# The Development of a Regional Guideline for Management of Massive Haemorrhage

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North West Regional Transfusion Committee
incorporating North Wales

# Background

- RTC members requested Regional Guideline to address new developments in this field:
  - Experience from the military arena on use of 'haemostatic resuscitation'[1,2]
  - Near patient testing techniques such as thromboelastography[3]
  - Use of additional therapies such as tranexamic acid[4], prothrombin complex concentrate[5] and fibrinogen concentrate[6]

# Background

- The National Patient Safety Agency has raised concerns with regards to delays in availability of blood in emergencies. Over a three year period (October 2006-Oct 2009) 10 deaths and 46 incidents associated with major morbidity were reported
- Emphasis needs to be on rapid provision of blood and blood components
- A key element is the effective communication between all staff who will be involved in the provision and transportation of blood

# A toolkit or a guideline?

- There is a paucity of good randomised controlled trial evidence on which to base guidelines – most publications describe level III or IV studies
- Two groups actively producing up to date guidelines: the Association of  Anaesthetists of Great Britain and Ireland (AAGBI) and Australian Patient Blood Management Program – both currently completing a consultation process on a final draft
- Decision to develop a toolkit rather than a guideline as a means of putting current evidence into practice

# Components of the Toolkit

- A simple algorithm for the management of major haemorrhage based on current evidence that can be customised according to local circumstances (Trust or Specialty Specific)
- Specialties covered:
  - Major trauma
  - Cardiac surgery
  - Paediatrics
  - General and vascular surgery
  - Obstetrics
  - Gastrointestinal haemorrhage
- A section on effective communication
- A section on monitoring the management of major haemorrhage

# Who is the toolkit for?

- For hospital transfusion teams and committees.
- It is recommended that the algorithm is used as a template for the production of a flow chart in each Trust that will complement the Trust guideline(s) for the management of major haemorrhage

# Who is the management algorithm for?

- 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 a major haemorrhage situation and know when and who to call for support
- The senior staff called as part of the emergency response team
- The laboratory and supporting services (eg: portering)

# Method

- Call for volunteers via RTC membership Nov 2009
- Literature review performed Jan 2010
- Volunteers divided into 8 subgroups
- Lead from each subgroup on steering group
- First steering group meeting held 23/4/10

# The subgroups

- **Communications and logistics**
- **Near patient testing, haemostasis and lab issues**
- **Obstetric haemorrhage**
- **Major Trauma**
- **Gastro intestinal haemorrhage**
- **General / vascular surgery**
- **Paediatrics**
- **Cardiac surgery**

# The process

- Interim workshop May 14th
- Final workshop 18th June
- Final draft circulated to RTC members, critical care, trauma and vascular surgery networks in NW consultation July – September 2010

# Dilemmas

- Is it possible to fit everything on one page in a clear and simple format?
- Is pathway just for transfusion management or should it include advice on resuscitation and other measures to control haemorrhage?
- Definition of major haemorrhage and when to trigger pathway
- A separate pathway for each specialty or one pathway for all?
- Major haemorrhage packs ('shock packs') or not? Just for major trauma, or applicable to all major haemorrhage situations?
- Thawed AB plasma on standby or group specific plasma when group known?
- When to order platelets and how many doses?
- The role of TEG / near patient testing
- The role of tranexamic acid, fibrinogen concentrate, prothrombin complex concentrate (other than for reversal of warfarin), use of rFVII a in light of SPC advice against using the product in this situation

# Pros and Cons of Formula driven Massive Transfusion Protocols

## Pros

- 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

## Cons

- 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 massive transfusion patients
- Increased wastage of FFP and platelets
- Depletion of platelet and plasma stocks

# Draft matrix

| Stage of pathway | Sub group variation or hospital variation | Other management aspects | Communication |
|---|---|---|---|
| **Trigger for activation**<br>**Patient bleeding / collapses**<br>Ongoing severe bleeding (overt / covert) eg: 150 mls / min and not controlled<br>With Class III / IV shock and / or coagulopathy<br>Or if bleeding ongoing after 4 units of blood and patient is haemodynamically unstable due to blood loss<br><br>**Paediatric version**<br>Ongoing severe bleeding (overt / covert) and received 20ml/kg of red cells or 40ml/kg of any fluid for resus in preceding hour<br>With hypovolaemic shock and / or coagulopathy | For population by subgroups:<br>Specific points re clinical situations that help to identify major haemorrhage early | **Resuscitation**<br>Assessment<br>High flow oxygen<br>Large bore IV access<br>Invasive BP and CVP monitoring if possible<br>Maintain normothermia and avoid acidaemia<br>Warm IV fluids, use blood warmer and level 1 infuser<br>'Hypotensive resuscitation' until haemostasis achieved (in absence of head injury)<br>**Stop the bleeding**<br>Simple measures: Direct pressure / tourniquet if appropriate<br>Surgery<br>Interventional radiology<br>Endoscopic techniques | **Who is responsible for activation?**<br>Depends on the clinical situation – for subgroup suggestions<br>Toolkit should be designed to allow junior doctor, senior doctor or senior nurse / midwife to recognise major blood loss situation and activate pathway (incorporate use of EWS) |

| Stage of pathway | Sub group variation or hospital variation | Other management aspects | Communication |
|---|---|---|---|
| **Activation of pathway**<br>**Assemble emergency response team (consultant delivered care recommended)**<br>▪ Team leader<br>▪ Team roles:<br>▪ ABC (Airway, breathing, circulation)<br>▪ Sample taker / investigation organiser / documenter<br>▪ Communicator<br>▪ Transporter (may be member of clinical team or porter)<br>▪ Theatre team / other team members as required | How team is mobilised and who is in team may vary between clinical groups<br>Each subgroup to consider who should be notified and how<br><br>Remember to include: laboratory person, portering team, on call consultant haematologist / SpR, consider cell salvage operator (esp if obstetric, elective surgery, vascular emergency, major trauma in theatre) | Ongoing assessment and resuscitation | **Contact switch to coordinate emergency response team**:<br>'Major Haemorrhage'<br>'Location'<br>Specialty<br><br>Alert: emergency response team |

| Stage of pathway | Sub group variation or hospital variation | Other management aspects | Communication |
|---|---|---|---|
| **Decision on immediate blood requirements**<br><br>Team leader to decide on immediate blood requirements :<br><br>•immediate use O Neg<br>•30 – 60 mins Group Specific<br>•60-90 mins Crossmatched | Pathway should be populated locally with sites of O Neg storage and number of units available and realistic time for blood availability for group specific and crossmatched blood, depending on transit arrangements and lab time | **Resuscitation**: permissive hypotension, oxygenation, normothermia, correction of acidosis etc<br>**Turning off the tap**: surgery, radiological / endoscopic control<br>Cell salvage | **Communicate with lab** ext : (out of hours: )<br>Communication should only occur between the designated communicator and the BMS<br>•'**This relates to major haemorrhage situation'**<br>•Name, location and ext no.<br>•The patient's details: surname, first name, Patient ID number, DOB or gender / A+E number if unidentified<br>•Whether O Neg has been used and how much<br>•Order MHP Pack 1 ASAP – see below<br>•Request urgent investigations – see below |

| Stage of pathway | Sub group variation or hospital variation | Other management aspects | Communication |
|---|---|---|---|
| **Blood sampling and other tests**<br>U+E, FBC, Crossmatch, PT, APTT, Fibrinogen, ABG, Calcium, lactate<br>Other investigations | Subgroups – please populate with tests that are required | Resuscitation, permissive hypotension, oxygenation, normothermia, correction of acidosis etc<br>Turning off the tap: surgery, radiological / endoscopic control | Communication to lab that urgent samples are on their way – see above – need appropriate transport<br>Lab needs to phone results back to clinical area (to 'communication lead') |
| **Near patient testing**<br>TEG / ROTEM ./ near patient PT | Subgroups – please consider role in your specialty and hospital variation | | |
| **Choice of components**<br>Massive Haemorrhage pack one (MHP 1)<br>4 units red cells<br>4 FFP<br>1 dose platelets<br>(lab may order 2 doses of platelets on blue light) | Subgroups – are there any variations to MHP 1<br>Also consider variation between hospitals – if platelets in stock then may not need to order 2 packs up front | Use of calcium after 5 units red cells – specify drug dose and method of admin<br>Tranexamic acid (major trauma 1g over 10 mins followed by infusion of 1g over 8 hours), also has role in cardiac and vascular surgery<br>Cell salvage | Contact with lab to order MHP 1 ( in reality this is likely to be done earlier in pathway –see decision on immediate blood requirements)<br>Lab orders two doses of platelets and rings communication lead to let clinical team know when blood components are ready |
| **Paediatric version**<br>**Order MHP 1**<br>**Administer up to:**<br>Red cells 40 ml/kg<br>FFP 20 ml/kg<br>Platelets 10 ml/kg | | | |

**Paediatric Major Haemorrhage pack 1 (MHP 1) order these volumes, volumes for administration are detailed in the flow chart**

| Weight | Red cells | FFP | Platelets |
|---|---|---|---|
| < 5kg | 2 Paediatric Units (80-100ml) | 2 'neonatal' units of Methylene Blue (MB) treated FFP (100ml) | 1 paediatric pack of platelets (50ml) |
| 5 -10kg | 1 Adult unit (250ml) | 1 paediatric unit MB treated FFP (225ml) | 2 paediatric pack of platelets (100ml) |
| 10 – 20 kg | 2 Adult units (500ml) | 2 paediatric units MB treated FFP (450ml) | 1 Adult apheresis pack (200ml) |
| 20 – 40 kg | 4 Adult units (1000ml) | 4 paediatric units MB treated FFP (900ml) | 1 Adult apheresis pack (200ml) |

| Stage of pathway | Sub group variation or hospital variation | Other management aspects | Communication |
|---|---|---|---|
| **Repeat blood tests**<br>PT, APTT, fibrinogen, FBC, U+E, Ca, lactate<br>Near patient tests may be more timely in guiding therapy | Subgroups – please populate with tests that are required | Cell salvage if available and appropriate<br>Consider ratios of other products 1 unit of red cells = approximately 250 mls salvaged blood | Communication to lab that urgent samples are on their way – see above – need appropriate transport<br>Lab needs to phone results back to clinical area |
| **Target results to aim for in ongoing bleeding situation:**<br>**Suggested figures:**<br>Hb 10 g/dl<br>Platelets 75 x $10^9$/l<br>Fibrinogen > 1 g/l<br>PT ratio < 1.5<br>APTT ratio < 1.5 | Subgroup to refine suggested figures depending on clinical scenario:<br>Eg: ?fibrinogen >2g/l in obstetric haemorrhage; platelets > 100 x $10^9$/l in head injury | | |

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|---|---|---|---|
| If bleeding ongoing:<br>**Request MHP 2**<br>4 red cells<br>4 FFP<br>1 dose platelets ( will have already been ordered with MHP 1)<br>2 packs cryoprecipitate | Subgroups – are there any variations to MHP 2?<br>Also consider variation between hospitals | | Contact lab to order MHP 2 |
| **Paediatric version**<br>**Order MHP 2**<br>**Administer up to**:<br>Red cells 20 ml/kg<br>FFP 20 ml/kg<br>Platelets 10 ml/kg<br>Cryoprecipitate 10 ml/kg | | | |
| **Repeat blood tests**<br>PT, APTT, fibrinogen, FBC, U+E, Ca, lactate<br>Near patient tests may be more timely in guiding therapy | Subgroups – please populate with tests that are required | | Communication to lab that urgent samples are on their way – see above – need appropriate transport<br>Lab to phone results |

**Paediatric Major Haemorrhage pack 2 (MHP 2) order these volumes, volumes for administration are detailed in the flow chart**

| Weight | Red cells | FFP | Cryoprecipitate | Platelets |
|---|---|---|---|---|
| < 5 kg | 2 Paediatric Units (80-100ml) | 2 'neonatal' units of Methylene Blue (MB) treated FFP (100ml) | 1 single donor unit Mb treated (40ml) | 1 paediatric pack of platelets (50ml) |
| 5 – 10 kg | 1 Adult unit (250ml) | 1 paediatric unit MB treated FFP (225ml) | 2 single donor units (80ml) | 2 paediatric pack of platelets (100ml) |
| 10 – 20 kg | 2 Adult units (500ml) | 2 paediatric units MB treated FFP (450ml) | 1 pool (5 units) (200ml) | 1 Adult apheresis pack (200ml) |
| 20 – 40 kg | 4 Adult units (1000ml) | 4 paediatric units MB treated FFP (900ml) | 2 pools (10 units) (400ml) | 1 Adult apheresis pack (200ml) |



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|---|---|---|---|
| If still bleeding:<br>**Contact haematologist**<br>Consider PCC, fibrinogen concentrate**, rFVIIa*<br>Further red cells<br>Tailor blood product use according to coagulation results<br>*rFVIIa : use with caution according to local protocol where conventional measures to control bleeding have failed<br>**PCC and fibrinogen: further recommendations to be made as evidence becomes available | Subgroups – please populate with specific requirements for your speciality | | Communicate with haematologist<br><br>Haematologist to review results and make recommendations – via communication lead on team |
| **Additional haemostatic challenges:**<br>**Warfarin:** Check urgent INR, reverse anticoagulation with vitamin K 5-10mg IV and PCC according to local policy<br>**Aspirin / clopidogrel:** consider additional dose of platelets in each MHP, discuss alternative approaches with haematologist<br>**Unfractionated heparin / LMWH / coagulopathy:** discuss with haematologist | | **Storage and handling of blood components**<br>•Red cell transfusion should commence as soon as practicable after removal from cold storage<br>•Platelets must be kept at room temperature and given through a fresh giving set<br>•FFP and cryoprecipitate must be infused ASAP<br>•Please follow NW Transfer of Blood Policy if blood is to be / has been transferred with the patient to / from another Trust<br>•Staff must be familiar with local protocols to record fate of units | |

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| **Stand down**<br>Bleeding controlled<br>Mechanism for checking / replenishing stocks of O Neg in satellite fridges<br>Replenish laboratory stocks of red cells / FFP / cryo / platelets if appropriate | Subgroups: specify definition of controlled situation | **Complete documentation**<br>Record of / Timings of blood samples and communications, transfusion documentation, traceability documentation, recording of vital signs<br><br>Venous thromboprophylaxis should be commenced ASAP after bleeding controlled | Communicate with lab and transport staff etc that situation under control |
| **Audit**<br>Monitor appropriateness of pathway activation<br>Monitor blood supply, usage and wastage<br>Monitor patient outcome data<br>Review process and team structure<br>Develop test exercises, drills<br>Regular testing of initiation system | Consider how to test the pathway in different clinical scenarios | | Whose role is this? – transfusion lab sends team leader audit proforma on stand down<br>?HTT to coordinate?<br>Supervised and reviewed by RTC<br>An audit proforma has been designed as part of the RTC toolkit |
| **Incident reporting**<br>All incidents where there are delays or problems in the provision of blood in an emergency must be reported and investigated locally, and reported to the NPSA and the Serious Hazards of Transfusion (SHOT) scheme. | Consider who should create incident report<br>Describe method in local trust with recommendation of level of incident and timescale for incident management | | Communication of results of investigation to change practice – oversight of all incidents in HTC |

# NHSBT logistics



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

[redacted]

**2. Allocate team roles**

I. Team leader
II. Communicator – dedicated person for communication with other teams, especially the transfusion laboratory
III. Sample taker / investigation organiser / documenter
IV. Transporter - porter, member of team from clinical area) ,

[redacted]

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

U+E, FBC, Crossmatch, PT, APTT, Fibrinogen, ABG, Calcium, lactate

[redacted]

**4. Request blood / blood components – team leader should decide on use of:**

I. Emergency O Neg (immediate)

[redacted]

II. Group specific insert time to availability here
III. Crossmatch insert time to availability here
IV. Communication with lab: contact BMS

[redacted]

and inform them:

a. Your name, location and ext number
b. 'this relates to the major haemorrhage situation'
c. The patient's details ideally surname, forename, hospital number, DOB (insert acceptable details for unknown casualty here)
d. Whether O Neg has been used and how many units
e. Order major haemorrhage pack 1
f. Contact lab if blood has been transferred in with patient from another trust

**5. Transport samples to laboratory, BMS to ring back with results of urgent investigations and when blood / components are ready, collect blood and blood components from laboratory**

[redacted]ated

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

**7. Ensure documentation is complete**

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

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# Benefits of the process

- Good engagement between different specialities and disciplines
- Sharing of best practice from Trusts around the region
- Sense of ownership of the final document
- Good links between clinical users and NHSBT
- Group is small enough to reconvene to allow for regular updating of the document
- RTC will support regional audit

# References

# Subgroup membership

| Name | Position | Trust | Subgroup |
|---|---|---|---|
| Mike Desmond | Cardiac Anaesthetist | Liverpool Heart and Chest | cardiac surgery |
| Richard Williams | Cardiothoracic Surgeon | Liverpool Heart and Chest | cardiac surgery |
| Niall O'Keeffe | Cardiac Anaesthetist | Central Manchster | cardiac surgery |
| Kate Pendry | Consultant Haematologist | NHSBT / CMFT | communication and logisitics |
| Emma Milser | Transfusion Practitioner | SMUH | communication and logisitics |
| Tony Davies | Transfusion Liaison Practitioner | NHSBT | communication and logisitics |
| John Tappin | Consultant Haematologist | St Helens | communication and logistics |
| Simon Cunningham | Consultant Obstetrician | Leighton | communication and logistics |
| Eithne Hughes | Transfusion Practitioner | Glan Clwyd | communication and logistics |
| Christine McQullian | Transfusion Lab Manager | Aintree | communication and logistics |
| Tracey Scholes | Hospital Liaison Manager | NHSBT | communication and logistics |
| Gurvinder Banait | Consultant Gastroenterologist | WWL | gastrointestinal haemorrhage |
| Prasad Neeraj | Consultant Gastroenterologist | WWL | gastrointestinal haemorrhage |
| David Raw | Consultant Anaesthetist | Aintree | gen / vascular surgery |
| Dr Nagaraja | consultant anaesthetist | Aintree | gen / vascular surgery |
| **Oliver Hill** | Consultant Anaesthetist - Obstetric and Emergency | UHSM | gen / vascular surgery |
| Tushar Mahambrey | Consultant Anaesthetist / ICU | St Helens | gen / vascular surgery |
| Jane Uttley | Transfusion Lab Manager | Stockport | gen / vascular surgery |
| Winston de Mello | Consultant anaesthetist | UHSM | major trauma |
| Patrick Nee | Consultant A+E | St Helens | major trauma |
| Paul Wallman | Consultant A+E | Trafford | major trauma |
| Derek Pegg | Trauma and Orthopaedics | Leighton | major trauma |
| Andy Curran | Med Director | NW Ambulance | major trauma |
| Lilian Parry | Transfusion Lab Manager | St Helens | major trauma |
| Jackie McLennan | | Wythenshawe | major trauma |
| Clare Barnes | Consultant Haematologist | Bolton | near patient testing, haemostasis and laboratory |
| Emma Searle | SpR Haematology | NHSBT | near patient testing, haemostasis and laboratory |
| Sharran Grey | TLM/TP | Bolton | near patient testing, haemostasis and laboratory |
| Lynne Mannion | Transfusion Practitioner | Blackburn | near patient testing, haemostasis and laboratory |
| Sarah Haynes | Autologous Transfusion Coordinator | SMUH | NPT / or gen / vascular surgery / obs |
| Dr Jothilakshmi | Consultant Obstetrician | Pennine Acute | obstetric haemorrhage |
| David Burch | Consultant Obstetrician | Lancaster | obstetric haemorrhage |
| Veera Gudimetla | Consultant Obstetrician | Leighton | obstetric haemorrhage |
| Shanthi Pinto | Consultant Obstetrician | Leighton | obstetric haemorrhage |
| Teresa Kelly | Consultant Obstetrician | Salford Royal | obstetric haemorrhage |
| Shuba Mallaiah | Obstetric Anaesthetist | Liverpool Women's | obstetric haemorrhage |
| Stephen Gilligan | Consultant Anaesthetist / ICU | Blackburn | or gen / vascular surgery |
| Bimal Mehta | Consultant Paed Emergency Medicine | Alder Hey | paediatric |
| Richard Craig | Consultant Paediatric Anaesthetist | Alder Hey | paediatric |
| Denise Bonney | Paediatric Haematologist | RMCH | paediatric |
| Wendy Ogden | Transfusion Lab Manager | RMCH | paediatric |
| Srivedi Kuchi | Consultant Paediatric Anaesthetist | Alder Hey Children's Hospital | paediatric |
| Sonia Desilva | | St Helens | burns surgery |

# Steering Group membership

| Group | Name of lead |
|---|---|
| Communications and logisitics | Tony Davies |
| Near patient testing, haemostasis and lab issues | Clare Barnes |
| Obstetric haemorrhage | Shuba Malliah |
| Major Trauma | Winston de Mello |
| Major trauma | Tushar Mahambrey |
| Gastro intestinal haemorrhage | Gurvinder Banait |
| Paediatrics | Bimal Mehta |
| Paediatrics | Denise Bonney |
| Cardiac surgery | Mike Desmond |
| Gen vascular surgery | Dr Nagaraja |
| Gen vascular surgery | David Raw |
| A+E | Paul Wallman |
| Burns surgery | Sonia Desilva |
| | |
| Other members: | Sarah Haynes |
| | Kate Pendry |