Aneurin Bevan University Health Board

Management of Major Haemorrhage Protocol

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 This is to avoid the risk of out of date printed versions of the document.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:

Introduction

Excessive blood loss may jeopardise the survival of patients in many clinical settings.

The latest annual report from Serious Hazards of Transfusion (SHOT 2019) highlighted 129 cases where there was delayed provision of blood products to the clinical area 63 of which were emergency / urgent despite the introduction of massive haemorrhage toolkits across the UK. There has been an increase in such reports over recent years (2010 - 2019).

The early recognition of major blood loss and effective, appropriate action is vital if hypovolemic shock and its adverse consequences are to be avoided. The rapid provision of blood and blood components is integral to successful management.

Effective communication with staff involved in the provision and transportation of blood is integral to the timely and uncomplicated provision of blood for life threatening haemorrhage and an unambiguous and focussed approach is required by all involved. SHOT 2019 highlights poor communication between the clinical and laboratory settings and staff shortages as the main contributory factor in delays.

The original document was reviewed by members of the Hospital Transfusion Committee (HTC) and submitted for approval by the Aneurin Bevan University Health Board's Clinical Standards & Quality Group in 2013.

It has been reviewed and updated by HTC in response to current evidence and local audit.

It should be noted that the appropriateness of activation of the major haemorrhage protocol should be discussed by the clinical team **prior to an emergency** and noted in the medical notes if treatment is futile and patient is for palliative care.

This Protocol has been adapted from NHSBT NW Region's Toolkit for the management of major haemorrhage (2013) and is intended for use within Aneurin Bevan University Health Board in The Grange University Hospital (GUH), Royal Gwent Hospital (RGH) and Nevill Hall Hospital (NHH) and Ysbyty Ystrad Fawr (YYF).

Protocol Statement

The Health Board is committed to maintaining the Health and Care Standards as stated in protocol document ABHB/Corporate/0571:

"All Divisions will have a process in place to ensure that they are meeting all of the standards across the full range of their activities; including activities being provided by other providers on their behalf through contracts."

Standard 2.8 refers to Blood Management:

Criteria:
Health services have robust governance systems in place to maintain a safe sufficient supply of blood, blood components and blood products to support timely appropriate and effective use for all.
There is compliance with legislation and national guidance on the supply and appropriate use of blood, blood components and products.
Effective schemes and systems are in place to actively manage stock, minimise wastage, and plan effectively for shortages.
A continuous innovative programme of education, training and competence assessment covers all staff involved in the transfusion process in line with national strategy.
Processes are in place that enhance the safety of blood transfusion and support the recognition and reporting of, and shared learning from all incidents, adverse blood events and reactions.
There is a collaborative approach to optimal blood management

Aims of the Protocol

1. To produce an evidence based algorithm for the transfusion management of major haemorrhage in adult and paediatric patients. Implementation will support the Health Board in meeting the requirements of the NPSA Rapid Response Report on emergency availability of blood and blood components.

2. The protocol will be updated as new evidence becomes available. Three recent guidelines are recommended for further reading: (AAGBI, Australian, European [3,6,7])

3. The scenarios considered in detail during the preparation of the protocol include:

    1. General and vascular surgery

2. Obstetrics
3. Gastrointestinal haemorrhage
4. Carotid Artery Rupture
5. Paediatrics

For major trauma please activate the Trauma Team at earliest opportunity by dialling '2222' and stating ADULT or PAEDIATRIC Trauma Call in Resus ED.

4. Examples of guidance on these subgroups / specialities are covered in the Appendices to this document.

5. There is a paucity of good randomised controlled trials on which to base recommendations – most publications contribute only Level III or Level IV evidence. The evidence for use of Major Haemorrhage Packs comes mainly from retrospective studies in major trauma (military and civilian) and major vascular surgery (particularly ruptured aortic aneurysm).

6. The use of such packs has been extended in this toolkit for use in other situations of life threatening haemorrhage but they should be used with caution. Table 1. below sets out some of the pros and cons of formula driven care:

Pros	**Cons**
• Reduce mortality from bleeding • Improve speed of delivery of blood components • Decrease need for communications back and forth between clinical area and lab • Prevent onset of coagulopathy • Reduce dependency on lab testing in acute resuscitation phase	• Based on level III and IV evidence mainly in major trauma • Exposure to additional units of FFP and platelets will increase risk of complications such as TRALI, organ failure, thrombosis and sepsis • Inappropriate triggering of use of formula driven care in non-major transfusion patients • Increased wastage of FFP • Depletion of platelet and plasma stocks

Table 1: Pros and Cons of Formula Driven Major Transfusion Protocols

The Protocol does not advocate the routine availability of thawed AB FFP and Group A platelets on standby within ABUHB.

Shortages of AB FFP have been reported by WBS so this scarce resource must be managed responsibly.

Components of the same blood group as the patient (group specific) can be made available rapidly once the patient's blood group has been confirmed.

Scope

The protocol has been produced by the Hospital Transfusion Team and agreed by the Major Haemorrhage Review Group.

The transfusion management algorithm is aimed at:

a. The junior doctor / senior nurse who may be the first person to see the patient and must be able to recognise the early stages of major haemorrhage and know when and who to call for support.
b. The senior clinical staff called as part of the emergency response team (including senior clinical Haematologist)
c. The laboratory staff and supporting services (e.g. portering services)

Roles and Responsibilities

Who is responsible for implementation?

- Clinical staff and Laboratory staff responding to the major haemorrhage event
- Consultant Haematologists for advice
- Supporting staff e.g. Porters, Switchboard Operators, Healthcare Support Workers
- **The Lead Clinician** is responsible for:
  - Clinical Assessment of the emergency
  - Appropriate Calling of the Major Haemorrhage Alert
  - Delegating a Lead Communicator
  - Review and assessment of need for further transfusion support including Haematologist consultation
  - Appropriate management of the emergency
  - Considering the advice of Hospital Transfusion Laboratory (HTL) Biomedical Scientists / Consultant Haematologist
  - Where necessary taking responsibility for the use of blood components eg. Emergency Issue group O blood
  - Ensuring that all documentation related to transfusion is completed correctly and where necessary returned to the HTL along with any unused blood components or products.

- **The Lead Communicator** is responsible for:

  - Communicating effectively and unambiguously between the clinical team and the HTL and other support services e.g. Radiology, Porters
  - Communicating Stand down to the HTL and other support services
  - NB: The Lead Communicator must not be directly involved in the clinical management but must be of appropriate seniority to effectively understand and communicate the nature and requirements of the emergency by telephone.

- **Hospital Transfusion Laboratory Staff** are responsible for:
  - The prompt provision of suitable blood components
  - Advising the clinical team of any actual or potential delays in provision and timescales if available
  - Compliance with regulatory legislation

- **Portering Staff** are responsible for:
  - Responding promptly to the emergency and safely transporting blood components and samples for the duration of the event.
  - NB: The porter will remain assigned to the emergency until Stand Down.

All cases of Major Haemorrhage will be formally audited and reviewed by representatives of the multi-disciplinary team. Outcomes will be reported to the HTC for review and appropriate follow-up.

Flowchart Pathway

1. Grange University Hospital
2. Adult Pathway: eLGH sites
3. Paediatric Pathway: Grange University Hospital

GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol Aneurin Bevan University Health Board

MANAGEMENT of MAJOR HAEMORRHAGE at GUH only

DEFINITION
Patient bleeding / Collapses: ongoing Severe Bleeding e.g. 150 ml/min and Shock.

STOP THE BLEEDING

Ring "2222" via Phone to contact Switchboard stating
"Major Haemorrhage at <location & site>"

Identify a LEAD COMMUNICATOR to phone Transfusion laboratory giving CONTACT DETAILS and PATIENT DETAILS as soon as possible:
Full Name, DoB & Hospital or NHS Number.
for Traceability of ALL Units transfused

INITIAL TREATMENT:
Administer Tranexamic Acid ideally within 1 hour (1 g bolus followed by 1 g infusion over 8 hours)

HAEMORRHAGE CONTROL
NB: IF OBSTETRIC consider 4 T's & refer to OBS CYMRU chart
Direct Pressure / Tourniquet if appropriate.
Stabilise fractures
Surgical intervention – consider damage control surgery
Interventional radiology
Endoscopic techniques

HAEMOSTATIC DRUGS
(Under direction of Consultant Haematologist)

Vitamin K & Prothrombin Complex Concentrate (PCC) for emergency reversal of warfarin & considered for reversal of DOAC.
Other haemostatic agents

CONSIDER CELL SALVAGE

WHERE DO I GET MY BLOOD FROM:
2 units Group O Blood from Transfusion Laboratory via emergency porter
Further blood components and products: liaise with lab.
Collection from remote issue fridge can be considered when appropriate and available on ward enquiry

SHOCK PACK (2 units of RBC) will be delivered on initial activation

Take blood samples for:
X-match, FBC, Coag Screen, U&E, Ca^{2+}, Point of Care Tests
Porter will take these to Lab after delivering Shock Pack
Emergency Porter can now be contacted via Vocera (See Panel)

REASSESS
If suspected continuing uncontrollable haemorrhage
Lead Communicator rings Transfusion Laboratory for Major Haemorrhage Pack: 4 units RBC; 2 Units FFP
(additional 2 units FFP supplied once baseline Coagulation samples received)

REASSESS
Discuss other products with Consultant Haematologist/Transfusion Lab
REPEAT BLOOD TESTS AS APPROPRIATE FOLLOWING CONSULTATION

NB: THROMBOPROPHYLAXIS should be considered when patient is stabilised

TRANSFUSION LABORATORY CONTACT NUMBER
GUH Transfusion Laboratory: 23920 or 23258 (24/7)
VOCERA team will be activated through "2222" phonecall
Consultant Haematologist contacted via Switchboard

USING VOCERA:
If more than one MHP on site additional porters will be assigned:
MHP1: Blood Porter
MHP2: Facilities Operative

RESUSCITATE

Control Bleeding
Airway
Breathing
Circulation
Continuous Cardiac Monitoring

PREVENT HYPOTHERMIA
Maintain temperature > 36°C
Use Blood warming device / Warm air blanket
Aim for Ca^{2+} > 1 mmol/L.
Consider 0.2 ml/kg of 10% Calcium Chloride (max 10 ml) over 30 mins.

AIMS FOR THERAPY

Haemoglobin	80-100 g/L
Plats.	> 75 x 10^9/L
PT	< 16 sec
APTT	< 40 sec.
pH	> 7.35 kPa
Fibrinogen	> 1 g/L > 2 g/L (if Obstetric)

STAND DOWN: Inform Lab; Complete all Documentation e.g. Traceability (including Emergency Group O) and RETURN UNUSED COMPONENTS.

ABG = Arterial Blood Gas
MHP = Major Haemorrhage Pack
APTT= Activated Partial Thromboplastin Time
PT = Prothrombin Time
ATD = Adult Therapeutic Dose (Platelets)
RBC = Red Blood Cells
DOAC = Direct Oral Anticoagulant
ROTEM = Thromboelastography
FFP = Fresh Frozen Plasma
4T's = Tone, Trauma, Tissue, Thrombin

GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol Aneurin Bevan University Health Board

MANAGEMENT of MAJOR HAEMORRHAGE at RGH, NHH & YYF

DEFINITION
Patient bleeding / Collapses: ongoing Severe Bleeding e.g. 150 ml/min and Shock.

STOP THE BLEEDING

Ring "2222" via phone to contact Switchboard stating
"Major Haemorrhage at <location & site>"

Identify a **LEAD COMMUNICATOR** to phone **Transfusion laboratory in GUH** giving **CONTACT DETAILS** and **PATIENT DETAILS** as soon as possible:
Full Name, DoB & Hospital or NHS Number.
for Traceability of ALL Units collected from fridge and transfused

SHOCK PACK (2 units of RBC) will be delivered on initial activation

INITIAL TREATMENT:
Administer Tranexamic Acid ideally within 1 hour (1 g bolus followed by 1 g infusion over 8 hours) if appropriate

HAEMORRHAGE CONTROL
NB: IF OBSTETRIC consider 4 T's & refer to OBS CYMRU chart
Direct Pressure / Tourniquet if appropriate.
Stabilise fractures
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Other haemostatic agents

CONSIDER CELL SALVAGE

WHERE DO I GET MY BLOOD FROM:
2 units Group O Rh(D) neg Blood will be collected by blood porter from Remote Issue Fridge
Further blood components and products: liaise with GUH lab
Emergency O Rh(D) POS located in emergency fridge in case of remote issue fridge failure
RGH/NNH: 4 Units
YYF : 2 Units

REASSESS:
Take samples for Point of Care Testing
If suspected continuing uncontrollable haemorrhage transfer to GUH should be considered ASAP.
Lead Communicator rings GUH Transfusion Laboratory for accessibility of other components or products.
Clinical Teams discuss with Consultant Haematologist for advice and authorisation of components and products
FFP – can be defrosted in RGH and NHH in hours (not in YYF)
Platelets – discuss availability with GUH lab
Fibrinogen, PCC (available in RGH,NHH & YYF) and Lyophilised Plasma (RGH,NHH Out of hours only)– for Porter collection

NB: THROMBOPROPHYLAXIS should be considered when patient is stabilised

TRANSFUSION LABORATORY CONTACT NUMBER
GUH Transfusion Laboratory: Ext: 23920 or 23258 (24/7)
GUH Laboratory staff will liaise with local on-site staff when appropriate
Consultant Haematologist contacted via Switchboard

Porter will be activated via "2222" call and then can be contacted as follows:
RGH: "Blood Porter 1" via Vocera
YYF: "Blood Porter" via Vocera
NHH: Ext 82055

RESUSCITATE

Control Bleeding
Airway
Breathing
Circulation
Continuous Cardiac Monitoring

PREVENT HYPOTHERMIA
Maintain temperature > 36°C
Use Blood warming device / Warm air blanket
Aim for Ca^{2+} > 1 mmol/L.
Consider 0.2 ml/kg of 10% Calcium Chloride (max 10 ml) over 30 mins.

AIMS FOR THERAPY

Haemoglobin	80-100 g/L
Plats.	> 75 x 10^9/L
PT	< 16 sec
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STANDOWN: Inform Lab; Complete all Documentation e.g. Traceability (including Emergency Group O) and RETURN UNUSED COMPONENTS.

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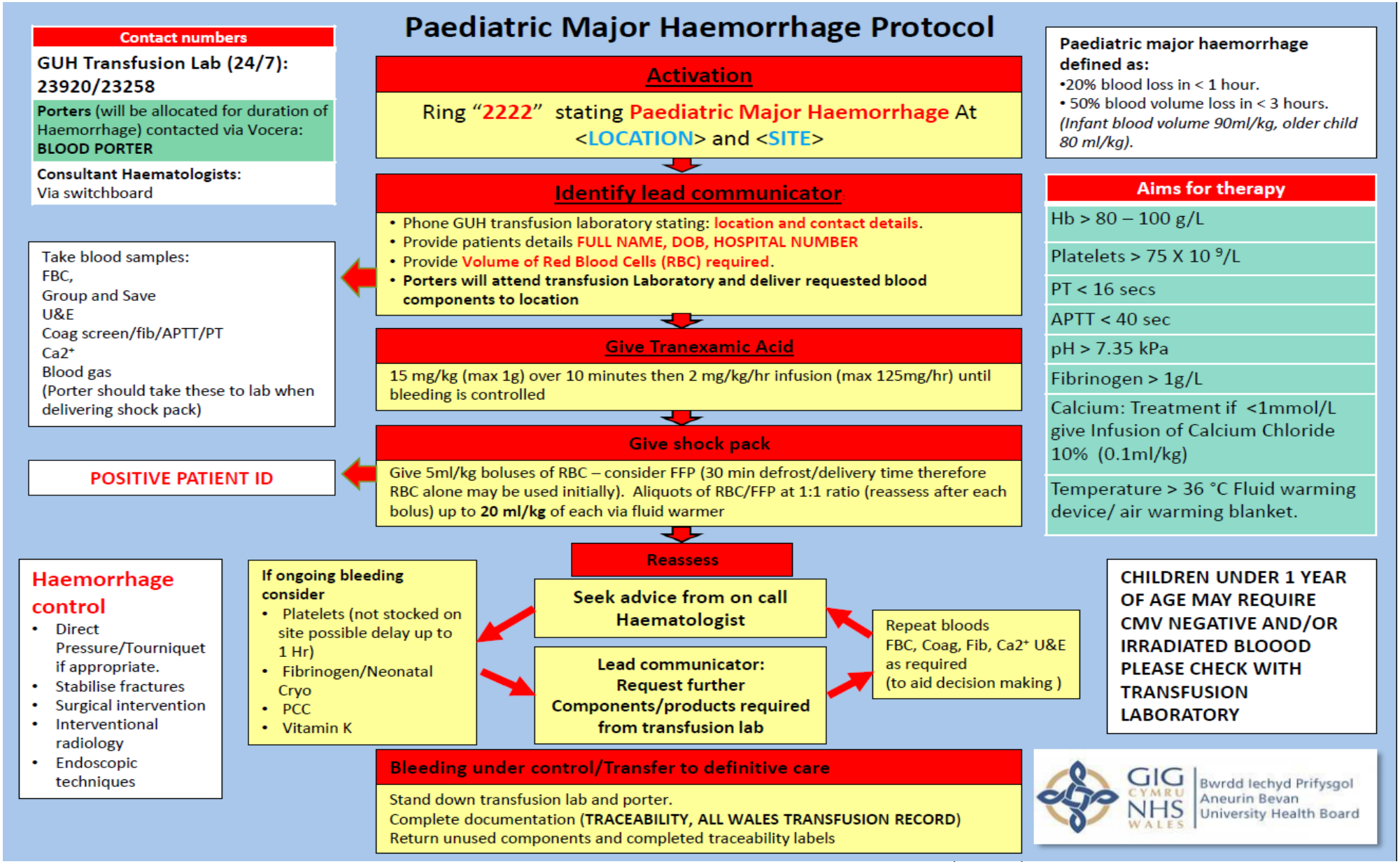
FFP = Fresh Frozen Plasma
MHP = Major Haemorrhage Pack
PT = Prothrombin Time
RBC = Red Blood Cells
ROTEM = Thromboelastography
4T's = Tone, Trauma, Tissue, Thrombin

Flowchart: Paediatric Pathway at the GUH



Training

It is now increasingly recognised that successful outcome of critical clinical situations is dependent not only on technical skills but also on non-technical skills. These are sometimes termed "Team Resource Management" or "Human Factors" skills, and include (but are not confined to) leadership, followership, situational awareness, task management, anticipation and planning. Successful treatment of a major haemorrhage requires teams to be proficient in both technical and non-technical skills.

It is recommended that teams should train and practice for management of major haemorrhage on a regular basis in order to develop these important non-technical skills in team management and to become familiar with the algorithm and guidelines.

The management of Major Haemorrhage has been incorporated into regular Maternity 'PROMPT Training' and Emergency Department 'Skill Drills'. It is recommended that this is also incorporated into the training schedules of other Departments where a Major Haemorrhage event is a possibility.

Implementation

- The major haemorrhage protocol is a key factor discussed in safe transfusion sessions in place within the Health Board
- Continuation of the "skill drills" are recommended
- Regular audit to access efficacy of the protocol is also recommended

Further Information Clinical Documents

This document has been developed using evidence and resources provided by Joint United Kingdom (UK) Blood Transfusion and Tissue Transplantation Services Professional Advisory Committee (JPAC) which can be accessed via:

http://www.transfusionguidelines.org.uk/transfusion-handbook/7-effective-transfusion-in-surgery-and-critical-care/7-3-transfusion-management-of-major-haemorrhage accessed on 16/6/2021

The protocol was developed following the recommendations from the North West Regional Transfusion Committee accessed via:

http://www.transfusionguidelines.org.uk/uk-transfusion-committees/regional-transfusion-committees/north-west/policies accessed on 16/6/2021

Audit

The following Key Performance Indicators are suggested and can be monitored using laboratory and clinical audit processes using an appropriate audit form:

	Key Performance Indicator	**Target**
a.	Number of cases receiving 2 units or fewer of emergency O red cells transfused	5%
b.	FFP wastage due to mismanagement	0%
c.	Platelet wastage due to mismanagement	0%
d.	Red cell wastage due to mismanagement	0%
e.	Emergency O red cell wastage due to mismanagement	0%
f.	Number of cases of rAAA with open surgical repair where cell salvage commenced	>80%
g.	Number of obstetric cases with caesarean section where cell salvage commenced	>80%
h.	Baseline Hb prior to activation	100%
i.	Baseline plt count prior to activation	100%
j.	Baseline PT & APTT prior to activation	100%
k.	Baseline Clauss fibrinogen prior to activation	100%
l.	Was ROTEM used according to Obs Cymru?	100%
m.	Was TXA given?	100%
n.	Time from activation to grouped red cells being ready for dispatch	5 Mins
o.	Time from activation to fresh frozen plasma being ready for dispatch	30 Mins
p.	Cases receiving rFVIIa	<2%
q.	Was lab informed of stand down?	100%

Table 2: Key Performance Indicators & Targets.

Review

3 years unless legislation requires differently.

References

1. National Patient Safety Agency Rapid Response Report NPSA/2010/RRR017 (2010). *The transfusion of blood and blood components in an emergency*: Author


NPSA RRR Transfusion_of_blooc

2. The importance of early treatment with tranexamic acid in bleeding trauma patients: an exploratory analysis of the CRASH-2 randomised controlled trial *The CRASH-2 collaborators** Published Online The Lancet March 24, 2011

3. Clinical review: Canadian National Advisory Committee on Blood and Blood Products - Major Transfusion Consensus Conference 2011: report of the panel *Critical Care* 2011, **15**:242 Dzik W et al

4. Management of bleeding following major trauma: an updated European Guideline *Critical Care* 2010,14:R52 Rossaint R et al

5. The decrease of fibrinogen is an early predictor of the severity of postpartum hemorrhage. J Thromb Haemost. 2007 Feb;5(2):266-73. Charbit B et al

6. Blood transfusion and the anaesthetist: management of major haemorrhage. *Anaesthesia* 2010;95:1153-1161

7. Australian Patient Blood Management Guideline Module 1 Critical bleeding / major transfusion 2011 http://www.nba.gov.au/guidelines/module1/cbmt-qrg.pdf

8. Johansson PI et al. Proactive administration of platelets and plasma for patients with a ruptured abdominal aortic aneurysm: evaluating a change in transfusion practice *Transfusion* 2007: 47; 593-8

General and vascular surgery

1.1 Who should be included in the team?

The clinician who identifies the need for a major 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 major 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.

1.2 Additional management aspects

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

General Measures

- The cornerstone of management is an ABCDE Approach.

1.2.1 Airway and Breathing

Ensure the patient has a patent airway and is breathing adequately, ensure adequate oxygenation and monitor SpO2.
Give High flow Oxygen (Mask with reservoir, 15L/min) if not intubated and ventilated.

1.2.2 Circulation

a. Insert wide bore peripheral cannulae. **Consider intra-osseous cannulation after two unsuccessful attempts at IV access.**
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 mean arterial pressure of at least 70mmHg.
h. Normothermia, normocalcaemia, and a pH>7.2 must be maintained[2]. All intravenous fluids should be warmed using equipment designed for that purpose. Use a warm air blanket.

1.3 Transfusion Goals in patients actively bleeding

a. Hb 80-100g/L (>100g/L if actively bleeding)
b. Fibrinogen >1.5g/L.

c. Platelets >75 x109/L.
d. PT <16 sec & APTT <40 sec

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

Obstetrics
Please refer to OBS Cymru strategy and flowchart which should be available in all obstetric departments.

Guidance below:

2.1 Who should be included in the team?

It may be a midwife or a junior doctor in obstetrics who alerts the 'team' which should include middle grade trainees from obstetrics and anaesthetics and senior midwife plus midwife in charge but should rapidly involve consultant obstetrician and consultant anaesthetist (Consider Neonatologist if APH), ODP or anaesthetic nurse, theatre team, one member of the team (the scribe) to keep records, porter and the lab staff and consultant haematologist for advice and support.

2.2 Additional management aspects

Follow the ABCD approach –

2.2.1 Airway and Breathing

Ensure the patient has a patent airway and is breathing adequately, ensure adequate oxygenation and monitor SpO2.
Give High flow Oxygen (Mask with reservoir, 15L/min) if not intubated and ventilated.

2.2.2 Circulation

a. Insert wide bore peripheral cannulae x 2. **Consider intra-osseous cannulation after two unsuccessful attempts at IV access.**
b. Institute basic monitoring – ECG, pulse oximetry, NIBP
c. Infuse warm crystalloid/colloid until blood is available – lead communicator asks for shock pack to be sent to clinical area as quickly as possible. Review ROTEM result and **consider fibrinogen concentrate early**.

d. Check uterine tone – uterotonics like syntocinon 5 units iv slowly or ergometrine 0.5mg by slow iv or im injection, syntocinon infusion at 10 units per hour, carboprost 0.25mg im repeated at 15 min intervals if required, (max 8 doses) or misoprostol 1000 mcgs pr and bimanual compression
e. If these fail, surgical measures may be required – EUA in theatres
f. Surgical interventions in ascending order of complexity – balloon tamponade, brace sutures, ligation of uterine or internal iliac arteries and ultimately hysterectomy (see next point re interventional radiology)
g. Interventional radiology - embolisation if available needs to be considered
h. Invasive BP monitoring, CVP monitoring, level 1 infusors, fluid warmers, forced air warmers and cell salvage may be required.
i. Normothermia, normocalcaemia, and a pH>7.2 must be maintained. All intravenous fluids should be warmed using equipment designed for that purpose. Use a warm air blanket.

2.3 Transfusion Goals in patients actively bleeding

a. Hb 80-100g/L (>100g/L if actively bleeding)
a. Fibrinogen >2.0g/L.
b. Platelets >75 x 109/L.
c. PT <16 sec & APTT <40 sec

Dosage information for tranexamic acid

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

Gastrointestinal haemorrhage

3.1 Who should be included in the team?

Initial assessment to establish the severity of the bleed by calculating Glasgow-Blatchford score, (and Rockall score used post-endoscopy). Medical history will alert to the risk of liver disease and possible variceal haemorrhage. Involve Medical SpR, +/- Gastro SpR (where rota exists)

Alert the locally available endoscopy service, as the key to successful management is resuscitation and early haemostasis, where treatment will require Inter/Intra-hospital transfer it is recommended the senior clinician and anaesthetic team on call is involved.

Access Clinical Standard Operating Procedure (C-SOP) for Emergency Transfer of Patients with Blood Components for intra-hospital transfers.

Emergency endoscopy will need to be arranged, for unstable patients, anaesthetic support for airway protection and resuscitation is advised.

3.2 Specific management aspects for major haemorrhage guidelines [3,4]

3.2.1 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).

3.2.2 Upper gastrointestinal endoscopy

Early diagnosis and haemostasis achieved endoscopically is the ideal. Whilst resuscitation and stabilisation is desirable prior to endoscopy, in cases when this cannot be achieved, particularly because of ongoing haemorrhage, endoscopy should not be delayed. Anaesthetic support to safeguard airway and continue fluid resuscitation is required

The endoscopist and endoscopy nurse assisting should be skilled in all modalities of therapy for variceal and non-variceal bleeding. For the former, modalities include oesophageal band ligation, cyanoacylate glue and Sengstaken Blakemore tube placement and for the latter at least dual therapies of injection of 1 in 10000 adrenaline, thermal therapy gold probe and haemostatic clips for Forrest 1a-2b lesions.

Failed haemostasis at endoscopy or instability in the post-endoscopy period should trigger involvement of surgical and /or interventional radiology on call teams. The former can offer laparotomy as an intervention for peptic ulcer disease; the interventional radiologist can coil bleeding arterial lesions, or arrange TIPSS for persistent bleeding due to varices and portal hypertension.

Endoscopy should be performed immediately after initial resuscitation in cases of severe upper GIB, and within 24 hrs for all other patients

Endoscopy and endo-therapy should be repeated within 24 hours when initial endoscopic treatment was considered 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 as is the case in acute alcohol withdrawal or hepatic encephalopathy often seen in cases of variceal haemorrhage

3.2.3 Lower gastrointestinal endoscopy

Early endoscopic examination should be undertaken within 24 hours of initial presentation, where possible. Consultation with the surgical team will guide the timing of this and surgical intervention.

3.2.4 Pharmacological therapy

Although the place of 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[5].
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.

Nasogastric aspiration may identify high-risk upper GI haemorrhage, allow lavage and facilitate endoscopy but no evidence that it alters outcome has been identified.

3.2.5 Other modalities

Angiography and coil 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) and are not fit for surgery.

Trans-jugular intrahepatic portosystemic stent shunting (TIPSS) is recommended as the treatment of choice for uncontrolled variceal haemorrhage.

Balloon tamponade using a Sengstaken-Blakemore tube should be considered as a temporary salvage treatment for uncontrolled variceal haemorrhage.

The availability of the above interventions will depend on local resources and cases must be treated on an individual basis.

3.2.6 Transfusion goals in major gastrointestinal haemorrhage*

a. Hb80-100g/L
b. Fibrinogen >1.5g/L.
c. Platelets >50 x109/L.
d. PT <16 sec & APTT <40 sec

* Transfusion in GI haemorrhage

In the absence of major haemorrhage and shock, the threshold for transfusion of red cells is 70-80 g /L (there is some evidence to suggest that transfusion at higher thresholds increases the risk of re-bleeding[7])

Carotid Artery Rupture

4.1 Who should be included in the team?

Management of the bleeding and treatment in a carotid artery rupture or more commonly known as "carotid blowout" will depend upon decisions made between the patient, family and head and neck team/palliative care teams. If the patient's life expectancy and overall quality of life warrants it, then management of acute bleeding episode consists of general resuscitative measures, such as volume and fluid replacement, and specific measures to stop the bleeding.

However, if the patient's goals are palliative, then management may include measures to stop bleeding without full resuscitative measures. Comfort measures only may be most appropriate for end-stage patients[6]**.**

The clinician who identifies the need for a major transfusion episode should seek appropriate assistance from senior colleagues and/or other medical specialties/disciplines. A consultant ENT and/or vascular surgeon and a consultant anaesthetist should be informed as soon as a major 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

4.2 Additional management aspects

- If the patient is expected to go to critical care, critical care should be informed early.
- If there is no plan for escalation of care, patient and family need psychological support throughout the emergency.

General Measures
The cornerstone of management is an ABCDE Approach.

4.2.1 Airway and Breathing

Ensure the patient has a patent airway and is breathing adequately, ensure adequate oxygenation and monitor SpO2.
Give High flow Oxygen (Mask with reservoir, 15L/min) if not intubated and ventilated.

4.2.2 Circulation

a) Insert wide bore peripheral cannulae. **Consider intra-osseous cannulation after two unsuccessful attempts at IV access.**
b) Institute basic monitoring: P, BP, ECG if available.
c) Monitor CVP if possible
d) Arrest bleeding
e) Early **surgical** intervention necessary
f) For patients with **ongoing losses** in whom haemostasis will be achieved by surgical 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.
g) Normothermia, normocalcaemia, and a pH>7.2 must be maintained[2]. All intravenous fluids should be warmed using equipment designed for that purpose. Use a warm air blanket.

4.3 Transfusion Goals in patients actively bleeding

a) Hb 80-100g/L (>100g/L if actively bleeding)
b) Fibrinogen >1.5g/L.
c) Platelets >75 x109/L.
d) PT <16 sec & APTT <40 sec

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

Paediatrics

5.1 Who should be included in the team?

A major haemorrhage in a neonate or child should trigger a "2222" crash call and major haemorrhage 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.

Lead communicator should ring the HTL and inform them of paediatric major haemorrhage.

Calling major haemorrhage will ensure a dedicated porter for the duration of the major haemorrhage.
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 infusers, 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.

5.2 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.

5.2.1 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 <20mmHg, 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:

Table 1: Paediatric reference values [8]

Age	Heart Rate beats/min		Respiratory Rate breaths/min	Systolic BP mmHg
	Tachycardia	Bradycardia		
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

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 Major Haemorrhage algorithm is part of an overall strategy of care aiming to deliver the child safely to definitive care as quickly as possible.

5.2.2 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.

5.2.3 Hypothermia

Infants and young children have a relatively large surface area to volume ratio and so lose heat quickly. Care must be taken avoid inadvertent hypothermia[2].

5.2.4 Hypoglycaemia

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

5.2.5 Drug doses

Drug doses and fluid volumes for resuscitation are calculated based on weight. The widely used formula for estimating weight in children aged 1-12 years is:

Child 0–12 months
Weight = (0.5 × age in months) + 4
Child 1–5 years
Weight = (2 × age in years) + 8
Child 6–12 years
Weight = (3 × age in years) + 7

The volumes of blood products administered are outlined in the algorithm 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 20ml/kg aliquots. In blunt and penetrating trauma 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 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.

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