THE FOLLOWING? **
•Any blood products given
•500ml further blood loss
•Clinical concern of bleeding
NO
No blood products required
CLINICAL MONITORING
Consider HDU care post op
ANY OF THE FOLLOWING
• Clinical concern
• Suspected further bleeding (inc concealed bleeding)
• >500ml further blood loss
REVIEW OTHER CAUSES OF BLEEDING
If coagulation normal, escalate obstetric & anaesthetic care
YES
1
REVIEW FIBTEM A5
(Fibrinogen)
FIBTEM A5 ≥ 9 mm
or
Fibrinogen > 2 g/L
No Fibrinogen concentrate currently required
FIBTEM A5 ≤ 8 mm
or
Fibrinogen ≤ 2 g/L
Give Fibrinogen Concentrate **
A5 5-8mm = 4g
A5 ≤ 5mm = 6g
REPEAT ROTEM 15 MINUTES AFTER BLOOD PRODUCTS ADMINISTERED
When FIBTEM A5 ≥ 9mm and/or Fibrinogen > 2 g/l after administering Fibrinogen, review EXTEM CT
2
REVIEW EXTEM CT
(Clotting Factors)
EXTEM CT < 80sec
Or normal PT/APTT
No FFP required
EXTEM CT ≥ 80sec
Or abnormal PT/APTT
GIVE FFP
*Booking weight ≤ 50Kg = 3 units
> 50Kg = 4 units
3
REVIEW FBC
(Platelets)
Platelets > 75 x 10⁹/L
No Platelets required
Platelets ≤75 x 10⁹/L
Give Platelets 1 adult dose
** CONSIDERATIONS
•If bleeding ongoing after ≥ 4 units RCC or > 4000ml blood loss, give FFP *(irrespective of EXTEM CT)
•If bleeding ongoing after 8-12g Fibrinogen concentrate, contact Haematology and consider cryoprecipitate
GHT ROTEM algorithm March 2025
If any further Haematological advice needed, contact Consultant Haematologist via switchboard
Refer to GHNHSFT Anticoagulant reversal guidelines if the patient is on any Anticoagulant
Adapted for use at GHNHSFT from OBSCYMRU ROTEM Protocol

Appendix 5 **Major Haemorrhage at CGH when Lab Closed Action Card**

In the event of a major haemorrhage at CGH overnight ie when CGH lab is closed, the situation will be managed by the Med Registrar on call +/- Acute Care Response Team. Remember the Reg managing this event will be feeling very vulnerable and will be looking for assurance on the timely provision of blood components/product, and will be waiting for clinical support and theatre teams, if required.

At the point of call, there are a few things you need to do:

1. On receipt of the call, you must ascertain the cause and degree of the haemorrhage, and by asking the Reg, establish if you are required to go to CGH and open the lab or if the blood component issue and delivery can be managed from GRH.

   NB It will be quicker for the BMS at GRH to go to CGH rather than waiting for back up to arrive at CGH. Remember this is their call not yours.

2. Remind them that there are 8 units of Group O blood; 2 O+ and 2 O- in both GT and OT fridges.
   This is enough blood to manage the initial resuscitation and to give enough time for further products to be prepared and received.
   If the patient is female and > 51 years age, the emergency O+ units can be transfused.

3. Establish if they are going to run a ROTEM (done by site team)

4. If the Reg asks for FFP, then provide FFP. It would be easier to start thawing at GRH rather than waiting to start thawing once you get to CGH

5. Issue 4 x red cells. Even if no sample, you can issue 4 x Group O using the ERCU test set

6. Mobilise the driver to take the blood to CGH

   AND / OR

   Mobilise the driver to take you if you have no transport and are required to open the lab.

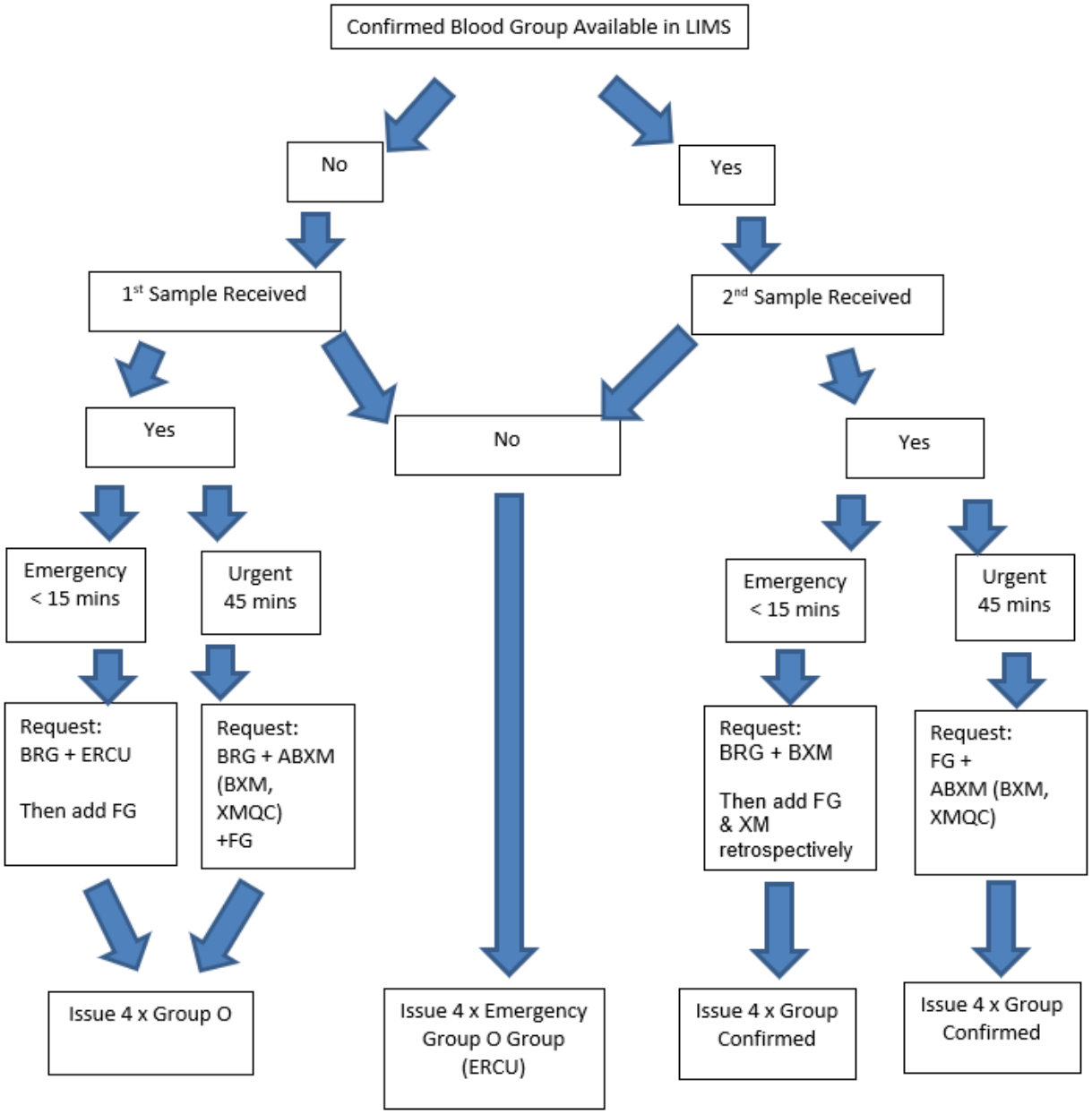
7. Contact the porters so they are waiting in pathology ready to receive blood

Remember:
Good communication is required between you and the Med Reg/ACRT for the duration of the haemorrhage event until you are told to stand down.

Once stood down, its good practice to ascertain what has been transfused and to ensure any unused components are returned to the blood fridge/ lab, scanned into blood360 and quarantined if required

Appendix 6

Request for Emergency Issue of Blood



Appendix 7

Porters Action on Receipt of Haemorrhage Call

MAJOR HAEMORRHAGE PROTOCOL ACTIVATED

Porter receives call
"….Major Haemorrhage in Location

Porter to collect samples from Location for Laboratory (Haematology & Blood Transfusion) AND take to blood transfusion

Porter to collect and transport:

- **2 units Emergency O negative red cells**
  OR
- **2 units of Emergency O positive red cells**
  OR
- **1 neonatal Emergency O Negative**
  OR
- **Issued Red cells from Lab /Blood Fridge**

AS DIRECTED BY HAEMATOLOGY BMS

Porter to collect and transport blood / components as required by laboratory / clinical area until "Stand down"
AND
Return any unused components immediately back to the laboratory.

Appendix 8

GRH Emergency Theatre Co-Ordinator Action Card

ADULT MAJOR HAEMORRHAGE PROTOCOL ACTIVATED

GRH Emergency Theatre Co-Ordinator (bleep 2600) receives call
"….Adult Major Haemorrhage in Location

- Location at GRH
  - GRH Normal working hours 24/7
    - GRH Theatre available to manage MH and run ROTEM
- Location at CGH
  - During CGH normal working hours
    08:00 - 22:00 Mon - Fri
    08:00 -13:00 Sat - Sun
    - No
      - Call in non-resident on call theatre team into CGH immediately
      - DCC resident doctor to discuss with DCC Consultant the need for theatre team
      - Inform CGH Site Team (bleep 1430) this action has been completed
    - Yes
      - CGH Theatre available to manage MH and run ROTEM

Appendix 9 **CGH ACRT and Site Team Action Card**

ADULT MAJOR HAEMORRHAGE PROTOCOL ACTIVATED

CGH ACRT and Site Team receives call
"Adult Major Haemorrhage" in Location

CGH ACRT
Follow Appendix 2

CGH ACRT ensures blood samples taken.
- **Crossmatch x 2**
- **FBC**
- **Coagulation x 2 (1 x ROTEM, 1 x lab)**
- **U&E's**

During CGH normal working hours (theatre)
08:00 - 22:00 Mon - Fri
08:00 -13:00 Sat - Sun

Yes

No

Site Team receives call from GRH Emergency Theatre Co-ordinator informing non-resident team coming in

Site Team to inform ACRT

Porter to take Lab samples to pathology

Porter to take sample for ROTEM to CGH GT Recovery

First Choice:
- Site Team to run sample on ROTEM
- Refer to QR code
- Refer to BTN 130 Quick Guide to running patient sample on ROTEM

Second choice:
- Wait for CGH non-resident theatre team to attend to run ROTEM
- Consider requesting FFP early

In the event, ROTEM is not available, consider
- Requesting FFP early
- Sending the sample to GRH