Management of Massive Haemorrhage: developed by the Northwest Regional Transfusion Committee.

Modified for use at AHCH, but to be used in conjunction with the local massive haemorrhage checklist (simplified version of flowchart from page 2).

Alder Hey
Transfusion Management of Massive Haemorrhage

Ensure a consultant is aware of the massive haemorrhage and a senior member of staff is available to take charge of resuscitation if not already present

Protocol Activation:
Via Switchboard on 2222

- **Emergency O red cells**

2 units of O negative red cells are stored in both the laboratory issue room fridge and theatre fridge (in the theatre corridor directly opposite the end of the PICU link bridge – first door on the left)

- **MHP1**

MHP1 will be available for collection from the lab 10-15 minutes from the call

Transfusion lab:
- 2492 (preferred)
- 2490 (alternative)
- Bleep 289

Theatre Porter bleep 498

Consultant Haematologist:
via switchboard (0)

Ongoing severe bleeding (overt / covert) and received 20ml/kg of red cells or 40ml/kg of any fluid for resuscitation in preceding hour.
Signs of hypovolaemic shock and / or coagulopathy
Consider Tranexamic acid (mandatory in trauma – give within 3 hours of injury)
15mg/kg (max 1000mg) intravenously over 10 minutes, then infuse 2mg/kg/hr (max 125mg/hr) intravenously for at least 8 hours or until bleeding is controlled

Activate Massive Haemorrhage Pathway

Call for help
Call switchboard (2222) and declare:
'Massive Haemorrhage, Location, Specialty'
Assemble team and allocate roles
Consultant involvement essential

A signed, handwritten emergency blood order form will be accepted for products

RESUS
Airway
Breathing
Circulation

Take bloods and send to lab:
Select patient
Choose Orders, New sets, Choose Clinician, type "Mas"
Order MHP 1 (see table 1)
Includes XM, FBC, PT, APTT, fibrinogen, biochemistry profile, blood gas, lactate

STOP THE BLEEDING

MHP 1
Red cells and FFP: Give aliquots of **10ml/kg** in a 1:1 ratio. Re-asses rate of blood loss & response to treatment & repeat as necessary

When half of MHP 1 has been used consider ordering MHP 2
Re-assess
Suspected continuing haemorrhage requiring further transfusion
Take bloods and send to lab:
Select patient
Choose Orders, New sets, Choose Clinician, type "Mas"
Order MHP 2 (see table 2)
Includes XM, FBC, PT, APTT, fibrinogen, biochemistry profile, blood gas, lactate

MHP 2
Red cells and FFP: give aliquots of 10ml/kg in a 1:1 ratio. Reassess rate of blood loss and response to treatment & repeat as necessary.
Platelets: Give 20ml/kg if this is <200ml otherwise give 1 adult dose.
Cryoprecipitate: Give 10ml/kg

When half of MHP 2 has been used consider ordering another MHP 2
Re-assess
Take bloods and send to lab:
Order MHP 2
If blood tests only are required to re-assess patient.
Choose **'Massive Haemorrhage lab Tests'** after typing "Mas"

Continuous cardiac monitoring

Prevent Hypothermia
Use fluid warming device
Use forced air warming blanket

Consider 0.5ml/kg 10% calcium gluconate (max 10ml) over 30 min

Further cryoprecipitate (10ml/kg) if fibrinogen <1.5g/l or as guided by ROTEM.

Aims for therapy
Aim for:

Hb	80-100g/l
Platelets	>75 x 10^9/l
PT ratio	<1.5
APTT ratio	<1.5
Fibrinogen	>1g/l
Ionised Ca^{2+}	>1.0mmol/l
Temp	>36°
pH	>7.35 (on ABG)
pH	>7.25 (cap/venous BG)

Monitor for hyperkalaemia

Haemorrhage Control
Direct pressure / tourniquet if appropriate
Stabilise fractures
Surgical intervention
Interventional radiology
Endoscopic techniques

Haemostatic Drugs
Vitamin K and Prothrombin complex concentrate for warfarinised patients

Other haemostatic agents: discuss with Consultant Haematologist

STAND DOWN
Inform lab
Return unused components
Complete documentation including audit

(A)BG – (Arterial) Blood Gas
APTT – Activated partial thromboplastin time
MHP – Massive Haemorrhage Pack
NPT – Near Patient Testing
PT – Prothrombin Time
ROTEM - Thromboelastography
XM – Crossmatch
OCT- Octaplas

Table 1 – Major Haemorrhage pack 1 (MHP 1)

Red cells	FFP
4 adult units (1000ml)	4 units (800ml)

Table 2 – Major Haemorrhage pack 2 (MHP 2)

Red cells	FFP	Cryoprecipitate	Platelets
4 adult units (1000ml)	4 units (800ml)	2 adult units (400ml)	1 adult pack (200ml)

These products will be provided as O negative in the first instance. In the event there is extreme demand for O negative (i.e. major incident) the lab may revert to group specific products where the patient's group has been confirmed.

Red cells and FFP may be given through the same cannula via a Y-connector or 3-way tap provided the connection to the cannula is a short line.
Platelets are ideally infused through a separate line, or after a clear flush, but may be given infused with red cells or FFP at a Y-connector or 3-way tap with a short connection to the cannula, **but the mixing must only occur after the platelets have passed through the filter.**

Administer red cells and FFP in aliquots of 10 ml/kg and in a ratio of 1:1; constantly assessing and reassessing the extent and rate of blood loss and the response to each such aliquot.

NOTE: Red cells MUST be warmed in a massive haemorrhage scenario.

When half of MHP1 has been administered consider ordering MHP 2, if bleeding is on-going and control of the situation remains elusive.

Continue to administer aliquots of red cells and FFP in 10 ml/kg boluses as dictated by the patient's response to fluids, rate of blood loss etc. (the whole clinical picture) until MHP2 is available.

With MHP2 use red cells and FFP in the same fashion and administer a further dose of platelets via a separate line (if possible). Give 20ml / kg of platelets if this is going to work out < 200ml otherwise give 1 adult dose. In addition, administer a bolus of cryoprecipitate in a dose of 10 ml/kg. NB. Cryoprecipitate is not routinely available for group AB patients. First choice will be Group A second choice will be Group B.
Stop administering red cells and FFP if the patient's condition stabilises, and it does not seem to be clinically indicated.

Fine tune what products to give and in what volumes based on the lab results (when these become available) and bedside evidence of coagulopathy (micro vascular bleeding).

Seven Steps for Successful Coordination in Massive Haemorrhage

1. Recognise trigger and activate pathway for management of massive haemorrhage; **assemble the emergency response team**.

Activate the protocol when a massive haemorrhage situation is recognised.
Massive haemorrhage may be defined as a situation where 1 to 1.5 blood volumes may need to be infused either acutely or within a 24-hour period. (Anaesthesia 2010, 65, p 1153 – 1161)

Other definitions include:

- Loss of 1 blood volume within 24 hours, or
- Loss of 50% of the blood volume within 3 hours, or
- Loss of ≥ 2-3 ml/kg/min (≥150 ml/min in adults).[2]

However, standard definitions are not particularly helpful as they are retrospective.
The context may be trauma, major surgery or an underlying medical condition affecting coagulation (or obstetric haemorrhage).

Activate the protocol by contacting switchboard (dial 2222).
State the following:

> We have a massive haemorrhage situation.
> Activate the massive haemorrhage protocol.
> The patient's location is …
> The patient's details are: name, date of birth, hospital number.
> My details are: name, occupation and grade, bleep number.
> The telephone extension from which I am calling is…

If the patient is a cardiac surgical patient instruct switchboard to contact the cardiac surgeon on-call in addition to those listed below.

Switchboard operator: call the following via Massive Haemorrhage Alert Code:

- Theatre porter - bleep 498,
- Hospital transfusion laboratory biomedical scientist (bleep 289; ext. 2492/2490),
- Anaesthetic Specialist Registrar on-call,
- Surgical Specialist Registrar on-call,
- PICU Registrar on-call,
- ODP (bleep 329)
- Emergency Theatre Co-ordinator (bleep 353)
- Band 8 bleep holder (bleep 304)
- Clinical Nurse Specialist (bleep 317)
- Night Matron (bleep 306)
- Transfusion Practitioner (605) – only available 8-4.

Switchboard will also inform Consultant Anaesthetist and Consultant Surgeon on call.

Switchboard operator: inform each of the following individuals
That there is a **massive haemorrhage situation**,
The patient's location is…,
The patient's name is. . .

All team members (excluding laboratory BMS) to assemble at MH site and manage the situation.

Early consultant involvement is important and the anaesthetic, surgical and PICU registrars must inform and involve their consultants in an opportune fashion. Similarly, the transfusion laboratory biomedical scientist must inform the consultant haematologist as appropriate and in a timely manner.

2. Allocate team roles

I. Team leader:
In theatre this will be the consultant anaesthetist responsible for the anaesthetic care of the patient.
In AED this will be the AED consultant.
On PICU this will be the consultant intensivist responsible for the case.
On a general ward this will the most senior clinician present until the arrival of the responsible consultant.

II. Communication lead– dedicated person for communication with other teams, especially the transfusion laboratory and support services. In theatre this may be the anaesthetic registrar involved in the case. Consider contacting the perfusionist to assist with cell salvage. Consider contacting the ECG techs to assist with near patient testing such as ROTEM and ABGs. **Contact the radiologist on call.** The radiologist can decide if they have the skills necessary to help with the specific case. If not, then there is an informal agreement that we can contact Andrew Healey for urgent vascular interventional work. If they are not available, then there is an informal arrangement with some of the adult interventional radiologists from the region to come and help.

III. Sample taker / investigation organiser / documenter. This could be an anaesthetic registrar or ODP.

IV. Transporter – this will be the theatre porter carrying the 498 bleep. On removing one unit of O negative blood from theatre fridge, go directly to the scene of the massive haemorrhage situation and present yourself to the team-leader as the transporter. Your role is to transport specimens from the scene of the massive haemorrhage situation to the laboratory and to transport blood products from the laboratory to the scene of the massive haemorrhage situation. If you are not actively transporting specimens to the laboratory or blood products from the laboratory you must be

present at the scene of the massive haemorrhage situation and in direct contact with the communication lead and the team leader until told to stand down.

3. Complete request forms / take blood samples, label samples correctly / recheck labelling.

This can be done through an order set on Meditech **(Select patient, choose Orders, New sets, Clinician and type "Mas").** This process can be used to request blood tests alone or blood products with blood tests included.

A signed, handwritten emergency blood order form will be accepted for products.

MHP BLOOD TESTS – U&E, FBC, PT, APTT, Fib, Blood Gas, Calcium, Lactate

MHP 1 – Blood products as outlined in Table 1 + MHP BLOOD TESTS

MHP 2 - Blood products as outlined in Table 2 + MHP BLOOD TESTS

- **Blood grouping and cross-matching**:

Purple top EDTA tube
1.3 ml if < 4 months old,
4ml if > 4 months old,
hand written label,

- **Full blood count**:

Pink top EDTA tube
0.5 ml

- **Prothrombin time, activated partial thromboplastin time, Clauss fibrinogen:**

Green top citrate tube
1.3 ml

- **U&E**:

Orange top
1.3 ml

- **Blood gas**:

1 ml heparinised blood gas syringe

- **Thromboelastogram**:

1 ml blood drawn up in a plain syringe and added to the purple topped ROTEM- Kaolin tube as soon as possible (within 2-3 min) and then a sample from this tube must be tested immediately. The ROTEM – Kaolin tubes are kept in the fridge in the ECG-techs' room where the blood gas analysers are. During office hours the ECG-techs will run the test for you. Out of hours this test is not available unless you are personally trained to run the test.

4. Request blood / blood components according to the algorithm above.
Team leader should decide on use of:

I. Emergency O Neg: time to availability – immediate.

2 units of O Neg red cells are stored in both the laboratory issue room fridge and the theatre fridge (in the theatre corridor directly opposite the end of the PICU link bridge – first door on the left). In the event that there is no crossmatched blood already available in the fridge for the patient (e.g. planned surgery), the theatre porter will bring 1 unit initially on receiving Massive Haemorrhage alert

Communication lead to contact laboratory: 2492 (preferred); 2490 (alternative)

Inform the BMS of the following:

a. Your name, location and ext. number
b. 'This relates to the **massive haemorrhage situation'**
c. The patient's details: ideally surname, forename, hospital number, DOB (unknown casualties are registered as UNKNOWN UNKNOWN and given a specific account number)
d. Whether O Neg has been used and how many units
e. Order massive haemorrhage pack(s)
f. Contact lab if blood has been transferred in with patient from another Trust or patient is being transferred to another Trust.

5. The clinical / laboratory interface

I. Communication lead to arrange for transport of samples / request forms to the laboratory
II. BMS to ring communication lead with all results of urgent investigations until told to stand down
III. BMS to ring communication lead when blood / blood components are ready
IV. Communication lead to arrange to collect blood and blood components from the laboratory
V. Any units of O emergency O negative blood that are taken from theatre fridge MUST be replaced as soon as possible by laboratory staff.

The Transporter is the theatre porter carrying the 498 bleep.

6. Communicate stand down of pathway and let lab know which products have been used

7. Ensure documentation is complete

I. Clinical area: monitoring of vital signs, timings of blood samples and communications. Transfusion documentation on blood transfusion prescription chart or through TAR,

return of paperwork that comes with emergency O negative units from theatre fridge and issue fridge, completion of audit proforma.

II. Laboratory: keep record of communications / telephone requests in patient laboratory record

Additional useful information

Estimate the patient's blood volume: [1]

- Preterm neonate 100 ml/kg
- Term neonate 90 ml/kg
- Infant 85 ml/kg
- Children 80 ml/kg
- Adult 70 ml/kg.

Estimate the blood loss:

Massive haemorrhage may be defined as a situation where 1 to 1.5 blood volumes may need to be infused either acutely or within a 24-hour period. (Anaesthesia 2010, 65, p 1153 – 1161)

Other definitions include:

- Loss of 1 blood volume within 24 hours, or
- Loss of 50% of the blood volume within 3 hours, or
- Loss of ≥ 2-3 m/kg/min (≥150 ml/min in adults).[2]

However, standard definitions are not particularly helpful as they are retrospective.

Anticipate the need for blood products:

- Acute loss of 10% of the blood volume in a neonate → transfuse red cells. [3]
- Acute loss of 30 - 40% of the blood volume in any other child → red cell transfusion is likely to be required. [2]
- After replacement of 100 – 150% of the blood volume → anticipate coagulation factor deficit (25% activity after 200% blood volume replacement). [2]
- After replacement of 150% of the blood volume → fibrinogen is likely to be < 1 g/l. [2]
- After replacement of 150 – 200% of the blood volume → anticipate a platelet count of < 50 x 10^9 l^{-1}. [2]

Anticipate the time delay between requesting and receiving blood products.

- Red cells:
  Immediately available as O Rh Negative packed red cells, 2 adult units, in the theatre fridge or laboratory issue room fridge
  Unless cross matched blood has been arranged pre-op you will receive O Rh Neg red cells as part of the MHP packs in 10-15 minutes of the MH call.
- Neonatal FFP 5 minutes to thaw (per pack)
- FFP 15 minutes to thaw (per pack)
- Adult Cryoprecipitate 15 minutes to thaw (per pack)
- Platelets: May be stocked on site but may need to come from Liverpool NBS or Manchester NBS. Blue light from Liverpool NBS – 60 minutes. Blue light from Manchester NBS - > 60 min.

Blood products come in the following volumes:[4]

Red cells (adult unit)	250 – 300 ml
Red cells (Paediatric unit)	45 ml
Adult FFP	200ml
FFP neonatal unit	40 – 60 ml
Cryoprecipitate single donor unit	20 – 50 ml
Platelets (1 Adult Therapeutic Dose)	150 – 350 ml
Platelets (single paediatric pack)	30 – 40 ml

Red Cells and Platelets are split into paediatric packs at the Liverpool NBS in Speke, not in this Hospital's Blood Bank!

Respond to laboratory test results.

Repeat laboratory blood investigations (PT, APTT, Fibrinogen, and FBC) at least **every hour if bleeding is on-going**, after replacement of 1/3 of the blood volume and after giving blood products.

- Hb < 80 g/L → transfuse red cells. Neonates with Hb < 100 g/L**.**
- Platelets < 75 x 10^9 /L and actively bleeding → transfuse platelets. 20 ml/kg if < 15 kg; 1ATD if > 15 kg. [3]
- APTT ratio > 1.5 and actively bleeding → give FFP 10 ml/kg. [3]
- INR > 1.5 and actively bleeding → give FFP 10 ml/kg. [3]
- Fibrinogen < 1 g/L after FFP → give cryoprecipitate 10 ml/kg.

Widespread micro vascular oozing is a clinical marker of haemostatic failure irrespective of blood tests and should be treated aggressively.

Tranexamic Acid.

Tranexamic acid is administered intravenously as an initial loading infusion of 15 mg/kg (up to a maximum of 1000 mg) over 10 min followed by a continuous intravenous infusion of 2 mg/kg/hr (up to a maximum of 125 mg/h.) for at least 8 hours or until bleeding controlled.

For trauma patients, commence within 3 hours of injury.
This dose regimen has been extrapolated from the CRASH-2 trial and follows the dosing recommendation of the RCPCH.

Recombinant FVIIa.

Consider use for persistent major bleeding in blunt trauma despite standard attempts to control bleeding and best practice use of blood component therapy
Preconditions: Fibrinogen ≥ 0.5 g/l, platelets > 50 x 10^9 l^{-1}, pH ≥ 7.2. Also correct hypothermia and hypocalcaemia.
Dose: 90 micrograms/kg. This should be rounded up or down to the nearest number of whole vials, except in very small babies.
The dose can be repeated after 1 hour if bleeding continues.

Expect clotting factors and platelets to be consumed rapidly after giving rFVIIa: be prepared to give more.
Likely to increase the risk of thromboembolic complications.[11]
Novoseven is available as 1mg, 2mg, 5mg and 8mg vials.

Equipment.

All components should be transfused through a dedicated blood giving set with a screen filter 170 - 200µ (micrometre).[3] You **do not** need to use an additional micro aggregate filter.

There are two administrations sets available for the administration of blood and blood components:

- Standard Alaris blood giving set
- Alaris MFX2207E neonatal giving set

NOTE: Red cells MUST be warmed in a massive haemorrhage scenario.

The Belmont fluid warmer is available in ED and theatre, for warming components. Alternatively, Biegler devices can be used that are available in theatre.

Note on specific requirements: CMV and Irradiated components.

In an emergency where an MHP has been called, special requirements, i.e. CMV neg, irradiated etc will not apply.

Specific subgroups.

1. **Gastrointestinal haemorrhage.**

   Resuscitation and stabilisation is essential prior to endoscopy.
   Contact the general surgeons in the first instance. A gastroenterologist should be contacted for advice as required.
   IV PPI (omeprazole) before endoscopy.
   Emergency O Neg if not stabilised after initial resuscitation with fluids, otherwise crossmatched.

2. **Trauma**.

   Small volume resuscitation may be appropriate in blunt or penetrating trauma, but not in the head injured patient. Small volume resuscitation involves giving volume in aliquots or 10ml/kg and assessing response and need for further volume. If the patient responds, maintains an adequate heart rate, blood pressure and mental status then no more fluid is given until definitive treatment or there is a deterioration in clinical condition necessitating further fluid resuscitation.

Consent.

Consent for blood product transfusion is not required in major haemorrhage. This includes children of parents of the Jehovah's Witness faith. All patients/carers should be informed of the use of blood product transfusion subsequently.

Regarding training and competency to administer blood products, medical staff and nursing staff should have completed, and be in date with, both their E-Learning and clinical skills session. Staff prescribing, ordering, collecting and administering blood products must have the relevant training and competencies.

ROTEM

Massive haemorrhage with ongoing bleeding

Patient receiving red cells and FFP in a 1:1 ratio to replace blood loss as well as definitive treatment to stop the bleeding

Take blood sample: 4 ml blood in a citrate sample tube.

Analyse sample using the ROTEM sigma device.

Review results:

enter 192.168.3.246 into a web browser.

You will be confronted with a screen saying: “your connection isn’t private”.

Click the “Advanced” button.

You will see a message reading:”This server couldn't prove that it's **192.168.3.246**; its security certificate is not trusted by your computer's operating system. This may be caused by a misconfiguration or an attacker intercepting your connection.”

Click on “Continue to 192.168.3.246 (unsafe).”

In the Login box, enter “admin”.

In the Password box, enter “CS1234”.

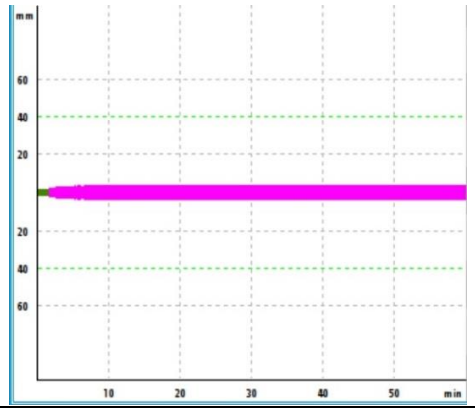
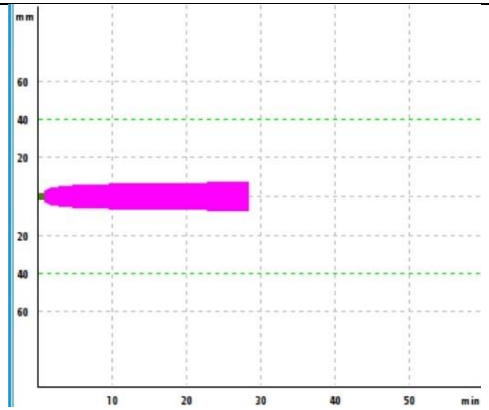
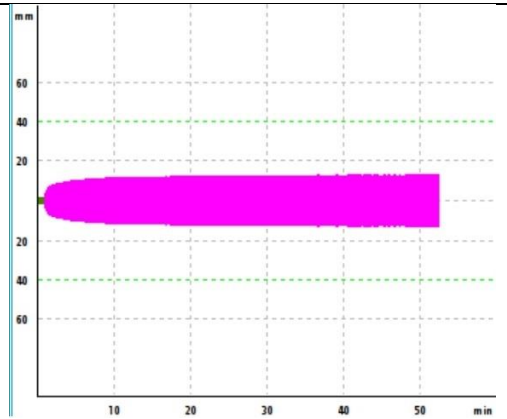
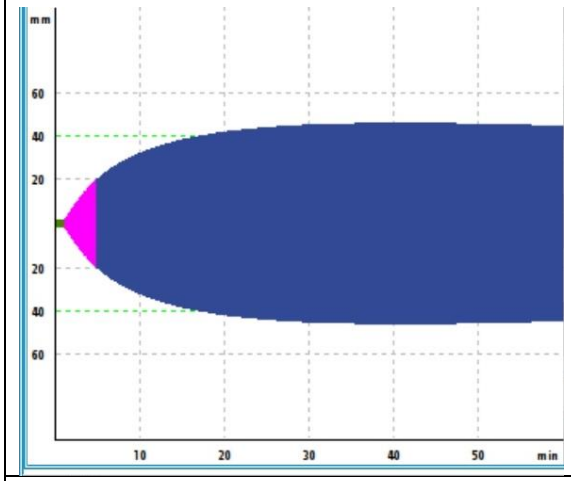
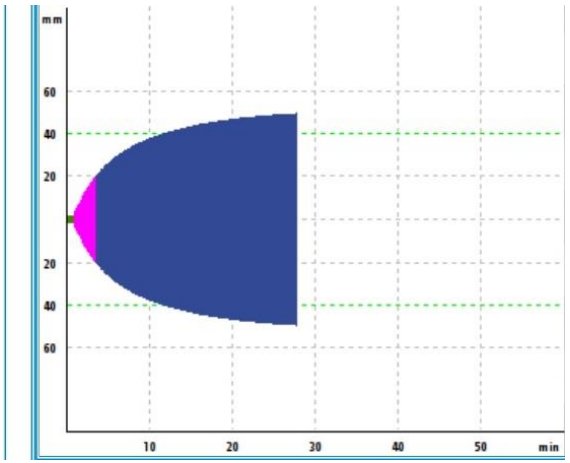
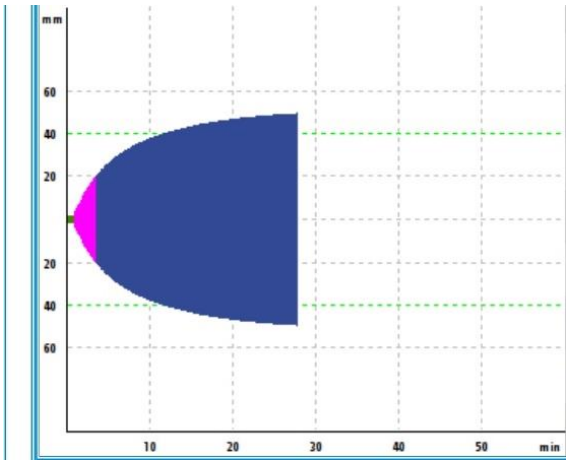
Then click “Enter”.

In the patientID box, enter the AH number. Then click “Search”.

Act on results:

FIBTEM A5		
<6 mm	< 10 mm	>10 mm
EXTEM A5		
< 22 mm	< 36 mm	<36 mm
Give fibrinogen and platelets	Give fibrinogen	Give platelets

Fibrinogen as Fibrinogen concentrate 70 – 100 mg/kg (max 4g) or cryoprecipitate 5 – 10 ml/kg (max 2 pooled dosed). Platelets 20 ml/kg (max 1 Adult therapeutic dose)

FIBTEM A5		
< 6mm	<10 mm	>10 mm
		
EXTEM A5		
< 22 mm	<36 mm	< 36 mm
		
Give fibrinogen and platelets	Give fibrinogen	Give platelets

Fibrinogen as Fibrinogen concentrate 70 – 100 mg/kg (max 4g) or cryoprecipitate 5 – 10 ml/kg (max 2 pooled dosed). Platelets 20 ml/kg (max 1 Adult therapeutic dose)

There is a ROTEM sigma thromboelastometry analyser in the main theatre hot lab. Operating department practitioners and clinical cardiac physiologists are trained to use the analyser.

A 4 ml blood sample is required. 4ml of blood drawn into a 5 ml syringe should be handed to the operating department practitioner who will then process the sample without delay. They will add the sample to a citrate sample tube before analysing the sample.

To access the results, enter the following web address into a web browser: 192.168.3.246

You will be confronted with a screen saying: “your connection isn’t private”. Click the “Advanced” button.

You will see a message reading: ”This server couldn't prove that it's **192.168.3.246**; its security certificate is not trusted by your computer's operating system. This may be caused by a misconfiguration or an attacker intercepting your connection.” Click on “Continue to 192.168.3.246 (unsafe).”

In the Login box, enter “admin”. In the Password box, enter “CS1234”. Then click “Enter”.

In the patientID box, enter the AH number. Then click “Search”. You can ignore the sampleID box (leave it blank).

In the context of massive haemorrhage with **ongoing bleeding**:

Red cells and FFP should be given in a 1:1 ratio to replace blood loss and maintain an adequate intravascular volume.

1. Rule out or treat fibrinogen deficiency.

   Look at the FIBTEM A5. If it is < 10 mm, then give fibrinogen concentrate (see dosing guidance below) or cryoprecipitate (5 – 10 ml/kg – max 400ml or 2 pooled doses).

2. Rule out or treat platelet deficiency.

   Look at the EXTEM A5 and the FIBTEM A5. If the EXTEM A5 is < 36 mm AND the FIBTEM A5 is > 10 mm, then give platelets (20 ml/kg or 1 Adult Therapeutic Dose). If the EXTEM A5 is <22 mm and the FIBTEM A5 is < 6 mm, then give fibrinogen and platelets.

3. Rule out or treat anticoagulation

   If the INTEM CT is abnormal in comparison with HEPTEM, this suggests heparin anticoagulation. Rule out contamination of the sample and consider protamine.

Do not delay surgical intervention whilst treating coagulation defects.

Repeat the ROTEM after each intervention and every 30 minutes until bleeding is controlled.

Fibrinogen Concentrate

FIBRYGA is the fibrinogen concentrate product available in the Trust. Search Omnicell for FIBRYGA or Fibrinogen Concentrate. It can also be found in the drug cupboard in theatre 5 and 6 and the main theatre pharmacy storeroom.

FIBRYGA is a powder that is reconstituted with sterile water. This takes 5 to 10 minutes. The reconstituted product contains 1000 mg of fibrinogen in 50 ml (20mg/ml) – do not dilute further.

The dose of fibrinogen concentrate can be calculated based on the lab fibrinogen level or the FIBTEM A5 according to the table below.

Lab Fibrinogen g/l	FIBTEM (ROTEM Sigma) A5	Does of fibrinogen mg/kg	Volume of fibrinogen ml/kg	Maximum Dose
<0.5	<3	100mg/kg	5ml/kg	4g
0.5-1	**3-9**	**70mg/kg**	**3.5ml/kg**	**2g**
>1- 1.5		35mg/kg	1.75ml/kg	2g
Administration of FIBRYGA 20mg/ml: As a slow intravenous injection or infusion at a recommended maximum rate of 10mls per minute				

In the event that a dose larger than 4g is needed then this should be discussed with Consultant Haematologist on call.

Fibrinogen concentrate **should not be given** if the fibrinogen concentration is greater than 2g/l (FIBTEM MCF >12).

Fibrinogen concentrate should only be given in patients with a fibrinogen concentration of 1.5-2g/l in the presence of immediately life-threatening bleeding refractory to other treatments or surgical haemostasis after discussion with Consultant Haematologist on call.

After administration, a fibrinogen concentration level or ROTEM FIBTEM should be checked urgently as soon as infusion is completed. This (in conjunction with the clinical status of the patient) will determine if and what further doses are necessary.

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+ North West RTC Audit of Major Haemorrhage +

Audit code | | | | | | Major Haemorrhage Date | | | | Time | |
DD MM YY HH MM

Patient Age (years) | | Diagnosis | |

Patient location at start: (please tick) Theatre | | Day unit | | Ward | | ICU | | A&E | | Other specify | |

Please tick speciality

General surgery	Vascular surgery	Cardiac Surgery	Ortho-paedics / trauma	A&E	ITU	Obstet rics	SCBU	Gastro-enterology	Plastics / burns	Other (specify)

Was the pathway activated? Yes | | No | | If no, what happened? | |

Who activated the pathway? Staff group? | | Grade | | Specialty | |

	BP	Pulse	Resp rate
Baseline			

Was the pathway activation appropriate? Yes | | No | | Comment | |

Was Emergency O Neg used? Yes | | No | | If yes, how many units? | |

	Date	Time	N/A
Start of Red cell transfusion O Neg			
Gp Specific			
Crossmatched			
Start of FFP/OCT transfusion			
Start of platelet transfusion			

Was cell salvage used Yes | | No | |

Start of salvaged red cell infusion | | | | | |

Total dose of allogenic red cells transfused In first 24 h | | Units | | mls | |

Total dose of autologous red cells transfused In first 24 hours | | Mls | |

Total dose OCT/FFP transfused | | units | | mls Total dose platelets transfused | | ATD | | mls

	Date	Time	Hb	Plt	PT	APPT Fn		Was TEG used?	Yes	No
First set of results										
	Date	Time	Hb	Plt	PT	APPT Fn			Yes	No

2nd set of results | | | | | | | | | | Was TEG used? | |

Was consultant haematologist / Haematology SpR consulted? Yes | | No | | If yes, what time? | | | HH MM

What advice was given? |

				Dose	Date	Time	N/A
Tranexamic acid	Yes		No				
Cryoprecipitate	Yes		No				
Fibrinogen concentrate	Yes		No				
rVIIIa	Yes		No				
Prothrombin Complex	Yes		No				

Did the patient have any other haemostatic challenge?

Warfarin?	Yes		No	Corrective action	
LMWH	Yes		No	Corrective action	
Unfractionated heparin	Yes		No	Corrective action	
Aspirin	Yes		No	Corrective action	
Clopidogrel	Yes		No	Corrective action	
Coagulopathy	Yes		No	Corrective action	

Were there any delays in treatment? Yes | | No |

If yes, please describe |

Patient Outcome

	Alive	Deceased	Morbidity	N/A
24 hours				

	Alive	Deceased	Morbidity	N/A
4 weeks				

Please state morbidity: | Please state morbidity: |

Blood product wastage? (please write amount units or mls)

Red cells | FFP/OCT | Plts | Cryo |

Any other comments?

Please return completed form to: Jane Murphy – RTC Administrator NWRTC

Management of Massive Haemorrhage Protocol	
Version:	8.3
Ratified by:	Transfusion Specialist / ED / Anaesthetics
Date ratified:	July 2021
Name of originator/author:	Bimal Mehta, Consultant in Paediatric Emergency Medicine
Name of responsible committee:	Massive Haemorrhage Leads
Key search words:	Massive, haemorrhage, protocol, blood, trauma, transfusion, bloods
Date issued:	September 2023
Review date:	September 2024

Version Control Table				
Version	**Date**	**Author**	**Status**	**Comment**
8.3	December 2024	Bimal Mehta, Consultant in Paediatric Emergency Medicine Richard Craig Consultant Anaesthetist	Current	Changed references to TEG to ROTEM. Additional note on warming blood. Change to HB threshold. Addition of ROTEM and Fibrinogen information.
8.2	September 2023	Bimal Mehta, Consultant in Paediatric Emergency Medicine Richard Craig Consultant Anaesthetist	Archived	Removed Octaplas and replaced with FFP. Changed comment that lab staff will NOT attend MHP call.
8.1	October 2021	Bimal Mehta, Consultant in Paediatric Emergency Medicine Richard Craig Consultant Anaesthetist	Archived	Vial sizes of Novoseven updated
8	July 2021	Bimal Mehta, Consultant in Paediatric Emergency Medicine Richard Craig Consultant Anaesthetist	Archived	Minor change to product description
7.1	August 2020	Bimal Mehta, Consultant in Paediatric Emergency Medicine Richard Craig Consultant Anaesthetist	Archived	Correction of maximum dose of Tranexamic acid in flowchart. Updated to 2 adult doses of cryoprecipitate
7	May 2018	Bimal Mehta, Consultant in Paediatric Emergency Medicine Richard Craig Consultant Anaesthetist	Archived	

6	April 2014	Bimal Mehta, Consultant in Paediatric Emergency Medicine Richard Craig Consultant Anaesthetist	Archived	Refined order sets for products added
5	June 2013	Bimal Mehta, Consultant in Paediatric Emergency Medicine Richard Craig Consultant Anaesthetist	Archived	Hb g/dl changed to g/L in line with Trust laboratory changes. Calculations updated
4	December 2012	Bimal Mehta, Consultant in Paediatric Emergency Medicine Richard Craig Consultant Anaesthetist	Archived	Minor edits. MMC Chair's action December 2012
3	October 2012	Bimal Mehta, Consultant in Paediatric Emergency Medicine Richard Craig Consultant Anaesthetist	Archived	No content changes. Image quality improved
2	October 2012	Bimal Mehta, Consultant in Paediatric Emergency Medicine Richard Craig Consultant Anaesthetist	Archived	Minor edits
1	September 2011	Bimal Mehta, Consultant in Paediatric Emergency Medicine Richard Craig Consultant Anaesthetist	Archived	

Review & Amendment Log Record of changes made to guideline version 8.3			
Section Number	**Page Number**	**Change/s made**	**Reason for change**
N/A	Throughout document	Changed references to TEG to ROTEM	TEG no longer in use
	P3 and P11	Addition of information of warming blood in MH.	Requirement to warm blood.
	P10	Change to Hb threshold	Consistency with algorithm.
	P12	Addition of ROTEM/Fibrinogen information	Agreement to be added from MH working group.

Review & Amendment Log Record of changes made to guideline version 8.2			
Section Number	**Page Number**	**Change/s made**	**Reason for change**
N/A	Title page	To include reference to checklist	Checklist developed.
	All pages	Reference to Octaplas removed and replaced with FFP	Octaplas no longer used.
	P4	Addition of Transfusion Practitioner	Required.
	P4-P5	BMS NOT attending MH situation	Clarification for users

	P10	Reference to blood warmers modified	Changed to Belmonts and Bieglers

Review & Amendment Log Record of changes made to guideline version 8.1			
Section Number	**Page Number**	**Change/s made**	**Reason for change**
N/A	9	Updated vial sizes of Novoseven	Change to product

Review & Amendment Log Record of changes made to guideline version 8			
Section Number	**Page Number**	**Change/s made**	**Reason for change**
Table 2	3	Amendment to product description	No longer using MB treated products
N/A	3	Amendment to product description	No longer using MB treated products
Additional Useful Information	8	Changed to adult doses	This is what would be provided