Management of Massive Haemorrhage

NB: The following amendments have been made:

1. Amendments to Section B: Obstetrics pp 17 - 23

N.B. Staff should be discouraged from printing this document. This is to avoid the risk of out of date printed versions of the document. The Intranet should be referred to for the current version of the document.

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CONTENTS

Abbreviations / Glossary

AAGBI	Association of Anaesthetists of Great Britain and Ireland
ABG	Arterial Blood Gases
ABHB	Aneurin Bevan Health Board
APH	Ante Partum Haemorrhage
APLS	Advanced Paediatric Life Support
APTT	Activated Partial Thromboplastin Time: *requires factors I, II, V, VIII, IX, X, XI & XII*
ATD	Adult Therapeutic Dose (of Platelets) *equivalent to ~ 5 individual donations*
ATLS	Advanced Trauma Life Support
BMI	Body Mass Index
BP	Blood Pressure
CCT	Controlled Cord Traction
CT	Computerised Tomography
CVP	Central Venous Pressure
ECG	Electro Cardiograph
FFP	Fresh Frozen Plasma – *(must be SD or MB treated for patients born after 1996).*
GA	General Anaesthesia
GI	Gastro-Intestinal
Hb	Haemoglobin g/l (g/dl)
HDU	High Dependancy Unit
HTC	Hospital Transfusion Committee
INR	International Normalised Ratio – *used to monitor and control oral anticoagulant dosing.*
ISS	Injury Severity Score
ITU	Intensive Therapy Unit
IUD	Intra Uterine Device
IV	Intra-Venous
MB	Methylene Blue *(viral inactivation treatment for non-UK sourced plasma)*
MHP	Massive Haemorrhage Pack
NHH	Nevill Hall Hospital, Abergavenny
NIBP	Non-invasive measurement of Blood Pressure
NPSA	National Patient Safety Agency
ODA	Operating Department Assistant
P	Pulse
PCC	Prothrombin Complex Concentrate – *contains factors II, VII, IX, X and Proteins C & S.*
PET	Pre-eclamptic Toxaemia
POCT	Point of Care Testing
PPH	Post Partum Haemorrhage
PT	Prothrombin Time – *requires factors I, II, V, VII & X.*
RBC	Red Blood Cells
RCOG	Royal College of Obstetricians & Gynaecologists
RGH	Royal Gwent Hospital, Newport
ROTEM	Rotational Thromboelastometry – POCT: *check availability in ABHB.*
rVIIa	recombinant activated Factor 7 – *requires Consultant Haematologist direction.*
SaO_2	Oxygen Saturation
SD	Solvent Detergent *(viral inactivation treatment for non-UK sourced plasma)*
TEG	Thromboelastography – POCT: *check availability in ABHB.*
U&E	Urea & Electrolytes
UHW	University Hospital of Wales
Xa	Activated coagulation Factor Xa –
YYF	Ysbyty Aneurin Bevan Hospital *(New Caerphilly Borough Hospital opened November 2011)*

Section 1: Introduction:

Massive Haemorrhage is a clinical emergency which requires effective multi-disciplinary teamwork with clear and efficient communication between all participants.

This Toolkit provides guidance and information to assist in the management of Massive Haemorrhage at the Royal Gwent Hospital Newport (RGH) and Nevill Hall Hospital, Abergavenny (NHH) and makes substantial use of the following documents:

Blood Transfusion and the Anaesthetist: management of massive haemorrhage [1]

The NHSBT NW Region's Toolkit for the Management of Massive Haemorrhage [2]

It has been written to comply with Aneurin Bevan Health Board policy and practice where relevant and in response to the NPSA recommendations for the management of Massive Haemorrhage. [3]

NB: The Blood Bank at Ysbyty Ystrad Fawr (YYF), Ystrad Mynach does not have 24/7 laboratory staffing and transfusion cover is provided by RGH. See page 4 for further guidance for YYF.

The various scenarios and forms in which massive haemorrhage can occur preclude too standardized an approach but lessons learned from civilian and military experiences have emphasized the need for clear timely communication between members of the clinical team and their supporting colleagues - especially staff in the Blood Bank - which is best achieved by designating a **Lead Communicator** at the start of the emergency.

This important role is filled by a senior member of the team who becomes responsible for all verbal communication and ensures that all documentation is completed and retained appropriately.

The **Lead Communicator** is central to the effectiveness of the guidance contained in this document.

Flow Charts for the general management of Massive Haemorrhage in Adults, Obstetrics and Children are provided with other sections providing more detailed information for different specialities.

Proformas are included in the form of checklists for the clinical and laboratory teams and for Audit which should be performed whenever the Massive Haemorrhage Alert is made.

Audit data will be kept under review by the Hospital Transfusion Committee which, along with national guidelines, will inform updating of this document.

This document was circulated to clinical leads for consultation with clinical leads prior to the July 13th meeting of the Hospital Transfusion Committee.

Responses were received from the following:

Dr Alison Carling, Chair of the Hospital Transfusion Committee.
Dr Andrew Bagwell, Lead Consultant for Anaesthetics.
Dr Miles Allison, Lead Consultant Physician for Gastroenterology & Endoscopy.
Dr Sarah Lewis Lead Consultant Haematologist for Coagulation.
Dr Sally Jones, Lead Consultant for Accident & Emergency Medicine.
Dr Rachel Bebb, Consultant Paediatrician.

Following incorporation of the responses the final draft was reviewed by members of the HTC and submitted for approval by the Aneurin Bevan Health Board's Clinical Standards & Policy Group.

Management of Massive Haemorrhage at hospitals outside RGH / NHH.

At YYF there is a Blood Bank which is stocked with 4 units of O Rh D Negative red cells which are kept available for immediate issue in an emergency. Use of these and notification of the reason must be communicated to Blood Bank at RGH (44477) as per this document. Management of the transfusion requirements will be provided by Blood Bank & Consultant Haematologist at RGH.

Massive Transfusion at the other outlying hospitals will be managed by the supplying hospital – RGH or NHH.

Haemovigilance Notice

Safe Transfusion requires compliance with the current ABHB Blood Component Transfusion Policy, the ABHB Blood Transfusion Sample Acceptance Rejection Policy and other guidelines especially with regard to positive patient identification and the accurate completion of all documentation throughout the transfusion process.

Massive Haemorrhage events will increase the risk of inappropriate or incorrect components being transfused if staff ignore the routine standard procedures which are designed to safeguard the patient against adverse events and reactions in normal circumstances.

Blood Bank staff cannot be responsible for the use of any component if they have expressed doubt about the safety of its transfusion to a particular patient.

Conservation of Blood Components must also be considered with appropriate transfusion practice and earliest return of unused components to the Blood Bank.

It is a legal requirement under the UK Blood Safety and Quality Regulations, 2005 (as amended) [4] to report all serious adverse events and reactions to the MHRA.

Help Save a Life – Give Blood Safely!

References:

1 Blood Transfusion and the anaesthetist: management of massive haemorrhage. Anaesthesia 2010;95: 1153 – 1161.

2 Toolkit for the Management of Massive Haemorrhage 2011: Steering Group of MW RTC Massive Haemorrhage Guidelines Group (available on www.transfusionguidelines.org.uk/docs/pdfs/rtc-nw_edu_mh_toolkit.pdf)

3. The transfusion of blood and blood components in an emergency: National Patient Safety Agency Rapid Response Report NPSA/2010/RRR017 October2010

4. Department of Health. Blood Safety and Quality Regulations (SI 2005, 50)

Section 2:

Management Guides for Display and use in Clinical Areas and Blood Bank

These are provided as an aid to the management of Massive Haemorrhage events and give basic information for initial guidance.

The rest of the document contains more detailed guidance and information which relevant staff should be made aware of.

Section 3 contains general guidance for the initial management of massive haemorrhage.

Section 4 contains Speciality Specific guidance as agreed by the clinical leads.

Section 5 contains further management guidance once bleeding has been controlled.

Section 6 provides information and guidance on dealing with problems with coagulation.

Appendix 1: Lists contact details for key staff.

Appendix 2: Is a Checklist for Blood Bank staff dealing with the emergency.

Appendix 3: Is the Audit Proforma to be used every time a Massive Haemorrhage alert is made.

Appendix 4: Is the "Seven Steps for Successful Coordination in Massive Haemorrhage" produced by the North West RTC Toolkit Team and amended for use in ABHB.

MASSIVE HAEMORRHAGE MANAGEMENT - ADULT PATIENT

The TEAM LEADER must appoint a Lead Communicator for communication with other teams, especially the Transfusion Laboratory and support services.

Contact Support Teams & Blood Bank and declare:
"Massive Haemorrhage in <location>, <speciality>"

STOP BLEEDING

Haemorrhage Control

Direct Pressure / tourniquet if appropriate. Stabilise fractures.
Surgical intervention – consider damage control surgery.
Interventional Radiology.
Endoscopic techniques.
Obstetric Techniques.

Haemostatic Drugs

Tranexamic Acid: 1g bolus followed by 1g over 8 hrs.

Vit K & PCC for Warfarin patients

Other haemostatic agents: Discuss with Consultant Haematologist.

Cell Salvage

If available & appropriate

Consider ratios of other components; 1 unit of rbc = c.250 ml salvaged blood.

REFER TO SPECIALITY SPECIFIC GUIDANCE FOR DETAILED MANAGEMENT

LABORATORY SUPPORT

Contact Numbers	RGH	NHH
Blood Bank	44477	2233 (Bl. 545)
Cons Haematologist	Sw/B	2253 (or Sw/B)
Haematology	44486	2245 (Bl. 545)
Coagulation	44481	
Biochemistry	44490	2243 (Bl. 346)

The Lead Communicator is responsible for contacting portering services.

Take bloods and send to lab for

XM, FBC, PT, APTT, FIBRINOGEN, U&E, Ca^{2+}, ABG

ORDER

Massive Haemorrhage Pack (Adult MHP)

Give MHP: Administer up to

RBC	**6 units ***
FFP	**4 units**
Platelets	**1 adult dose****

* group supplied as per Blood Bank policy

** From stock or order 2 ATD by Blue LIght

RESUSCITATION

Airway
Breathing
Circulation

Continuous Cardiac Monitoring

Prevent Hypothermia

AIMS FOR THERAPY

Hb **80-100 g/l** (8–10 g/dl)
Platelets **> 75 x 10^9/l**

PT < 16 sec
APTT < 40 sec

Fibrinogen **> 1 g/l**
Fibrinogen Concentrate *under direction of Cons Haematologist if Fibrinogen < 1g/l (< 2g in Obstetric Haemorrhage)*

Ca^{2+} **> 1 mmol/l**
Consider 10 ml 10% Calcium Chloride over 10 mins.

Temp **> 36 °C**
Use fluid warming device Use forced air warming blanket.

pH **> 7.35** (on ABG)

Monitor for Hyperkalaemia

RE-ASSESS

With reference to Consultant Haematologist.

THROMBOPROPHYLAXIS should be considered when patient stable

S T A N D D O W N

Inform Blood Bank. Return unused components. Complete Documentation including Audit

MASSIVE HAEMORRHAGE MANAGEMENT - OBSTETRIC PATIENT

The TEAM LEADER must appoint a Lead Communicator who will be the Coordinating Midwife for communication with other teams, especially the Transfusion Laboratory and

Contact Support Teams & Blood Bank and declare:
"Massive OBSTETRIC Haemorrhage at , <Location>"

STOP BLEEDING

Haemorrhage Control

Bi-manual compression of uterus

Syntocinon 5 units i.v. ***slowly.***

Ergometrine 500 micrograms i.v. ***slowly.***

Syntocinon infusion (40 units in 500 ml Normal Saline at 125 ml/hour).

Carboprost (Hemabate) 250 micrograms i.m. or direct intra-myometrial injection (total dose not greater than 2 mg) in doses of 250 micrograms, separated by at least 15 mins, maximum 8 doses.

Misoprostol 1000 micrograms per rectum.

Haemostatic Drugs

Tranexamic Acid: 1g bolus followed by 1g over 8 hrs.

Vit K & PCC for Warfarin patients

Other haemostatic agents: Discuss with Consultant Haematologist.

Cell Salvage

If available & appropriate

Consider ratios of other components; 1 unit of rbc = c.250 ml salvaged blood.

LABORATORY SUPPORT

Contact Numbers	RGH	NHH
Blood Bank	44477	2233 (Bl. 545)
Obs Anaesthetist Blp: 0141		Bleep 026
Cons Haematologist Sw/B		2253 (or Sw/B)
Haematology	44486	2245 (Bl. 545)
Coagulation	44481	
Biochemistry	44490	2243 (Bl. 346)

The Lead Communicator is responsible for contacting portering services.

Take bloods and send to lab for

XM, FBC, PT, APTT, FIBRINOGEN, U&E, Ca^{2+}, ABG

ORDER

Massive Haemorrhage Pack (Adult MHP)

Give MHP: Administer up to

RBC 6 units *

FFP 4 units

Platelets 1 adult dose**

*** group supplied as per Blood Bank policy**

**** From stock or order 2 ATD by Blue Light**

RESUSCITATION

Airway
Breathing
Circulation

Continuous Cardiac Monitoring

Prevent Hypothermia

AIMS FOR THERAPY

Hb **80-100 g/l** (8–10 g/dl)
Platelets **> 75 x 10^9/l**

PT < 16 sec
APTT < 40 sec

Fibrinogen **> 1 g/l**
Fibrinogen Concentrate *under direction of Cons Haematologist* ***if Fibrinogen < 2 g.***

Ca^{2+} **> 1 mmol/l**
Consider 10 ml 10% Calcium Chloride over 10 mins.

Temp **> 36 °C**
Use fluid warming device Use forced air warming blanket.

pH **> 7.35** (on ABG)

Monitor for Hyperkalaemia

RE-ASSESS

With reference to Consultant Haematologist.

THROMBOPROPHYLAXIS should be considered when patient stable

S T A N D D O W N

Inform Blood Bank. Return unused components. Complete Documentation including Audit

MASSIVE HAEMORRHAGE MANAGEMENT – PAEDIATRIC PATIENT

(Ongoing severe bleeding (overt/covert) and received 20 ml/kg of red cells or 40 ml/kg of any fluid for resuscitation in preceeding hour. Signs of hypovolaemic shock and / or coagulopathy).

The TEAM LEADER must appoint a Lead Communicator for communication with other teams, especially the Transfusion Laboratory and support services.

Contact Support Teams & Blood Bank and declare:
"Massive Haemorrhage in a Child <location>"

STOP BLEEDING

Haemorrhage Control

Direct Pressure / tourniquet if appropriate.

Stabilise fractures.

Surgical intervention – consider damage control surgery.

Interventional Radiology.

Endoscopic techniques.

Obstetric Techniques.

Haemostatic Drugs

Tranexamic Acid:

20 mg/kg bolus over 10 min and 10 mg/kg/hr infusion.

Vit K & PCC for Warfarin patients

Other haemostatic agents: Discuss with Consultant Haematologist.

LABORATORY SUPPORT

Contact Numbers	RGH	NHH
Blood Bank	44477	2233 (Bl. 545)
Obs Anaesthetist	Blp: 0141	Bleep 026
Cons Haematologist	Sw/B	2253 (or Sw/B)
Haematology	44486	2245 (Bl. 545)
Coagulation	44481	
Biochemistry	44490	2243 (Bl. 346)

The Lead Communicator is responsible for contacting portering services.

Take bloods and send to lab for

XM, FBC, PT, APTT, FIBRINOGEN, U&E, Ca^{2+}, ABG

ORDER

Massive Haemorrhage Pack (See Paediatric MHP Table)

Give MHP: Administer up to

RBC	**40 ml/kg**
FFP	**20 ml/kg**
Platelets	**10 ml/kg**

Rate will depend on child's weight & rate of blood loss.

RESUSCITATION

Airway
Breathing
Circulation

Continuous Cardiac Monitoring

Prevent Hypothermia

AIMS FOR THERAPY

Hb **80-100 g/l** (8–10 g/dl)
Platelets **> 75 x 10^9/l**

PT < 16 sec
APTT < 40 sec

Fibrinogen **> 1 g/l**
Fibrinogen Concentrate under direction of Cons Haematologist if Fibrinogen < 1g/l

Ca^{2+} **> 1 mmol/l**
Consider 0.2 ml/kg 10% Calcium Chloride (max 10 ml) over 30 mins.

Temp **> 36 °C**
Use fluid warming device Use forced air warming blanket.

pH **> 7.35** (on ABG)
pH > 7.25 (capil.)

RE-ASSESS

With reference to Consultant Haematologist.

THROMBOPROPHYLAXIS should be considered when patient stable

S T A N D D O W N

Inform Blood Bank. Return unused components. Complete Documentation including Audit

- PAEDIATRIC MASSIVE HAEMORRHAGE PACK – RECOMMENDED VOLUMES

APLS guidance for estimating weight in children. [1]

Works best for	Formula
0-12 months	Weight (in kg) = (0.5 x age in months) + 4
1 – 5 years	Weight (in kg) = (2 x age in years) + 8
6 – 12 years	Weight (in kg) = (3 x age in years) + 7

Massive Haemorrhage Pack: Order these volumes, which are also the maximum volumes to be administered from this pack in each weight category.

Calculate volumes to be administered as detailed in the flow chart but do not exceed these maximums.

Weight	**Red Cells**	**FFP**	**Platelets**	**Fibrinogen Concentrate if Fibrinogen < 1 g/l (< 2 g/l in Obsteric Patient)**
< 5 kg	2 Paediatric Units (80 – 100 ml)	2 'Neonatal' Units of Paediatric use* FFP (100 ml)	1 Paediatric pack of Platelets (50 ml)	As directed by Consultant Haematologist
5 – 10 kg	1 Adult Unit (250 ml)	1 Paediatric Unit of Paediatric use* FFP (225 ml)	2 Paediatric packs of Platelets (100 ml)	As directed by Consultant Haematologist
10 – 20 kg	2 Adult Units (500 ml)	2 Paediatric Units of Paediatric Use* FFP (450 ml)	1 Adult apheresis pack (200 ml)	As directed by Consultant Haematologist
>20 kg	4 Adult Units (1000 ml)	4 Paediatric Units of Paediatric Use* FFP (900 ml)	1 Adult apheresis pack (200 ml)	As directed by Consultant Haematologist

* Paediatric Use FFP: Children born since 1996 require non-UK sourced Fresh Frozen Plasma which has been treated with Solvent Detergent (SD) or Methylene Blue (MB) activation / removal as an enhanced viral-inactivation stage. [2]

The Blood Bank will stock and issue the appropriate component.

Example:

In a 5 kg child you may administer up to 200 ml RBC (40 ml/kg) and 50 ml platelets (10 ml/kg), however, in a 30 kg child do not administer more than 4 adult units of RBC (33 ml/kg) or 1 ATD of platelets (6 ml/kg).

References:

1. Advanced Paediatric Life Support 5th Edition. BMJ Publishing Group.
2. Joint UKBTS / NIBSC Professional Advisory Committee Position Statement 15 July 2010. (*http://www.transfusionguidelines.org.uk/docs/pdfs/dl_ps_vcjd_2010-08.pdf)*

LABORATORY MANAGEMENT OF MASSIVE HAEMORRHAGE

MASSIVE HAEMORRHAGE PATHWAY ACTIVATED
Transfusion receives call "Massive Haemorrhage <location> <speciality>

Receive call from designated Lead Communicator in clinical area

Caller will state:
- Name & contact telephone number, name of consultant responsible.
- Patient's ID (Surname, forename, hospital number, DoB, first line of address) or, if unknown, Emergency number & gender.

Requirements:
- Whether Emergency O Neg units are required / have been used.
- Issue Massive Haemorrhage Pack (MHP)
- Clarify urgency of requirements to decide on need for further emergency O Neg or wait for group specific / cross-matched red cells as part of MHP
- U&E, FBC, PT, APTT, Fibrinogen, ABG*, Calcium*, Lactate* (* may be POCT)
- Confirm Consultant Haematologist is aware of the emergency

NB: The 'Blood' Porter will be assigned to emergency until Stand Down is declared.

Lead Communicator Name & Contact Number

WHITE BOARD PEN

On Laminated Sheet

Receive Samples and Request Forms

HAEMATOLOGY

Perform FBC, PT, APTT, Fibrinogen

CLINICAL CHEMISTRY

Perform U&E, ABG Calcium etc as required.

Telephone Lead Communicator when results and Components are available.

TRANSFUSION

Perform Group, Antibody Screen, Cross-match as required.

Prepare & Issue MHP

Red cells	***6 units**
FFP	***4 units**
Platelets	***1 dose (ATD)**

(from stock or order 2 ATD by Blue Light transport from WBS)

*** Adjust if Paediatric Haemorrhage**

Receive further calls from Lead Communicator

Repeat investigations:

Order further components in d/w Haematologist (Cons / SpR)

S T A N D D O W N

Restock Emergency Group O Blood; Complete Traceability Trail;

Compile checklists and other records for post event Audit

SECTION 3: General Clinical Management of Massive Haemorrhage:[1]

NB: In all events a Lead Communicator is required and must be designated at the start of the call by the Team Leader. Lead communicator responsible for communication with support services including porters.

Please refer to the Speciality Sections for specific management and Section 6 for advice on dealing with Coagulation problems.

There are both clinical and logistic issues to consider. These include clinical management of the patient, setting processes in place to deliver blood and blood components to the patient, and organisation of emergency interventions to stop the bleeding (surgical or radiological).

There are two common scenarios:

3.1 A massively bleeding/injured/ill patient en route:

With warning, resources and personnel can be mobilised to be in position to receive the patient. A brief history can alert the team to the risk of massive bleeding:

- History of trauma (blunt or penetrating)
- Obstetric patient
- Major surgery (neurosurgery, spinal, cardiac, liver surgery)
- Underlying medical condition affecting coagulation

3.2 Presentation of a patient with minimal or no notice

This is the common scenario in the accident and emergency department. Here, the immediate concern is hands-on management of the patient:

- Stop any external bleeding
- Assess the patient and treat
- Trigger massive haemorrhage protocol
- Move to the next appropriate level of care

Immediate actions in dealing with a patient with massive haemorrhage:

- Control obvious bleeding points (pressure, tourniquet, haemostatic dressings)
- Administer High Flow Oxygen
- IV access – largest bore possible including central access. Consider intraosseous access if peripheral IV access not possible.
- If patient is conscious and talking and a peripheral pulse is present, the blood pressure is adequate.
- Baseline bloods – full blood count (FBC), prothrombin time (PT), activated partial thomboplastin time (aPTT), Clauss fibrinogen and cross-match.
- If available, undertake near-patient testing e.g. thromboelastography (TEG) or thromboelastometry (ROTEM).
- Fluid resuscitation – in the massive haemorrhage patient, this means warmed blood and blood components. In terms of time of availability:

  Blood group O is the quickest, followed by

  Group specific, then Cross-matched blood.
- Actively warm the patient and all transfused fluids.

Next steps: rapid access to imaging (ultrasound, radiography, CT), appropriate use of focused assessment with sonography for trauma scanning and/or early whole body CT if the patient is sufficiently stable, or surgery and further component therapy.

- Alert theatre team about the need for cell salvage auto-transfusion.

Ongoing assessment:

- Look at injury patterns
- Look for obvious blood loss (on clothes, on the floor, in drains)
- Look for indications of internal blood loss
- Assess physiology (skin colour, heart rate, blood pressure, capillary refill, conscious level)

Some patients compensate well despite significant blood loss. A rapid clinical assessment will give very strong indications of those at risk. It is important to restore organ perfusion, but it is not necessary to achieve a normal blood pressure at this stage.

1. Blood Transfusion and the anaesthetist: management of massive haemorrhage. Anaesthesia 2010;95: 1153 – 1161.

Section 4: Speciality Team Specific Information

NB: In all events a Lead Communicator is required and must be designated at the start of the call by the Team Leader. Lead communicator responsible for communication with support services including porters.

A. Major Trauma

A.1 Who should be included in the team?

a. In general, this should be all the personnel included in the Trauma Team with the addition of the lab response, appropriate portering service and consultant haematologist advice.

b. The ideal is consultant led care. When a consultant is not immediately available an appropriate senior doctor within the department must be informed.

c. The senior doctor should become the trauma team leader and make the decisions as to whether O Rh (D) negative or group specific blood are used.

d. The massively bleeding trauma patient is highly likely to need urgent/immediate surgery.

e. The appropriate surgical and anaesthetic staff should have been contacted immediately as part of the trauma team. If the team has not been activated, they will need calling immediately.

f. If the patient is expected to go to critical care, critical care should be informed early.

A.2 Additional management aspects

Turning off the tap is just as important as immediate resuscitation and should run along side the initial ABC approach. The British Military uses a C-ABC approach which involves dealing with catastrophic haemorrhage first by simple first aid measures such as direct pressure and tourniquet use where there is obvious external haemorrhage.

Consider intraosseous access if peripheral IV access is not possible.

About one quarter to one third of major trauma patients (ISS > 16) are coagulopathic on arrival[1,2]. Managing this with appropriate use of blood products is essential.

Tranexamic acid: As per CRASH-2 study [3] 1g over 10 mins, then 1g in infusion over 8 hours

Consider **rVIIa** if bleeding persists after fibrinogen concentrate and FFP and Platelets have been used and PT/APTT/Fibrinogen have been corrected. This needs to be discussed and authorised by a consultant haematologist. [4]

A.2.1 Airway with C Spine

Ensure the patient has a patent airway.
Give High flow Oxygen (Mask with reservoir, 15 L/min) if not intubated and ventilated.

Maintain Cervical Spine protection where appropriate.

A.2.3 Breathing

Ensure breathing adequate and monitor Respiration Rate and $S_a O_2$. Treat using ATLS principles (APLS for paediatrics)

A.2.4 C (Circulation)

a. Insert wide bore peripheral cannulae and take blood samples including a venous gas.

b. Institute basic monitoring: P, BP, ECG if available.

c. Arrest bleeding:

d. Early surgical/radiological/endoscopic intervention.

e. If external bleeding apply pressure/tourniquet as appropriate.
NB: A pelvic binder should be considered in cases of pelvic trauma

f. Monitor CVP and arterial line if possible.

g. For patients with **ongoing losses** in whom haemostasis will be achieved by **surgical/radiological/endoscopic** intervention, use balanced resuscitation until haemostasis can be achieved [5].

Aim for a blood Pressure adequate to maintain conscious level (usually a systolic pressure **90-100 mmHg**). In a ventilated patient aim for a systolic of 90 mmHg. Once haemostasis has been achieved, patients should be resuscitated to normal haemodynamic values.

Balanced resuscitation is not appropriate for patients with an associated head injury; such patients should have a systolic blood pressure > 100 mm Hg.

For children, aim for BP values referenced in Table 1 on page 22 (section 5.2.1)

h. Keep the patient warm. Dry the patient and keep them covered as much as possible. Use warm fluids and a warm air blanker. All intravenous fluids should be warmed using equipment designed for that purpose. Use a level one infuser (or equivalent) when available to ensure warm blood given.

i. Normocalcaemia, and a pH>7.2 must be maintained

A.2.5 Tourniquet use:

a. It is appropriate to use a tourniquet in a shocked patient with a massive bleed from a limb wound/amputation where direct pressure and elevation are unsuccessful in controlling the bleed.

b. Appropriate devices such as the combat action tourniquet or equivalent are the ideal; if not available, a normal sphygmomanometer blown up above arterial pressure will suffice.

c. Use proximal to the bleeding site, but as distal as practically possible to control bleeding.

d. It should not be applied over joints as this is unlikely to work. It can be difficult to obtain control when placed over the forearm or lower leg because of the structure (two bones) and if control is not reached in these sites the cuff should be moved more proximally.

e. The time of application of the tourniquet MUST be recorded.

f. Definitive surgical care to allow removal of the tourniquet must be a priority following tourniquet use. Departments may find it useful to produce a Massive Haemorrhage Equipment pack to contain all the necessary equipment for use in massive transfusion situations.

A.3 Transfusion Goals in patients actively bleeding

a. Hb 80 – 100 g/l (8-10 g/dL) (>100g/l if actively bleeding)

b. Fibrinogen >1.0 g/L.

c. Platelets >75 x 10^9/L except in head trauma where should be >100 x 10^9/L.

d. PT less than 16 s and APTT less than 40 s. (equivalent to PT & APTT ratio <1.5)

e. Ca^{2+} 1.0 mmol/L

References:

1. Brohi K, Singh J, Heron M, Coats T. Acute traumatic coagulopathy. *Journal of Trauma-Injury Infection & Critical Care* 2003 Jun; 54:1127-30.

2. Maegele M, Lefering R, Yucel N, Tjardes T, Rixen D, Paffrath T, et al. Early coagulopathy in multiple injury: an analysis from the German Trauma Registry on 8724 patients. *Injury* 2007 Mar; 38:298-304.

3. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial. CRASH-2 trial collaborators *The Lancet* 2010: 376; 23-32

4. ABHB Protocol for the administration of NovoSeven (eptacog alfa) – *on Intranet* Policy Number ABHB/Clinical /0023

5. Jansen JO, Thomas R, Loudon MA, Brooks A. Damage control resuscitation for patients with major trauma 1 *BMJ* 2009;338:b1778

B. Obstetrics: [1]

NB: In all events a Lead Communicator is required and must be designated at the start of the call by the Team Leader.
This should be the Coordinating Midwife on Labour Ward. Lead communicator responsible for communication with support services including porters.

B 1. Triggers for calling a Major Obstetric Haemorrhage:

Alert the blood bank if 1000 mls blood loss and activate the policy if at

1. **1500mls blood loss or more.**
2. **Ongoing significant bleeding.**
3. **Signs of shock.**

Haemorrhage can happen quite unexpectedly and be life threatening.
Experienced help must be summoned immediately.

Most cases of major obstetric haemorrhage occur post partum (PPH).
Significant antepartum haemorrhage (APH) usually warrants delivery and may be followed by PPH.

In young fit women the severity of haemorrhage may not be recognised until the cardiovascular system decompensates suddenly. Tachycardia will usually indicate hypovolaemia and blood pressure may not fall until the circulating blood volume is very low. However some women may not exhibit the normal tachycardic response to haemorrhage, such as women with pregnancy-induced hypertension treated with beta blockers.

B.2 Risk factors:

Predisposing factors are often present and the haemorrhage should be anticipated and preventive measures taken.

- APH
- Asian Ethnicity
- Past history of PPH.
- Precipitous (less than 4 hours) or prolonged labours.
- Uterine over distension (multiple pregnancy, polyhydramnios, large baby)
- Impaired uterine contractility (multiparity, abruption, fibroids)
- Bleeding tendency (severe PET, IUD, abruption, amniotic fluid embolus, infection)
- Assisted delivery
- Increased BMI >35
- Haemoglobin < 90g/l
- Advanced maternal age
- Placenta Accreta
- Placenta Praevia. There is an increasing risk of accreta with successive previous sections

During labour and delivery, these factors should prompt extra vigilance:

- Delivery by emergency/elective surgery
- Induction of labour
- Retained placenta
- Operative vaginal delivery
- Mediolateral episiotomy
- Prolonged labour >12 hrs
- Large baby >4kg
- Pyrexia in labour
- Age >40

The Massive Obstetric Haemorrhage Plan (page 9) and the Contact List (Appendix 1, p 39) should be laminated and displayed in the appropriate area(s) as an aide-memoire.

B.3 Prevention:

As soon as a woman with any of risk factors is identified and she is in established labour:

a. Take blood for FBC, U&E, coagulation screen and group & hold (include clinical details).

b. Set up IV infusion with either 14 or 16 g cannula.

c. At delivery administer 500 micrograms ergometrine i.v. to produce tonic uterine contraction OR give 1 ml Syntometrine i.m. with the delivery of the anterior shoulder and infuse Syntocinon 40 IU in 500 ml N/Saline solution at a rate of 125 ml/h.

d. (Avoid Ergometrine and syntometrine if the woman is hypertensive or has a significant cardiac disease).

e. Remove placenta by CCT

B.4 Management of Major Obstetric Haemorrhage :

a. Obstetric Haemorrhage requires a multidisciplinary approach with early involvement of other specialities.

b. Ensure that Obstetric Consultant, Anaesthetic Consultant and the Blood Bank are informed.

c. If appropriate, inform the patient that she may need to go to theatre and there is a possibility of a hysterectomy.

B 5 To Activate Major Obstetric Haemorrhage Protocol

B 5.1 Implementation :

a. Recognition and declaration of a **'Massive Obstetric Haemorrhage at <*Location*>'** by the most senior person present

b. Central coordinator appointed: Midwife in Charge of the labour ward

c. Blood Bank will contact switchboard, stating there is a **'Massive Haemorrhage'** and the location to which the blood porter must be sent

d. Switchboard will ensure all relevant personnel and teams are contacted

e. Call senior midwife, senior obstetrician and senior anaesthetist

f. Alert on call haematologist

B 5.2 Central Co-ordinator role:

The central coordinator is responsible for the following:

a. **Call Blood Bank and give full patient details:**

b. State there is a **'MASSIVE OBSTETRIC HAEMORRHAGE at <Location>'** (This will trigger the action plan)

The following patient details will be required:

i. Full name
ii. Address
iii. Date of birth
iv. Hospital/emergency number
v. **Exact location** of patient (MDU or labour ward /ward/A&E)
vi. Name and bleep number of co-ordinator

c. Ensure a blood transfusion sample is taken (before transfusion) and correctly labelled including all patient details, signature of person taking sample and the date taken.

d. Take additional bloods for – FBC, U&E, coagulation screens, (including fibrinogen) and arterial blood gas (ABG).

e. Ensure Blood pack labels (including emergency O Negative units) have been completed with full patient details and returned to the laboratory as soon as possible after transfusion.

B 5.3 Additional Responsibilities

***a. Designate a Recorder to** use the appropriate scribe sheet(s).*

*b. **Designate a Receptionist** to man telephone (out of hours designate a person not directly required to assist team).*

c. Designate Theatre Team.

d. Designate a member of staff to address the patient's relatives who should ideally be in a quiet room if possible and keep them informed.

e. Alert ITU.

f. Alert Line Manager.

g. Weigh all swabs and estimate blood loss

B 5.4 Clinical management:

Initial Resuscitation: Airway/Breathing/Circulation commenced by staff present but taken over by appropriate medical staff on arrival.

The aim of the management involves the ABCDE approach to:

Maintain oxygenation and ventilation

Restore circulating blood volume

Diagnose the cause of bleeding

Early intervention to stop the bleeding

Correction of coagulopathy.

All these measures need to be done simultaneously

- **Inform** Obstetric SpR and consultant; Anaesthetic SpR and consultant.
- **Compress (not massage) the uterus**.
- **High flow O_2** (10–15 litres/minute) via a facemask.
- **Insert minimum 2 x 14G i.v.** (Orange cannulae).
- **Intraosseous access** peripheral if IV access is not possible.
- **Take at least 20 ml blood for samples** FBC, U&Es, LFTs Group and screen, cross-match, coagulation screen and fibrinogen levels. Label carefully and give clinical details.
- **Establish monitoring** every 5 minutes on MEOWS chart including

  SaO_2, ABGs, NIBP, ECG

  Pulse, Temperature and Output from urometer (Urinary catheter)

  Arterial-line if haemodynamically unstable,

  Consider CVP may be contraindicated in coagulopathy

  Remember Haemacue, Use Bair Hugger.

- **Commence fluid resuscitation**:

  Crystalloids (Hartmanns) 2 litre, colloids 1-2 litres, until blood available.

  Give O (Rh) negative blood if group specific blood is not available

  (Group specific blood available in 10 minutes if antibody negative)

  Warm fluids, use Ranger and Level 1 rapid infuser

- **Blood and coagulation components**:

  Give blood components sooner if bleeding ongoing.

  A 'major haemorrhage blood pack' will be provided by the Blood Bank, containing **6** units of red cells, **4** units of FFP (2 units will be thawed and issued at a time, the provision of the second 2 units will be based on the coagulation screen results) and 1 adult dose of platelets (if in stock – otherwise will be ordered from Blood Centre by Blue Light Transport).

  Early liaison with a Consultant Haematologist is essential.

  Wait for lab results *before* making the decision to use fibrinogen and contact the Consultant Haematologist for advice.

  Consider fibrinogen concentrate if symptoms of DIC or fibrinogen <1.0g/l (Continue using FFP until the decision about use of fibrinogen has been made).

  Consider **rVIIa** if bleeding persists after fibrinogen concentrate and FFP and Platelets have been used and PT/APTT/Fibrinogen have been corrected. This needs to be discussed and authorised by a consultant haematologist. [7]

Continue regular measurement of FBC, U&Es, coagulation, fibrinogen levels and ABGs following interventions and ensure continued liaison with a Consultant Haematologist regarding further management of the patient.

Tranexamic acid: As per CRASH-2 study [8] 1g over 10 mins, then 1g in infusion over 8 hours

- **Medical Management including Contractile agents:**

Bimanual Uterine compression
Empty bladder
Syntocinon 5 units IM/IV x 2 ***slowly.***
Ergometrine 500 micrograms IM/IV ***slowly.*** (Caution in hypertensive patients)
Syntocinon infusion (40 units in 500 ml Normal Saline solution at 125 ml/hour). unless fluid restriction is necessary
Carboprost (Hemabate) 250 micrograms i.m. (total dose not greater than 2 mg) in doses of 250 micrograms, separated by at least 15 mins, maximum 8 doses. (Caution in patients with asthma)
Consultant decision for Carboprost 0.5mg (intramyometrial) (Caution in patients with asthma)
Misoprostol 1000 micrograms per rectum.

B 5.5 Surgical Management

* GA recommended if active, major bleeding.

If regional block is already on-board be cautious with conversion to GA in the presence of severe hypotension.

Exclude retained products and check the placenta again for completeness.
Repair genital tract trauma
Uterine packing or Intrauterine balloon catheter (balloon tamponade)
Haemostatic Brace suture
Internal iliac ligation or bilateral mass ligation of uterine arteries and veins
Hysterectomy – consider sooner rather than later if haemorrhage not controlled especially in placenta accreta or uterine rupture
Aortic compression
Vascular surgical support
Interventional radiological support

NB: Constant communication between Anaesthetist and Obstetrician is vital.

B 6 After the haemorrhage is controlled:

Continue all monitoring, using the MEOWS chart. Readings recorded every 5 mins until haemodynamically stable
Continue oxygen & careful fluid balance
Liaise early with HDU / ITU for post-op care
Monitor urine output hourly
Correct oliguria, hypothermia and coagulopathy.

Return all unused blood components directly to blood bank (do not send blood to another area with the patient).

Complete all relevant documentation including Audit Proforma (Appendix 3)

Senior clinician to debrief the patient and her relatives, as soon as possible.

Senior clinician to debrief all staff, within 24 hours of the incident.

B 6.1 Main therapeutic goal of management of massive blood loss is to maintain:

Haemoglobin > 80 g/l (8 g/dl) Platelet count > 75 x 10^9/l Fibrinogen > 2.0 g/l.

PT less than 16 s and APTT less than 40 s. (equivalent to PT & APTT ratio <1.5)

B 7 Special considerations:

B 7.1 Management of Jehovah's Witness: [2]

Jehovah's Witness mothers are managed in accordance with the Labour Ward Guidelines. (There should be an early warning system detailing the management of all booked Jehovah's mothers including the booking of delivery dates).

B 7.2 Use of Cell Salvage in Obstetrics: [3, 5, 6]

a. Although the clinical experience in the use of cell salvage in obstetric haemorrhage is still limited, there are situations where it can be life saving.
b. Potential benefits are transfusion of packed red cells with a haematocrit of 0.40 - 0.60 (i.e., in terms of red cell mass, 250 ml of cell salvage blood is equivalent to 500 ml of whole blood) and avoiding transfusion reactions and infections.
c. Cell Savers are easy to set up (can be set up in 5 minutes), simple to use and must be operated by a trained ODA
d. Potential risks include introducing bacteraemia and sepsis as well as the theoretical risk of iatrogenic **amniotic fluid embolism** secondary to contamination of amniotic fluid from the surgical field. Inevitable transfusion of fetal red cells may be a problem in Rhesus incompatibility but can be treated with anti-D immunoglobulin according to Kleihauer test results
e. A Pall Leukoguard RS leucocyte removal filter should be used for complete removal of fetal squames and fetal proteins. It may be that high resistance of the filter will slow transfusion unacceptably and it may be removed.

   NB: Hypotension has been reported in the use of Leucocyte Reduction filters. If this occurs, stop the transfusion. If hypotension rapidly resolves further transfusion can be attempted with the filter removed. [4]
f. It is recommended that a double-suction set-up be used. One suction line should be connected to the cell-salvage reservoir and used for suctioning of maternal blood and the other should be connected to the regular wall suction and used for aspiration of amniotic fluid.

References:

1. RCOG Green-Top Guideline, 2009 No. 52 Royal College of Obstetricians and Gynaecologists, London (http://www.rcog.org.uk/files/rcog-corp/GT52Postpartum Haemorrhage0411.pdf)
2. Management of Jehovah's Witness women. AAGBI guidelines (March 1999).
3. Blood Transfusion in Obstetrics Green-top Guideline No.47 (December 2007) RCOG (http://www.sld.cu/galerias/pdf/sitios/anestesiologia/bloodtransfusions_obstetrics.pdf)
4. Cell Salvage induced Hypotension and London Buses. Anaesthesia 2010; **65**: 661 - 663
5. Cell salvage in obstetrics, Jan 2008 *International Journal of Obstetric Anaesthesia*, Volume 17, Issue 1, Pages 37-45 J.ALLAM
6. Blood conservation techniques in obstetrics: a UK perspective, May 2007, *International Journal of Obstetric Anaesthesia*, Volume 16, Issue 3, Pages 241-249, Catling S.
7. ABHB Protocol for the administration of NovoSeven (eptacog alfa). Policy Number ABHB/Clinical /0023
8. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial. CRASH-2 trial collaborators *The Lancet* 2010: 376; 23-32

C. General and vascular surgery

NB: In all events a Lead Communicator is required and must be designated at the start of the call by the Team Leader. Lead communicator responsible for communication with support services including porters.

C.1 Who should be included in the team?

The clinician who identifies the need for a massive transfusion episode should seek appropriate assistance from senior colleagues and/or other medical specialties/disciplines.

A consultant vascular and/or general surgeon, and a consultant anaesthetist should be informed as soon as a massive transfusion is expected to be required.

It is the responsibility of the Duty Haematologist to provide advice and support to the managing doctor during such an episode

C.2 Additional management aspects

If the patient is expected to go to critical care, critical care should be informed early.

Consider intraosseous access if peripheral IV access is not possible.

General Measures: The cornerstone of management is an ABCDE Approach.

C.2.1 A, B (Airway and Breathing)

Ensure the patient has a patent airway and is breathing adequately, ensure adequate oxygenation and monitor S_aO_2.

Give High flow Oxygen (Mask with reservoir, 15 L/min) if not intubated and ventilated.

C.2.2 C (Circulation)

a. Insert wide bore peripheral cannulae.

b. Institute basic monitoring: P, BP, ECG if available.

c. Monitor CVP if possible

d. Arrest bleeding:

e. Early surgical/radiological/endoscopic intervention

f. If external bleeding apply pressure/tourniquet as appropriate.

g. For patients with **ongoing losses** in whom haemostasis will be achieved by **surgical/radiological/endoscopic** intervention, use hypotensive resuscitation until haemostasis can be achieved.

   Aim for a blood Pressure adequate to maintain conscious level (usually a systolic pressure **90-100 mmHg**). Once haemostasis has been achieved, patients should be resuscitated to normal haemodynamic values.

Hypotensive resuscitation is not appropriate for patients with an associated head injury; such patients should have a systolic blood pressure of at least **100** mmHg.

h. Normothermia, normocalcaemia, and a pH>7.2 must be maintained.[1] All intravenous fluids should be warmed using equipment designed for that purpose. Use a warm air blanket.

C.3 Transfusion Goals in patients actively bleeding

a. Hb 80 – 100 g/l (8-10 g/dl) (>100 g/l if actively bleeding)

b. Fibrinogen >1.0 g/L.

c. Platelets >75 $x10^9$/L.

d. PT less than 16 s and APTT less than 40 s. (equivalent to PT & APTT ratio <1.5)

Consider rVIIa if bleeding persists after fibrinogen concentrate and FFP and Platelets have been used and PT/APTT/Fibrinogen have been corrected. This needs to be discussed and authorised by a consultant haematologist. [2]

Dosage information for tranexamic acid

Tranexamic acid:

As per CRASH-2 study [2] 1g over 10 mins, then 1g in infusion over 8 hours

References:

1. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial. CRASH-2 trial collaborators *The Lancet* 2010: 376; 23-32

2. ABHB Protocol for the administration of NovoSeven (eptacog alfa).
Policy Number ABHB/Clinical /0023

3. Martini WZ et al. Independent contributions of hypothermia and acidosis to coagulopathy in swine. *J Trauma* 2005: 58; 1002-9

D. Gastrointestinal haemorrhage.

NB: In all events a Lead Communicator is required and must be designated at the start of the call by the Team Leader. Lead communicator responsible for communication with support services including porters.

D.1 Who should be included in the team?

A medical (if not gastroenterological) opinion should be obtained. A surgical opinion should be obtained if there is lower gastrointestinal haemorrhage, or if there is a likelihood of persistent or recurrent bleeding. In the post-endoscopy situation, surgical referral should take place if there are complications stemming from endoscopic therapy or if endoscopic therapy is unlikely to be successful.

D.2 Specific management aspects for major haemorrhage guidelines [1, 2]

D.2.1 Prognostic factors

Factors associated with a poorer outcome in upper and/or lower gastrointestinal haemorrhage defined in terms of severity of bleed, uncontrolled bleeding, re-bleeding, need for intervention and mortality are:

initial shock
advanced age
co-morbidity
liver disease
in-patients
continued bleeding after admission
initial haematemesis or haematochezia
specific drugs (aspirin or NSAIDs).

D.2.2 Upper gastrointestinal bleeding

Adequate resuscitation and stabilisation should be attempted prior to endoscopy to minimize treatment-associated complications.

Combinations of endoscopic therapy comprising an injection of 1:10,000 adrenaline coupled with either a thermal or mechanical treatment are recommended in preference to single modalities.

The optimal timing of endoscopy has not been clearly established and the timing of early endoscopy has ranged from one to 24 hours after initial presentation. The British Society of Gastroenterology audit [3] suggests that patients admitted to hospitals with out-of-hours endoscopy may have a lower mortality, and early endoscopy (four to twelve hours after presentation) may be associated with a reduced transfusion need and a reduction in the length of stay in high-risk patients with non-variceal bleeding.

A small patient subgroup remains unstable because of continuing active bleeding, when earlier endoscopy and endo-therapy may be associated with reduced transfusion requirements, a reduction in re-bleeding and a lower need for surgery compared to later endoscopy. Therefore, emergency endoscopy during resuscitation may be necessary if the bleeding is not appearing to settle, especially in the elderly and patients with co-morbid illnesses. Angiography and embolisation may need to be considered in those in whom endoscopic treatment is not possible or

successful (especially if they have had a second unsuccessful attempt at endoscopic haemostasis).

Endoscopy and endo-therapy should be considered within 24 hours when initial endoscopic treatment was perceived sub-optimal or in patients in whom re-bleeding is likely to be life threatening.

Endotracheal intubation is necessary if active haematemesis or unstable vital signs or altered mental state.

D.2.3 Variceal bleeding:

Care should be taken to avoid over-transfusion of red cells. More emphasis needs to be given to the correction of coagulopathy with FFP and platelets (Section 6). The commencement of IV terlipressin is recommended if there is a risk of variceal haemorrhage.

Antibiotic therapy should be commenced in patients with chronic liver disease who present with acute upper gastrointestinal haemorrhage.

Endoscopy is often performed in ICU with the patient intubated and ventilated. This reduces the risk of aspiration pneumonia.

Balloon tamponade still has a role as a temporary salvage treatment for uncontrolled variceal haemorrhage, and is sometimes done before endoscopy in patients with repeated fresh haematemesis and known varices or signs of chronic liver disease.

Trans-jugular intra-hepatic porto-systemic stent shunting is recommended as the treatment of choice for uncontrolled variceal haemorrhage. This will require discussion with UHW, Cardiff, or a specialist liver unit.

D.2.3 Lower gastrointestinal bleeding

The large majority of intestinal bleeds settle spontaneously. CT angiography should be considered early, especially if there is obvious ongoing red bleeding, perhaps with a view to angiographic embolotherapy. An upper GI endoscopy may be necessary in order to exclude gastroduodenal origin. Colonoscopy is best delayed until after the bleeding has settled. Active lower GI bleeding limits visualisation at colonoscopy, and it is rarely possible to intervene endoscopically to stop bleeding. Consultation with the surgical team will guide the timing of this and any surgical intervention.

Although Intravenous (IV) proton pump inhibition therapy in patients with major peptic ulcer bleeding following endoscopic therapy is recommended, it is often administered prior to endoscopy. There is evidence that its use can result in a shorter length of stay, fewer actively bleeding ulcers, and more ulcers with a clean base [4]. It is sometimes given alone in patients in whom major comorbidity precludes endoscopy.

D.3 Transfusion Goals in patients actively bleeding

a. Hb 80 – 100 g/l (8-10 g/dl) (>100 g/l if actively bleeding)

b. Fibrinogen >1.0 g/L.

c. Platelets >75 $x10^9$/L.

d. PT less than 16 s and APTT less than 40 s. (equivalent to PT & APTT ratio <1.5)

Consider rVIIa if bleeding persists after fibrinogen concentrate and FFP and Platelets have been used and PT/APTT/Fibrinogen have been corrected. This needs to be discussed and authorised by a consultant haematologist. [5]

Dosage information for tranexamic acid

Tranexamic acid:

As per CRASH-2 study [6] 1g over 10 mins, then 1g in infusion over 8 hours

References:

1. Scottish Intercollegiate Guidelines Network. Management of acute upper and lower gastrointestinal bleeding (No. 105), September 2008.

2. Cheung FK and Lau JY. Management of massive peptic ulcer bleeding. Gastroenterol Clin North Am. 2009 Jun; 38(2):231-43. Review.

3. Sarah A Hearnshaw et al Use of endoscopy for management of acute upper gastrointestinal bleeding in the UK: results of a nationwide audit Gut 2010;59:1022-1029 doi: 10.1136/gut.2008.174599

4. Lau *et al*. Omeprazole before endoscopy in patients with gastrointestinal bleeding. *N Engl J Med.* 2007 Apr 19; 356(16):1631-40.

5. ABHB Protocol for the administration of NovoSeven (eptacog alfa). Policy Number ABHB/Clinical /0023

6. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial. CRASH-2 trial collaborators *The Lancet* 2010: 376; 23-32

E. Paediatrics

NB: In all events a Lead Communicator is required and must be designated at the start of the call by the Team Leader. Lead communicator responsible for communication with support services including porters.

E.1 Who should be included in the team?

This will depend on the facilities available in hospital.

In district general hospitals, a massive haemorrhage in a neonate or child should trigger a Paediatric Crashcall to ensure that at least a Paediatric middle grade doctor (Specialist Registrar, Speciality Trainee 4 or above) and Paediatric Specialty Trainee 1-3 are in attendance.

A Consultant Paediatrician should be alerted to the situation urgently if not already present.

Other team members will depend on the specifics of the situation as outlined in the other specialty sections, for example the Trauma Team in a trauma situation, or surgical team in the case of a post-operative bleed.

Staff present should be familiar with the location and use of all equipment necessary such as vascular access devices, rapid infusors, fluid warmers and advanced airway equipment.

Discussions should begin with the local Paediatric Intensive Care Unit, and with specialist paediatric services such as Paediatric Surgery as soon as is practicable for advice regarding continuing management and definitive care.

In tertiary paediatric hospitals, the members of the team to be alerted may more closely mirror those in adult situations.

For a Massive Haemorrhage on ward, a senior Paediatrician should be alerted at least, but most of these events are likely to trigger a crash call.

E.2 Additional Management Aspects

Many of the general principles outlined in the other specialty sections equally apply to when those situations occur in children, and the guidance given in those sections should be considered. However, physiologically and psychologically, neonates and children behave differently to adults, and so there are some specific points which should be noted.

E.2.1 Shock

Indicators of shock in children are as follows:

combination of at least 2 of:

tachycardia,
bradycardia,
BP less than 5th centile (see table 1) or pulse pressure <20 mmHg,
capillary refill time >3 seconds centrally or central / peripheral gap,
abnormal conscious level agitation,
confusion,
lack of normal social interaction,
Glasgow Coma Score <13 or falling,
responds to only voice, pain or unresponsive

Of these, tachycardia is the most reliable early indicator, but all the available clinical information must be used to decide whether a patient is shocked. The normal ranges of these vary with age.

A reference table is provided to aid decision making:

Age	Heart Rate (Beats / min)		Respiratory Rate	Systolic BP
	Tachycardia	Bradycardia	Breaths / min	mmHg
0 – 7 days	> 180	< 100	> 50	< 59
7 – 28 days	> 180	< 100	> 40	< 79
1 month – 1 year	> 180	< 90	> 34	< 75
2 – 5 years	> 140	< 60	> 22	< 74
6 – 12 years	> 130	< 60	> 18	< 83
13 – 18 years	> 110	< 60	> 14	< 90

Table 1: Paediatric reference values [1]

Children's responses to pain and frightening situations can make this assessment difficult, and experienced clinical input is essential as soon as is practicable. Hypotension is a late, pre-terminal, sign in children.

In a hypotensive child with on-going haemorrhage, or who has not responded to 20 ml/kg of crystalloid solution, O negative blood should be used unless type-specific or cross-matched blood is immediately available.

In a haemodynamically unstable child, the Massive Haemorrhage algorithm (page 9) is part of an overall strategy of care aiming to deliver the child safely to definitive care as quickly as possible.

E.2.2 Vascular access

Large bore intravenous access should be obtained. This is often difficult in young, shocked children and early use of intraosseous access is recommended. If intravenous access is not obtained within 90 seconds in a bleeding or shocked child, the **intraosseous route** should be used.

E.2.3 Hypothermia

Infants and young children have a relatively large surface area:volume ratio and so lose heat quickly. Care must be taken avoid inadvertent hypothermia.

E.2.4 Hypoglycaemia

Infants and young children are prone to hypoglycaemia and care must be taken to monitor and treat hypoglycaemia.

E.2.5 Drug doses

Drug doses and fluid volumes for resuscitation are calculated based on weight. The current APLS [2] guidance for estimating weight in children is:

Works best for	**Formula**
0-12 months	Weight (in kg) = (0.5 x age in months) + 4
1 – 5 years	Weight (in kg) = (2 x age in years) + 8
6 – 12 years	Weight (in kg) = (3 x age in years) + 7

The volumes of blood products administered are outlined in the algorithm (page 9) and are based on replacing blood components in specific quantities and ratios to achieve target values both in terms of laboratory results and clinical condition (vital signs within the parameters identified in the reference tables).

In general, it is usual to give volume in 20 ml/kg aliquots. In blunt and penetrating trauma however it may be safer to give smaller volumes and assess response as outlined below. Once the targets are reached, then it may be appropriate to withhold further blood product administration but continue monitoring for deterioration.

Although the tables (page 10) recommend administering up to an amount, this is not a hard limit but a way to anticipate the need for on-going blood component therapy and a trigger to continue down the algorithm.

E.2.6 Trauma [2]

1. An ABCDE approach should be followed. The primary survey should include control of obvious haemorrhage as well as cervical spine immobilisation.

2. In the paediatric population, trauma more commonly results in contained bleeds that require conservative management rather than aggressive resuscitation and treatment. The trigger for entry into the algorithm should take into account the clinical condition of the child.

3. It is not recommended to wait until the loss of a peripheral pulse before administering fluid in a trauma situation. 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 of 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.

E.3 Transfusion Goals in patients actively bleeding

a. Hb 80 – 100 g/l (8-10 g/dl) (>100 g/l if actively bleeding)

b. Fibrinogen >1.0 g/L.

c. Platelets >75 $x10^9$/L.

d. PT less than 16 s and APTT less than 40 s. (equivalent to PT & APTT ratio <1.5)

Consider rVIIa if bleeding persists after fibrinogen concentrate and FFP and Platelets have been used and PT/APTT/Fibrinogen have been corrected. This needs to be discussed and authorised by a consultant haematologist. [3]

Dosage information for tranexamic acid

Tranexamic acid:

20 mg /kg bolus over 10 minutes and 10 mg/kg/hr infusion [4]

References:

1. Goldstein *et al.,* International pediatric sepsis consensus conference:
   Definitions for sepsis and organ dysfunction in pediatrics. Special article in *Pediatric Critical Care Medicine* 6(1), 2005. DOI: 10.1097/01.PCC.0000149131.72248.E6
   With correction in *Pediatric Critical Care Medicine* 6(5), 2005 DOI: 10.1097/01.PCC.0000164344.07588.83
2. Advanced Paediatric Life Support 5th Edition. BMJ Publishing Group.
3. ABHB Protocol for the administration of NovoSeven (eptacog alfa). Policy Number ABHB/Clinical /0023
4. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial. CRASH-2 trial collaborators *The Lancet* 2010: 376; 23-32

Section 5: Further management:

Once control of bleeding is achieved, aggressive attempts should be made to normalise blood pressure, acid-base status and temperature, but vasopressors should be avoided. Active warming is required.

Coagulopathy should be anticipated and, if possible, prevented. If present, it should be treated aggressively (see **Section 6: Dealing with coagulation problems**).

Surgery must be considered early. However, surgery may have to be interrupted and limited to 'damage control'. Once bleeding has been controlled, abnormal physiology can be corrected.

Following treatment for massive haemorrhage, the patient should be admitted to a critical care area for monitoring and observation, and monitoring of coagulation, haemoglobin and blood gases, together with wound drain assessment to identify overt or covert bleeding.

Venous thromboprophylaxis:

Standard venous thromboprophylaxis should be commenced as soon as possible after bleeding has been controlled, as patients rapidly develop a prothrombotic state. Temporary inferior vena cava filtration may be necessary.

Traceability and the return of un-used blood components:

Confirmation of the fate of all blood components issued from the Blood Bank (Traceability) is a legal requirement under the UK Blood Safety & Quality Regulations 2005. [1]

All traceability documentation must be completed and processed in compliance with the ABHB Blood Component Transfusion Policy. [2]

Once control of bleeding has been achieved **all unused components must be returned** to the Blood Bank in order to account for all issued units and minimise wastage.

Investigation of a suspected Transfusion Reaction will require the return of all transfused and partially transfused bags to the Blood Bank.

If there are no signs of an acute transfusion reaction following transfusion of the last unit the empty bags may be disposed of in clinical waste.

References:

1. ABHB Blood Component Transfusion Policy: Policy Number ABHB/Clinical /0048
2. Department of Health. Blood Safety and Quality Regulations (SI 2005, 50)

Section 6: Dealing with coagulation problems:

Haemostatic defects in massive haemorrhage:

The haemostatic defect in massive haemorrhage will vary, depending on the amount and cause of bleeding and underlying patient-related factors. It is likely to evolve rapidly.

Patient management should be guided by laboratory results and near-patient testing, but led by the clinical scenario. Early involvement of the Consultant Haematologist should be sought.

Dilutional coagulopathy: All patients being treated for massive haemorrhage are at risk of dilutional coagulopathy leading to reduced platelets, fibrinogen and other coagulation factors.

This occurs if volume replacement is with red cells, crystalloid and plasma expanders, and insufficient infusion of fresh frozen plasma (FFP) and platelets.

Dilutional coagulopathy should be prevented by early infusion of FFP.

Consumptive coagulopathy: Some patients with massive haemorrhage are also at risk of a consumptive coagulopathy and are liable to develop haemostatic failure without significant dilution. Consumption is commonly seen in obstetric haemorrhage, particularly associated with placental abruption and amniotic fluid embolus, following massive trauma especially involving head injury, and in the context of sepsis.

Activation of anticoagulant pathways is associated with massive trauma and patients may have haemostatic compromise without abnormal coagulation tests.

Platelet dysfunction is associated with renal disease and anti-platelet medication.

Hyperfibrinolysis is particularly associated with obstetric haemorrhage and liver surgery.

Anticoagulant drugs: In the context of massive haemorrhage, warfarin should be reversed with a Prothrombin Complex Concentrate (PCC) [1] and intravenous vitamin K (5–10 mg).

The dose is dependent on the international normalised ratio (INR) See Table 1 below.

Unfractionated heparin can be reversed with protamine (1 mg protamine reverses 100 u heparin). Excess protamine induces a coagulopathy. Usual reversal is by infusing either 25 or 50 mg of intravenous protamine.

Low molecular weight heparin can be partially reversed with protamine.

Direct thrombin and factor Xa inhibitors e.g. fondaparinux, dabigatran and rivaroxaban cannot be reversed.

Table 1 Suggested regimen for prothrombin complex concentrate (PCC) [1] NB: must be administered under direction of a Consultant Haematologist.

INR (International Normalised Ratio)	Dose of PCC; iu / kg
< 5.0	15
> 5.0	30

Cerebral bleed confirmed	50

Aspirin and P2Y12 antagonists: Patients taking aspirin have a low risk of increased bleeding, whilst those on P2Y12 antagonists have a higher risk. The anti-platelet effect of aspirin can be reversed by platelet transfusion, but the effect of the P2Y12 antagonist, clopidogrel, is only partially reversed by platelets.

Inherited bleeding disorders: It is very likely that patients with an inherited bleeding disorder will be registered with a haemophilia centre and urgent advice should be sought if they present with massive haemorrhage.

Liver disease is associated with decreased production of coagulation factors, natural anticoagulants and the production of dysfunctional fibrinogen (dysfibrinogenaemia).
It should be anticipated that these patients will develop a clinically significant dilutional coagulopathy and haemostatic failure with bleeds less than one blood volume.

Interpretation of laboratory tests A fibrinogen < 1.0 g/l or a PT > 16 s and APTT > 40 s. (equivalent to PT & APTT ratio <1.5) represents an established haemostatic failure and is predictive of micro-vascular bleeding. Early infusion of FFP should be used to prevent this occurring if a senior clinician anticipates a massive haemorrhage.

Clauss fibrinogen is an easily available test and should be specifically requested if not part of the routine coagulation screen. The fibrinogen level is more sensitive than the PT and aPTT to a developing dilutional or consumptive coagulopathy.

Levels below 1.0 g/l, in the context of massive haemorrhage, are usually insufficient, and emerging evidence suggests that a level above 1.5 g/l (2.0 g/l for Obstetric patients) is required. Higher levels are likely to improve haemostasis further.

A **platelet count** below 50 x 10^9 /l is strongly associated with haemostatic compromise and microvascular bleeding in a patient being treated for massive haemorrhage. A minimum target platelet count of 75 x 10^9 /l is appropriate in this clinical situation.

The **PT** is an insensitive test for haemostatic compromise and a relatively normal result should not necessarily reassure the clinician. It is common practice to correct to PT to within 1.5 of normal (< 16 s) however, this may not be an appropriate target in many situations.

An **INR** is not an appropriate test in massive haemorrhage because it is standardised for warfarin control, and results may be misleading in the context of dilutional and consumptive coagulopathies and liver disease.

The **aPTT** is commonly used to guide blood product replacement but, as with the PT, correcting to 1.5 times normal is not necessarily an appropriate strategy because haemostatic failure may already be significant at this level. The aPTT should be maintained below 1.5 times normal (< 40 s) as the minimum target.

Haemostatic tests and FBC should be repeated at least every hour if bleeding is ongoing, so that trends may be observed and adequacy of replacement therapy documented.

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

Management of haemostasis:

The coagulopathy during massive haemorrhage is likely to evolve rapidly and regular clinical review and blood tests are required.

It is important to anticipate and prevent haemostatic failure, but if haemostatic failure has occurred, standard regimens (e.g. FFP 15 ml/ kg can be predicted to be inadequate and larger volumes of FFP are likely to be required.

Prevention of coagulopathy:

Emerging evidence supports the early use of FFP to prevent dilutional coagulopathy. If an experienced clinician anticipates a blood loss of one blood volume, FFP should be infused to prevent coagulopathy.

While FFP 15 ml/kg is appropriate for uncomplicated cases, increased volumes of FFP will be needed if a consumptive coagulopathy is likely or the patient has underlying liver disease.

A minimum target platelet count of 75 x 10^9 /l is appropriate in this clinical situation.

NB: The 1:1:1 Red Cells:FFP:Platelet regimens, as used by the military, are reserved for the most severely traumatised patient and are not routinely recommended.

Treatment of haemostatic failure:

In the context of massive haemorrhage, patients with widespread microvascular oozing or with coagulation tests that demonstrate inadequate haemostasis (fibrinogen < 1.0 g/l or PT > 16 s and APTT > 40 s. equivalent to PT & APTT ratio >1.5) should be given FFP in doses likely to correct the coagulation factor deficiencies. This will require more than 15 ml/kg, and at least 30 ml/kg would be a reasonable first-line response.

Platelets should be maintained at at least 75 x 10^9 /l

Although it is often recommended that hypo-fibrinogenaemia unresponsive to FFP be treated with cryoprecipitate, treatment may be associated with delays because of thawing and transportation.

Fibrinogen replacement can be achieved much more rapidly and predictably with **fibrinogen concentrate** (no requirement for thawing as for cryoprecipitate) given at a dose of 30–60 mg/kg.

NB: This product is not currently licensed in the UK and must be given on a named patient basis under the direction of a Consultant Haematologist.

Hyperfibrinolysis:

Intravenous **tranexamic acid** should be used in clinical situations where increased fibrinolysis can be anticipated. Support for its use has strengthened recently with the positive report of its use in traumatic haemorrhage. [2]

Hypocalcaemia and **hypomagnesaemia** are often associated with massively transfused patients and will need monitoring and correction.

References:

1. ABHB Protocol for the Administration of Prothrombin Complex Concentrate (PCC) for the Reversal of Life Threatening Over-anticoagulation due to Warfarin. Policy Number ABHB/Clinical /0463
2. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial. CRASH-2 trial collaborators *The Lancet* 2010: 376; 23-32

Appendix 1: Massive Haemorrhage Contact List

	ROYAL GWENT HOSPITAL	NEVILL HALL HOSPITAL
Blood Bank	**44477 / 44475**	**2233 / 2335** **Bleep 545**
Consultant Anaesthetist	**Via switch on-call list**	**Via switch on-call list**
Consultant Obstetric Anaesthetist	**Bleep 0141**	**Bleep 026**
Consultant Haematologist	Ext. **44464** or **via switch**	Ext. **2253** or **via switch**
Consultant Surgeon(s)	**Via switch on-call list**	**Via switch on-call list**
Haematology Lab	**44486 (Coagulation 44481)**	**2245** **Bleep 545**
Biochemistry Lab	**44490**	**2243** **Bleep 346**

Take blood samples for the laboratory:

- Blood Group and Antibody Screen
- Baseline Haematology & Coagulation levels including Fibrinogen
- Biochemistry investigations

Positive Patient Identification via the identity band is absolutely essential and Blood Transfusion samples and forms must be completed accurately according to the Sample Acceptance / Rejection policy. [1]

The safe provision of group specific blood is dependant on an acceptable written request and properly labelled sample.

1. ABHB Blood Transfusion Sample Acceptance / Rejection Policy. Policy Number ABHB/Clinical /0269

Appendix 2: Transfusion Laboratory Checklist

This list should be completed **in real time** to ensure that the correct action is taken whenever the massive haemorrhage policy is activated. Tick when each activity is completed. BMS staff band 5 or above should deal with the phone call.

Name of person who has activated the policy: _____

Date and time of activation (24 hour clock) ___/___/___ at __:__ hours

Name of laboratory staff member-give your name as laboratory contact: _____ Name of Porter assigned to emergency: _____

Name of Consultant or Clinician responsible for Patient _____

Name of Patient _____ Hospital ID number _____

Location of patient_____

Lead Communicator in clinical area _____ Contact number_____

Agree what is required for provision of red cells :

- ☐ Immediate uncrossmatched group O number taken :☐
- ☐ Group specific (20 mins)
- ☐ Fully crossmatched (45 mins)
- ☐ None-cell salvage is in use

Check for availability of platelets - if no stock, order 2 by emergency delivery ☐
If 1 available as stock order 1 by emergency delivery (group A HT neg if unknown)

Check stocks of red cells and FFP when patient group is known ☐
Re-order if necessary. (Use AB FFP if group unknown).

Inform Haematology and Reception areas of the patient details and ☐
ask one staff member to phone all results as soon as available to the contact number and clinical contact provided (not applicable night period)

Note details of any problems or delays below Lab ID number:_____

Designated staff to review and ensure audit sheet is sent to clinical lead ☐
Communicator.

Appendix 3: Audit of Massive Haemorrhage: Part A - 1

Audit Code						Event Date				Event Time		

Patient age (yrs)		Diagnosis	

Patient Location	Theatre	Labour Ward	Ward	ICU	A&E	Other (specify)

Speciality

A&E	Trauma / Ortho-paedics	Gastro-enterology	Obstetrics	General Surgery	Vascular Surgery	ICU	SCBU	Other (specify)

Was the Pathway Activated?	Yes	No	If no, what happened?	

Who activated the Pathway?	Staff Group	Grade	Speciality

Baseline Obs:	BP	Pulse	Resp. Rate

Was the activation appropriate?	Yes	No	Comments

Was emergency blood used?	Yes	No	If yes, how many units and was it Rh D Pos or Neg?	Units	Rh D

	Date	Time
Start of Red Cell Transfusion — Emergency O		
Group specific		
Cross-matched		
Salvaged red cells		
Start of FFP transfusion		
Start of Platelet transfusion		

In first 24 hours, total dose: *units, bags or ml (delete as appropriate)*

Allogeneic Red Cells	Salvaged red cells	FFP	Platelets	Fibrinogen Concentrate
Units / ml	*ml*	*Units / ml*	*Units / ml*	*g*

Audit of Massive Haemorrhage: Part A - 2

Results Set	Date	Time	Hb	Plt	PT	aPTT	Fib		
1								TEG?	Yes / No
2								TEG?	Yes / No

Advice sought from Cons. Haematologist / SpR	Yes / No	Time	

What advice was given?

Were any other treatments used? *e.g.*

	Yes / No	Dose	Date	Time
Tranexamic Acid				
Fibrinogen Concentrate				
Prothrombin Complex Concentrate				

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 - describe	Yes / No	Corrective action	

Were there any delays in treatment?	Yes / No

If yes, please describe	

Please return completed Part A to : Transfusion Practitioners, 1st Floor, Pathology Administration, The Friars, RGH.

(Part B - Patient outcome / follow up should be completed and returned when information available)

Audit of Massive Haemorrhage: Part B

Audit Code						**Event Date**				**Event Time**		

Patient Age (years)		**Diagnosis**	

Patient Outcome

24 hours	**Alive**	**Deceased**	**Morbidity**	**N/A**	**4 weeks**	**Alive**	**Deceased**	**Morbidity**	**N/A**

Please state Morbidity		**Please state Morbidity**	

Blood Component / Product wastage *(please write amount in units or ml)*

Red Cells	**FFP**	**Platelets**	**Fibrinogen Concentrate**
Units / ml	*Units / ml*	*Units / ml*	*ml*

Any other comments?

Please return completed Part B to : Transfusion Practitioners, 1st Floor, Pathology Administration, The Friars, RGH.

Appendix 4:

Seven Steps for Successful Coordination in Massive Haemorrhage

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

Adult: ***"We have a Massive Haemorrhage in <location>, <speciality>"***
Obstetric: ***"We have a Massive Obstetric Haemorrhage at <location>"***
Child: ***"We have a Massive Haemorrhage in a child <location>"***

Populate with local arrangements for how to activate team (eg: through switch) and which people need to be contacted (See Speciality Specific Guidance)

2. Allocate team roles

I. **Team leader**: most senior clinician present.
II. **Lead Communicator**– dedicated person for communication with other teams, especially the transfusion laboratory and support services
III. **Sample taker** / investigation organiser / documenter
IV. **Transporter** - a Porter will be allocated to the emergency until stand down declared.

Only staff trained and competent to collect blood components are authorised to perform this task

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

U+E, FBC, Cross-match, PT, APTT, Fibrinogen, ABG, Calcium, lactate

For Transfusion samples:
Use correct request form which must also be signed by person taking sample.
Sample must be hand written.
All patient details on form and sample must match exactly.
Minimum data for known patient is Full name, DoB, 1st line of address and Hospital / NHS Number.
For unidentified patients use Emergency number and Gender. (Refer to Blood Transfusion Sample Acceptance / Rejection Policy)

4. Request blood / blood components: Team leader should decide on use of:

i. Emergency O Neg (immediate)
ii. Group specific: available in 10 minutes subject to appropriate group and antibody screen results.
iii. Cross-match: usually takes 45 - 60 minutes for full cross-match. Presence of antibodies may increase delay.

A stock of O Rh D Negative, Kell Negative is kept available in Blood Bank for immediate collection on the responsibility of the requesting doctor.

Lead Communicator to contact laboratory:

Blood Bank:	**RGH: 44477 / 75**	**NHH: 2233 / 35**
Haematology:	**RGH: 44486**	**NHH: 2245 (Bleep 545)**
RGH Coagulation:	**44481**	
Biochemistry:	**RGH: 44490**	**NHH: 2243 (Bleep 346)**

and inform the BMS of the following:

a. Your name, location and extension number
b. Message format: *'this relates to the massive haemorrhage situation in ……."'*
c. The patient's details: ideally surname, forename, hospital number, DOB (for unknown casualty here use emergency number and Gender)
d. Whether O Neg has been used and how many units
e. Order Massive Haemorrhage Pack (MHP)
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. Lead Communicator to arrange for transport of samples / request form to the laboratory
II. BMS to ring Lead Communicator with results of urgent investigations
III. BMS to ring Lead Communicator when blood / blood components are ready
IV. Lead Communicator to arrange to collect blood and blood components from the laboratory

Only staff trained and competent to collect blood components are authorised to perform this task

6. Communicate stand down of pathway

Arrange immediate return of unused blood components and products.
Complete Traceability documentation ensue Tags are returned to Blood Bank and label is attached in medical notes.

7. Ensure documentation is complete

I. **Clinical area:** monitoring of vital signs, timings of blood samples and communications, transfusion documentation in patient case note record, return traceability information to laboratory, completion of audit proforma.
II. **Laboratory:** keep record of communications / telephone requests in patient laboratory record.