Massive Transfusion Policy – including Trauma, Paediatrics and Obstetrics

Date | Version
--- | ---
March 2017 | 6.1

**Purpose**
This policy is designed to standardise and ensure safety in procedures for massive transfusion to all patients across Plymouth Hospitals NHS Trust including community hospitals that use the services of the PHNT Blood Bank.

**Who should read this document?**
All staff involved with any part of the transfusion process.

**Key messages**
Ensure a safe, appropriate and efficient transfusion service to all patients. That the massive haemorrhage policy is intended to supplement current Resuscitation guidelines and specialist policies. That the policy gives up to date and agreed standardisation on triggering a massive haemorrhage response. The massive haemorrhage event is controlled via an agreed algorithm/protocol that guides all parties. To consider alternatives to transfusion wherever possible.

**Accountabilities**

| Production | Specialist Practitioner of Transfusion. |
| Review and approval | Records and Information Governance Forum. |
| Ratification | Hospital Transfusion Committee. |
| Dissemination | Specialist Practitioner of Transfusion. |
| Compliance | Hospital Transfusion Committee. |

**Links to other policies and procedures**
Hospital Transfusion Policy.
Injectable Drug Administration Policy.
Policy for the Use of Intraoperative Cell Salvage.
Unidentified and Hospital Trauma Call patients policy

**Version History**
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1.1 August 2010 Final Version
2 June 2011 Reviewed and amended
3 March 2015 Reviewed and amended
4 September 2017 Reviewed and amended
5 November 2019 Extended to December 2019
6 February 2020 Extended to April 2020
6.1 August 2020 Extended to December 2020

**Last Approval** | **Due for Review**
--- | ---
September 2017 | Extended to December 2020

PHNT is committed to creating a fully inclusive and accessible service. Making equality and diversity an integral part of the business will enable us to enhance the services we deliver and better meet the needs of patients and staff.
We will treat people with dignity and respect, actively promote equality and diversity, and eliminate all forms of discrimination regardless of (but not limited to) age, disability, gender reassignment, race, religion or belief, sex, sexual orientation, marriage/civil partnership and pregnancy/maternity.

An electronic version of this document is available on the Trust Documents Network Share Folder (G:\TrustDocuments). Larger text, Braille and Audio versions can be made available upon request.
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### Abbreviations (NB: not all abbreviations are used in this document)

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<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>A&amp;E</td>
<td>Accident and Emergency now known as the Emergency Department (ED)</td>
</tr>
<tr>
<td>ABO</td>
<td>Blood Group System (A, B, AB and O)</td>
</tr>
<tr>
<td>ATD</td>
<td>Adult Therapeutic Dose</td>
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<tr>
<td>ATO</td>
<td>Assistant Technical Officer</td>
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<tr>
<td>ARDS</td>
<td>Acute Respiratory Distress Syndrome</td>
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<tr>
<td>BCSH</td>
<td>British Committee for Standards in Haematology</td>
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<tr>
<td>BMS</td>
<td>Bio-Medical Scientist</td>
</tr>
<tr>
<td>BNF</td>
<td>British National Formulary</td>
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<tr>
<td>BSQR</td>
<td>Blood Safety and Quality Regulations</td>
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<tr>
<td>CMV</td>
<td>Cytomegalovirus</td>
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<tr>
<td>CTS</td>
<td>Controlled Temperature Storage</td>
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<tr>
<td>CPD</td>
<td>Congenital Platelet Defect</td>
</tr>
<tr>
<td>DATIX</td>
<td>Software for Incident Reporting and Risk Management</td>
</tr>
<tr>
<td>DCL</td>
<td>Derriford Combined Laboratories</td>
</tr>
<tr>
<td>ED</td>
<td>Emergency Department (formerly the A&amp;E Dept or Casualty)</td>
</tr>
<tr>
<td>EDTA</td>
<td>Ethylenediaminetetraacetic acid</td>
</tr>
<tr>
<td>ESR</td>
<td>Electronic Staff Record</td>
</tr>
<tr>
<td>FBC</td>
<td>Full Blood Count</td>
</tr>
<tr>
<td>FFP</td>
<td>Fresh Frozen Plasma</td>
</tr>
<tr>
<td>HAS</td>
<td>Human Albumin Solution</td>
</tr>
<tr>
<td>HBV</td>
<td>Hepatitis B Virus (HepB)</td>
</tr>
<tr>
<td>HCA</td>
<td>Health Care Assistant</td>
</tr>
<tr>
<td>HCT</td>
<td>Haematocrit</td>
</tr>
<tr>
<td>HDN</td>
<td>Haemolytic Disease of the Newborn</td>
</tr>
<tr>
<td>HepA</td>
<td>Hepatitis A (also types HepB and HepC)</td>
</tr>
<tr>
<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
</tr>
<tr>
<td>HLA</td>
<td>Human Leukocyte Antigen</td>
</tr>
<tr>
<td>HSC</td>
<td>Health Service Circular</td>
</tr>
<tr>
<td>HTC</td>
<td>Hospital Transfusion Committee</td>
</tr>
<tr>
<td>HTP</td>
<td>Hospital Transfusion Policy</td>
</tr>
<tr>
<td>HTT</td>
<td>Hospital Transfusion Team</td>
</tr>
<tr>
<td>iCM</td>
<td>iSoft Clinical Manager (computer software for patient bar code labelling)</td>
</tr>
<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
</tr>
<tr>
<td>ID</td>
<td>Identification (of a patient or staff member)</td>
</tr>
<tr>
<td>IUT</td>
<td>Intrauterine Transfusion</td>
</tr>
<tr>
<td>MHRHA</td>
<td>Medicines and Healthcare Regulatory Authority</td>
</tr>
<tr>
<td>MSBOS</td>
<td>Maximum Surgical Blood Order Schedule</td>
</tr>
<tr>
<td>NA</td>
<td>Nursing Auxiliary</td>
</tr>
<tr>
<td>NAIT</td>
<td>Neonatal Alloimmune Thrombocytopenia</td>
</tr>
<tr>
<td>NCW</td>
<td>Non-Conforming Work report</td>
</tr>
<tr>
<td>NHS</td>
<td>National Health Service</td>
</tr>
<tr>
<td>NPSA</td>
<td>National Patient Safety Agency</td>
</tr>
<tr>
<td>NTC</td>
<td>National Transfusion Committee</td>
</tr>
<tr>
<td>ODA/P</td>
<td>Operating Department Assistant/Practitioner</td>
</tr>
<tr>
<td>OLM</td>
<td>Oracle Learning Manager</td>
</tr>
<tr>
<td>PHNT</td>
<td>Plymouth Hospitals NHS Trust</td>
</tr>
<tr>
<td>Q-Pulse</td>
<td>Quality and Improvement Management System (computer software)</td>
</tr>
<tr>
<td>RAADP</td>
<td>Routine Antenatal Anti-D Prophylaxis</td>
</tr>
<tr>
<td>RBC</td>
<td>Red Blood Cells</td>
</tr>
<tr>
<td>RES</td>
<td>Reticuloendothelial System</td>
</tr>
<tr>
<td>PSEs</td>
<td>Potentially Sensitising Events</td>
</tr>
<tr>
<td>RTC</td>
<td>Regional Transfusion Service</td>
</tr>
<tr>
<td>SABRE</td>
<td>Serious Adverse Blood Related Events</td>
</tr>
<tr>
<td>SHOT</td>
<td>Serious Hazards of Transfusion</td>
</tr>
<tr>
<td>SLA</td>
<td>Service Level Agreement</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
</tr>
<tr>
<td>SPOT</td>
<td>Specialist Practitioner of Transfusion</td>
</tr>
<tr>
<td>TP</td>
<td>Transfusion Practitioner</td>
</tr>
<tr>
<td>TRALI</td>
<td>Transfusion Related Lung Injury</td>
</tr>
<tr>
<td>UKNEQAS</td>
<td>UK National External Quality Assessment Scheme</td>
</tr>
<tr>
<td>vCJD</td>
<td>Variant Creutzfeldt-Jakob Disease</td>
</tr>
<tr>
<td>WI</td>
<td>Written Instruction (term used to ‘prescribe’ blood and blood products)</td>
</tr>
</tbody>
</table>
1. Policy statement

Equality impact Statement

PHNT is committed to creating a fully inclusive and accessible service. By making equality and diversity an integral part of the business, it will enable us to enhance the services we deliver and better meet the needs of patients and staff.

We will treat people with dignity and respect, promote equality and diversity, and eliminate all forms of discrimination regardless of (but not limited to) race, nationality, gender, disability, age, sexuality, religion or belief, and/or family status.

General considerations

This policy is designed to standardise and ensure safety in procedures for massive transfusion to all patients across Plymouth Hospitals NHS Trust.

The recommendations are based on perceived current best practice that is subject to change.

Employees will be made aware of this policy and procedure via their manager, staff handbook, corporate induction and transfusion education workbook and assessments.
2. Aims and objectives

The aims and objectives of this policy are to:

- Ensure a safe, appropriate and efficient transfusion service to all patients.
- That the massive haemorrhage policy is intended to supplement current Resuscitation guidelines and specialist policies.
- That the policy gives up to date and agreed standardisation on triggering a massive haemorrhage response.
- The massive haemorrhage event is controlled via an agreed algorithm/protocol that guides all parties.
- To consider alternatives to transfusion wherever possible.

This policy will be reviewed every 2 years (unless required sooner) by the Hospital Transfusion Committee (HTC).

Process for monitoring compliance

Every massive transfusion event notified to the blood bank will be audited. These audits will then be subject to scrutiny by the Hospital Transfusion Committee at its next quarterly meeting as recommended by the Rapid Response Report NPSA/2010/017.

Effectiveness is also measured within the clinical risk system.

All transfusion related incidents and ‘near misses’ are reported (locally to Q-Pulse and Datix and nationally to SHOT and the MHRA) and investigated by the transfusion team.
3. Definitions

The management of massive haemorrhage is only one component of the management of a critically unwell patient. The massive transfusion policy is intended to supplement current resuscitation guidelines and specialist policies.

**Critical bleeding**
- This can be a major haemorrhage that is life threatening and is likely to result in the need for massive transfusion.
- This can be haemorrhage of a smaller volume in a critical area or organ, i.e. intracranial, intraspinal or intraocular.

**Massive haemorrhage**
Massive blood loss can be defined as the loss of one blood volume within a 24 hour period, normal adult blood volume being approximately 7% of ideal body weight, 8% to 9% in children.

An alternative definition is 50% blood volume loss within 3 hours, or a rate of loss of 150ml per minute.

Both definitions emphasise the importance of early recognition of major blood loss and the need for effective action to prevent shock and its consequences.

The nature of the injury will usually alert clinical staff to the probability of massive haemorrhage.

In children massive transfusion may be defined as a transfusion of more than 40ml blood/kg. The normal blood volume of a child is approximately 80ml/kg

**Therapeutic Goals**
The restoration of an adequate blood volume, to maintain tissue perfusion and oxygenation.

Achieve haemodynamic stability.

Minimise blood loss and achieve haemostasis by;
- rapid control of bleeding
- correcting coagulopathy by judicious use of blood component therapy
- interventional radiography
4 Consent

Patients presenting with a massive haemorrhage will do so in a variety of ways. As a result of trauma, as a result of underlying medical conditions i.e. pregnancy, oesophageal varices. They may be children or adults and have communication difficulties i.e. deafness blindness. Patients may be conscious or unconscious or somewhere in between.

Some patients mostly in-patients we will know a lot about and will have information that will guide treatment in the event of a major haemorrhage.

Each massive haemorrhage event is different but we must be aware that consent is an important concern that needs to be considered at some time in the process.

Gaining consent for treatment before the treatment happens is the ideal however this is not always possible for patients coming into the Emergency Department for example but staff may be made aware of a patients beliefs by a relative or friend accompanying the patient.

Jehovah’s Witness’s

A patient who is a Jehovah’s Witness may carry an ‘Advance Directive’ indicating their wishes in various clinical circumstances. This is not exclusive to the Jehovah’s Witness patient and may be held by any patient.

It is important that once this has been declared or discovered that it is acted upon and not ignored. (For further advice, please see Refusal of Blood/Blood Products Policy.)
5 Pregnancy and children

Critical bleeding in pregnancy

Obstetric haemorrhage including postpartum haemorrhage can rapidly become life threatening and require massive transfusion.

There is a potential for concealed haemorrhage and early development of disseminated intravascular coagulation (DIC).

Critical bleeding in children

Between children and adults there are key differences to consider;
- Blood volume
- Ability to tolerate blood loss
- Age appropriate haemoglobin
- Haematocrit levels

In children a massive transfusion may be defined as a transfusion of more than 40mls of blood/kg. The normal blood volume of a child is approximately 80mls/kg.
Assess your patient and recognise their communication needs. Patients that are deaf, blind, non-English speaking, have learning difficulties or mental health issues, may require the resources of the Trusts Interpretation and Translation Service. Contact Patient Services Department on ☎55136 or ☎01752 245136.

Please note that phone calls to the Blood Bank Laboratory are now recorded.

Introduction

In order to prevent hypovolemic shock and its consequences, recognising major blood loss very early and taking effective action promptly is vital. The critical nature of the situation may lead to tension between those treating the patient and those supplying blood and providing laboratory services (British Committee for Standards in Haematology 2006). Efficient communication is paramount for effective management and good outcomes. (NPSA/2010/Rapid Response Report 017)

It is necessary to find a balance between the need to access blood components as rapidly as possible in cases of urgent need and rigorous procedures very legitimately aimed at avoiding unnecessary use of blood components and wastage and ensure patient safety.

In the event of a massive haemorrhage the systems in place to ensure the rapid provision of blood and components can fail due to misunderstandings at every point in the process. The Rapid Response Report October 2010 cites a number of known incidents where this has happened.

The protocols should be accessible in all relevant clinical and laboratory areas. Staff working in these areas must become familiar with them.

Contact Information

In the event of a massive haemorrhage, Blood Bank should be contacted on the hotline number ☎52828 during working hours 0800 – 1730. Outside these hours and on weekends and bank holidays use bleep 0871.

During out of hours, weekends and bank holidays DO NOT PHONE, staff may not necessarily be in earshot of the blood bank laboratory phone. At these times always use the bleep 0871.
Protocol activation

There is a clear and unambiguous phrase that activates the massive transfusion protocol. When you phone 52828 or have bleeped 0871 you must follow the protocol activation as described in the section as below;

Massive Transfusion Protocol

1. Ring Blood Bank Hotline on 52828 during hours 0800 – 1730, Between 1730 – 0800 bleep 0871, (DO NOT PHONE as staff not necessarily in earshot of laboratory phone)

2. Say to the laboratory, “I want to trigger the Massive Transfusion protocol”. You will be asked to state your location and patient name (if known). You will also be requested to provide the name and contact number of your team coordinator for the duration of this activation of the protocol.

3. Any future communication during this time should be preceded by, “this call relates to the massive transfusion in …………….(state clinical area)

4. Arrange delivery, by hand to the Blood Bank, a blood sample in pink sample tube with Blood Transfusion Request Form.

You may be asked to provide the patient details if they are available. There may be more than one massive transfusion event under way that the laboratory is dealing with in the Trust and it is vital that any communications to the lab clearly identifies the name (if available) of the patient and ward or department.

The Emergency Department may receive advance warning of a major haemorrhage on its way to the ED and will give the Blood Bank lab advance warning also.

The activation of the Massive Transfusion Protocol, Trauma Transfusion Protocol and Obstetric Transfusion Protocol will determine how the laboratory staff will respond. On triggering the protocol the laboratory staffs prioritises availability of product.

The auditing of each massive transfusion event will enable the members of the Hospital Transfusion Committee to ensure that it is appropriately triggered and give the lab staff confidence that each event is a properly considered as a potential or actual massive transfusion thereby keeping wastage to a minimum.

Any wastage of blood or blood product will be investigated as part of the audit.
Clinical team attending the patient
The NPSA made a number of points about how the massive transfusion event should be managed. It is for each area to manage these events according to their own requirements but the following should be considered;

- Nominate a team lead for each event.
- Nominate one person to make and take all calls during the event.
- Designate an individual (usually a porter) to transport samples to the lab and to collect product from the labs.

Patient samples
Blood samples need to be labelled correctly to prevent delays in treatment.

SHOT highlighted a particular confusion around the term ‘crossmatch’. Clinicians frequently use the word without realising that they are requesting a time consuming procedure which is not optimal in an emergency. This emphasises the need for essential information to be communicated effectively.

Miss-labelling of samples prevents the blood bank laboratory from being able to provide the product required. Having to resampling a patient and providing the correctly completed documentation will lead to delays in the patient receiving blood products (not emergency blood).

The Blood Bank in Derriford deals with samples from a great many sources and may not be dealing with just one urgent event but a number of them at the same time.

In the case of major haemorrhage in the patient with no or insufficient venous access, it may be necessary to insert an intraosseal needle, as an interim emergency measure to administer drugs, fluids and Blood/Blood Products.

Samples obtained via an intraosseal route are not suitable for routine processing and must be clearly identified as an Intraosseal sample (IO).

Certain laboratory tests may be performed on IO samples: Please refer to the use of Intraosseous blood samples for laboratory analysis 2017.

Training
Regular training and drills will improve awareness and confidence and ensure that the massive transfusion process works efficiently.

These need to be carried out regularly due to staff turnover and to educate and train as many staff as possible.
7 Patient Identification

Patient details can be taken over the phone by the blood bank laboratory staff but will need to be backed up by production of the necessary forms before product issue (except O Neg emergency blood).

Except for Emergency O Neg and Emergency O Pos (where applicable) RBC’s and AB Platelets, all other issues require the blood bank to know the patient ID.

If the patient details are not immediately available then the ‘Unidentified and Hospital Trauma Patients policy’ must be used. This allows the Emergency Department an immediate and effective means with which to safely identify a patient against which product can be issued.

If any of the four points of a patient’s identity are unknown the Unidentified and Hospital Trauma Patients Policy must be applied. Having any three points of identity is insufficient; you must have all four.

Note of caution:

Once the Unidentified Patient Policy has been used should the patient’s actual identity become known it is important that the unknown patient ID continues to be used.

If blood results and/or blood product are issued against the Unknown Patient ID and then the actual patient ID starts to be used, all samples must be repeated before any more blood product can be issued.

The Unidentified Patient ID and the actual patient ID will be seen as separate patients until records can be formally merged by the hospital Merge team.

Please refer to the Standard Operating Procedure for the safe management and treatment of Unidentified and Hospital Trauma Patients, for further information.
8 Patients with massive haemorrhage

In adult patients with massive haemorrhage the haemoglobin concentration (Hb) is a poor indicator of acute blood loss and empirical decisions about the immediate use of red cell transfusion are required by clinicians experienced in resuscitation.

In a child, if there has been on-going severe bleeding (overt/covert) and they have received 20 ml/kg red cells or 40 ml/kg of any fluid for resuscitation in preceding hour or if there are signs of hypovolemic shock and/or coagulopathy, the massive haemorrhage protocol should be activated.

Patient assessment
If the patient is conscious, talking and a peripheral pulse is present, the blood pressure is adequate.

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. In the initial phase following trauma (without brain injury), target systolic blood pressure of 80-100mHg is recommended until major bleeding has been stopped.

Heart rate, blood pressure and urine output are useful but non-reliable parameters for the initial assessment of blood loss.

A heart rate >100 BPM or a decrease in urine output are probably the earliest signs of hypovolemia and can be detected with blood loss around 15% (750mls in a 70 kg person).

Systolic blood pressure below 90 mmHg generally suggests a greater blood loss of approximately 20 – 30% of blood volume, but it should be remembered that some patients compensate well and maintain an adequate blood pressure despite significant blood loss.

The clinical symptoms of shock are:-

- Mental status/level of consciousness (cerebral perfusion) – agitation, confusion, drowsiness or lethargy
- Peripheral perfusion – cold and clammy skin, delayed capillary refill time, tachycardia
- Renal perfusion – urine output <0.5 ml/kg/hour

Look for obvious blood loss (on clothes, floor, in wound drains) and injury patterns.

Haemostatic tests and FBC should be repeated after each therapeutic intervention, and at least every hour if bleeding is on-going, so that trends can be observed and adequacy of replacement therapy documented.

ABG can indicate lactate levels and base deficit represents highly sensitive parameters for recognition of metabolic acidosis.
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.

Surgery must be considered early.

An intensive care bed is likely to be required and early warning of this is advisable.

There should be on-going monitoring of vital signs, coagulation, Hb and ABG’s, together with observation of wound drainage to identify overt or covert bleeding.

Venous Thromboprophylaxis

Given the risk of thromboembolic complications, the use of pro-coagulant measures should be ceased once haemostasis has been achieved.

Standard venous thromboprophylaxis should be commenced as soon as possible after bleeding has been controlled, as patients rapidly develop a prothrombotic state. Please refer to the Venous Thromboprophylaxis Policy.

Patients who do not accept or refuse transfusions

Every patient has a right to be treated with respect, and staff must be sensitive to their individual needs, acknowledging their values, beliefs and cultural background.

The priority for a patient undergoing a massive haemorrhage is to treat appropriately.

Clinical practitioners must be aware of Jehovah’s Witness patients’ beliefs in relation to receiving blood or blood products and of the non-blood, medical alternatives to transfusion that may be applicable.

Jehovah’s Witnesses may carry an Advance Medical Directive which directs that no allogeneic blood be administered under any circumstances. In carrying this legal directive Witnesses are simply choosing non-blood medical treatment, and their choice must be respected.

It is essential that any agreement to preserve total clinical confidentiality is strictly honoured.

For further advice, please see Refusal of Blood/Blood Products Policy
Coagulation Problems of Massive Haemorrhage
The haemostatic defect in massive haemorrhage will vary, depending on the amount and cause of bleeding and underlying patient-related factors.

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

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 FFP and platelets.

Dilutional coagulopathy should be prevented by early infusion of FFP.

Consumptive coagulopathy
During traumatic, surgical, and obstetric haemorrhage, as well as blood loss depleting blood components, massive tissue factor exposure may result in intensive early fibrin clot formation. This activation of coagulation factors and subsequent fibrinolysis will consume and deplete haemostatic factors.

These patients are liable to develop haemostatic failure without significant dilution. Consumption is commonly seen in obstetric haemorrhage, particularly placental abruption and amniotic fluid embolus, in patients on cardiopulmonary bypass (CPD), following massive trauma especially involving head injury, and in sepsis.

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

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

Hyperfibrinolysis
This is particularly associated with obstetric haemorrhage, CPD and liver surgery.

Anticoagulant drugs
Warfarin should be reversed with a Prothrombin Complex Concentrate (PCC) and intravenous vitamin K (5-10mg). The dose is dependent on the INR.

Unfractionated heparin can be reversed with protamine sulphate. Usual reversal is by infusing either 25 or 50 mg of IV protamine sulphate (1 mg protamine sulphate reverses 100 iu heparin). Excessive doses of protamine can however induce a coagulopathy.

Low molecular weight heparin can be partially reversed with protamine sulphate.
Direct factor Xa inhibitors, e.g. Fondaparinux, Rivaroxaban, Apixaban, Edoxaban cannot currently be reversed.

The Direct thrombin inhibitor, Dabigatran (Pradaxa) may be reversed by Idarucizumab (trade name: Praxbind)

For further information, including advice about direct acting oral anticoagulants and glycoprotein 2B/3A antagonists please refer to the Anticoagulation Policy on Trust net.

Aspirin and P2Y12 antagonists (Clopidogrel).
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 is only partially reversed by platelets.

Inherited bleeding disorders
It is very likely that patients with an inherited bleeding disorder will be registered with the haemophilia centre and urgent advice (from the on-call haematologist) should be sought if they present with massive haemorrhage.

Liver disease
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, where blood loss is less than one blood volume. Patients with liver disease are at risk of both increased bleeding and thrombosis despite prolonged laboratory clotting times (PT and APTT)

Hypothermia and metabolic acidosis
Haemostasis is strongly influenced by body temperature, and hypothermia is associated with increased risk of severe bleeding.

In hypothermia, a coagulation screen, which is performed at 37°C, will underestimate the extent of any coagulopathy.

The effects of hypothermia include altered platelet function, impaired platelet function (a 1°C drop in temperature is associated with a 10% drop in platelet function), enzyme inhibition and fibrinolysis.

Furthermore coagulation disorders are aggravated by acidosis. Metabolic acidosis due to high lactate levels usually reflects the degree of tissue hypoxia.

These factors combine to form a vicious cycle. If the lethal triad of hypothermia, acidosis and coagulopathy are present, surgical control of bleeding alone is unlikely to be successful and disseminated intravascular coagulation (DIC) may occur and mortality rates are high.
9 Laboratory Investigations

Laboratory testing
Patient management should be guided by laboratory results and near patient testing, but led by clinical status.

When dealing with an evolving process it is important to check haemostatic parameters at least hourly, and after each therapeutic intervention, to monitor the need for and the efficacy of component therapy.

Although it is important to monitor laboratory test results frequently during massive transfusion, the administration of blood/components should not wait for these tests.

Advice should be sought from a haematology consultant with transfusion expertise regarding appropriate investigations, their interpretation and optimum corrective therapy.

Appropriate use of near-patient testing devices, including TEG and ROTEM can offer rapid data to guide component therapy, but requires expert interpretation.

Interpretation of laboratory results
A fibrinogen <1.5g/l or APTTT >1.5 times normal represents established haemostatic failure and is predictive of microvascular bleeding.

Early infusion of FFP should be used to prevent this occurring if a senior clinician anticipates a massive haemorrhage.

Clauss fibrinogen measurement should be specifically requested as early as possible during massive haemorrhage situation.

The fibrinogen level is more sensitive than the PT and APTT to a developing dilutional or consumptive coagulopathy. Levels below 1g/l, in the context of massive haemorrhage, are usually insufficient, and emerging evidence suggests that a level above 1.5g/l is required. Higher levels are likely to improve haemostasis further. The normal range is between 1.5 and 4.5g/l.

A platelet count below 50 x 10^9/l is strongly associated with haemostatic compromise and microvascular bleeding in a patient with 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 the PT ratio to within 1.5 of normal; 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 time’s normal as the minimum target.

**Management of haemostasis**

The indication for use of FFP in massive transfusion with significant bleeding is a fibrinogen <1.5 g/l or PT/APTT >1.5 above normal.

In the context of massive haemorrhage, patients with widespread microvascular oozing or coagulation tests that demonstrate inadequate haemostasis should be given FFP in doses likely to correct the coagulation factor deficiencies. This will require more than 15ml/kg, and at least 30 ml/kg would be a reasonable first-line response.

A minimum target platelet count of $75 \times 10^9/l$ is appropriate in massive haemorrhage, to provide a margin of safety to ensure that the level does not fall below that critical for haemostasis.

A higher platelet target level of $100 \times 10^9/l$ is recommended for patients with high velocity trauma, eye or central nervous system injury.

The platelet count should be checked 10-15 minutes after platelet infusion to ensure the adequacy of therapy.

A poor platelet increment of less than $20 \times 10^9/l$ after 15 minutes may be indicative of antiplatelet antibodies, usually human leucocyte antigen (HLA) antibodies.

Cryoprecipitate should be considered, if fibrinogen levels remain critically low in spite of administration of FFP, and the patient is bleeding.

The requirement for cryoprecipitate is varied depending upon the source of the massive haemorrhage.

Cryoprecipitate should be administered in Obstetric Haemorrhage cases where the Fibrinogen level is <2.0g/l

Cryoprecipitate should be administered in Traumatic and general Haemorrhage cases where the Fibrinogen level is <1.5g/l

A typical adult dose of cryoprecipitate is two five-donor pools (equivalent to 10 single donor units), containing 3-6 g fibrinogen in a volume of 200 – 500 ml.

One such treatment administered to an adult would typically raise the plasma fibrinogen by approximately 1g/l.

1:1:1 red cell: FFP: platelet regimens, as used by the military, are not routinely recommended in massive haemorrhage.
10 Blood Components

Emergency Blood
Group O RhD negative is the blood group of choice for transfusion of red cells in an emergency where the clinical need is immediate and patient blood group is unknown.

However, overdependence on group O RhD negative red cells is may have an adverse impact on local and national blood stock management.

It is acceptable to give group O Rh positive red cells to males and postmenopausal females of unknown blood group.

Premenopausal females, whose blood group is unknown, should be given group O Rh negative red cells in order to avoid sensitisation and the risk of haemolytic disease in the new-born.

Women who are Rh D negative and of childbearing age, who are resuscitated with RhD positive blood or platelets, can develop immune anti-D, which may cause haemolytic disease of the new-born in subsequent pregnancies.

To prevent this, a combination of exchange transfusion and anti-D can be administered, on the advice of a haematologist, within 72 hours of the transfusion.

Group Specific Blood
In the emergency situation, clinical staff should endeavour to provide immediate blood samples for grouping in order to allow the use of group specific blood.

Group specific red blood cells should be given at the earliest opportunity as O Rh D negative blood is a scarce resource.

In the emergency situation, blood can be issued following identification of group without knowing the result of an antibody screen – ‘group specific blood’. Blood group determination takes less than 10 minutes, so it should not be necessary to give large volumes of group O Rh D negative blood.

The use of group specific blood is a higher risk strategy and depends on the urgency for blood. In massive bleeding, patients will have minimal circulating antibodies, so will usually accept group specific blood without reaction. Antibodies may develop at a later stage.

Platelets
1 ATD of platelets (either 1 platelet apheresis concentrate or 6 pooled buffy coats) will increase the platelet count by 50 x 10⁹/l

Specific platelet giving sets are available from the Blood Bank. They reduce wastage as they have less dead space.

Transfusion of platelets through a giving set previously used for red cells is not recommended, as one that has previously been used for red cells may cause the platelets to stick to the red cells and therefore reduce the effective transfused platelet dose.
Stock management of labile components, such as platelets, when there is unpredictable demand, is a challenge. Large stock-holding is associated with wastage, whereas insufficient stocks may lead to clinical disaster. Clinical staff should be aware that platelets may need to be ordered from National Blood Service (NBS) which may cause a delay in their provision.

A transfusion of platelets should be commenced as soon as possible after they are received. If there is any delay in transfusion, platelets should be returned to blood bank. Platelets must not be refrigerated.

<table>
<thead>
<tr>
<th>Product</th>
<th>Indication and target levels</th>
<th>Dose</th>
</tr>
</thead>
</table>
| Platelet concentrate   | • Platelet count is unlikely to fall below a critical level of 50 x 10^{9}/l until 1.5-2.5 blood volumes have been replaced.  
                         | • Count should be maintained above 75 x 10^{9}/l.                                           | • Adult therapeutic dose will increase the platelet count by 50 x 10^{9}/l.  
                         | • In multiple or CNS trauma above 100 x 10^{9}/l.                                           | • If bleeding continues, monitor the platelet count as further transfusion may be needed to maintain target count. |

**Fresh Frozen Plasma (FFP)**

Early treatment with thawed FFP is recommended in patients with massive bleeding. FFP is stored at -37°C and it takes 30 minutes to defrost FFP ready for use.

It is crucial that the Blood Bank is informed as soon as possible of a massive haemorrhage, so that this defrosting process can begin.

A transfusion of FFP should be commenced as soon as possible after the product is received. If FFP is not transfused within 4 hours, it should be returned to blood bank.

**Methylene Blue treated FFP**

Methylene Blue treated Fresh frozen plasma is a single donor pathogen reduced component. The methylene blue process inactivates encapsulated viruses and bacteria. The Methylene blue process is used to treat packs of FFP imported from low vCJD risk countries. This is the product preferred by paediatricians and neonatologists.

In March 2012, the Advisory committee on the Safety of Blood, Tissues and Organs (SaBTO) recommended that the cohort of people born on or after the 1st January 1996 continue to receive imported plasma (Methylene Blue treated FFP or Octoplas LG). These individuals are accepted as being at a lower risk of developing vCJD as they are not likely to have been exposed to BSE through the food chain.
**Octoplas LG**

Solvent detergent treated FFP is prepared from pools of plasma (multiple donations). The pooling process leads to more standardised concentrations of clotting factors in each unit. The Solvent detergent process inactivates bacteria and most encapsulated viruses (including Hepatitis B and C and HIV). Octoplas LG is used when the date of birth of patient cannot be confirmed i.e. if the patient is classified as “unknown” and the “Unidentified patient policy has been activated by ED.

**Cryoprecipitate**

Cryoprecipitate is a concentrated source of fibrinogen and also contains factor VIII, factor VIII and von Willebrand factor.

10 units of cryoprecipitate will increase the plasma fibrinogen level by approximately 1.0g/l.

Although ABO blood group compatibility is not required with cryoprecipitate, it is preferred because of the 10-20 mls of plasma in each unit.

**Prothrombin Complex Concentrate (PCC)**

PCC contains factors II, VII, IX and X, but not factors V or VIII.

The main indication for PCC is warfarin overdose, where there is life – threatening bleeding.

Dose of PCC is 25 – 50 units/kg plus vitamin K 1 -5 mg IV. The dose is dependent on the requirement for continuing anticoagulation and INR.

<table>
<thead>
<tr>
<th>INR</th>
<th>Dose of PCC (iu/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 - 2.5</td>
<td>25</td>
</tr>
<tr>
<td>2.5-3.0</td>
<td>32</td>
</tr>
<tr>
<td>3.0-3.5</td>
<td>40</td>
</tr>
<tr>
<td>&gt;3.5</td>
<td>50</td>
</tr>
</tbody>
</table>

*Single dose must not exceed 3000iu*

If PCC is not available, a similar effect can be produced with an FFP dose of 15-20ml/kg.
**Paediatric components**

Many of the general principles outlined equally apply to when those situations occur in children. Donor exposure should be minimised by using paediatric components where possible.

Paediatric blood component volumes for infants and children.

<table>
<thead>
<tr>
<th>Component</th>
<th>Volume (administer up to:)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red cell concentrates</td>
<td>Vol (ml) = 10-20ml/kg or Vol (ml) = desired Hb rise (g/L) x wt (kg) x 3</td>
</tr>
<tr>
<td>Platelets</td>
<td>Children &lt; 15 kg (10-20 ml/kg)</td>
</tr>
<tr>
<td></td>
<td>Children &gt; 15 kg (1 adult bag)</td>
</tr>
<tr>
<td>FFP (MB treated only)</td>
<td>10 – 20 ml/kg</td>
</tr>
<tr>
<td>Cryoprecipitate</td>
<td>5 – 10 mls/kg (usually max 10 units - approx. 300 ml)</td>
</tr>
</tbody>
</table>

The rate of administration will depend on the child’s weight and the rate of blood loss.
11 Logistics of blood supply

Patient Identification
Positive patient identification is essential at all stages of the blood transfusion process and the patient should always have an identity band in situ. The healthcare professional administering the blood component must perform the final administrative check with another registered practitioner at the patient's bedside for every component given. Apply Unidentified and Hospital Trauma Patient Policy, if any of the four points of patient identity are missing.

Blood Storage
Cold chain requirements have become UK law under BSQR 2005.

Red blood cells should be transfused within 4 hours of leaving a blood fridge. Blood issued cannot be returned to the blood fridge if it has been out of temperature control for more than 30 minutes.

Traceability
It is a statutory requirement where the ‘fate’ of all blood components must be accounted for. These records must be held for 30 years. Staff must record all blood use in the clinical notes.

When emergency blood is used Blood Bank should be informed immediately and details of which patient has received the emergency blood should be returned to Blood Bank.

All empty bags should be returned to Blood Bank within 24 hours of use with blue traceability labels completed in full (red traceability labels to be entered into patient’s clinical records on designated Transfusion clinical record sheet (Appendix 5)

Blood shortages
National demand for blood components may exceed supply. National blood shortage plans will be activated in the event of red cell and platelet shortages. Guidance is given for the prioritisation of patient groups during shortage.

The transfusion support during massive haemorrhage is a priority. However it is expected that all efforts be made to stop the bleeding and reduce the need for donor blood.
12 Risks of Massive Transfusion

Wrong blood
Frequently reported adverse event associated with blood transfusion is giving the wrong blood to the patient, which may result in a fatal haemolytic transfusion reaction. The Serious Hazards of Transfusion (SHOT) organisation suggests that the risk of error may be particularly high in an emergency situation.

It is therefore essential that the protocol for administration of blood and blood products in the Hospital Transfusion Policy are adhered to whatever the degree of urgency.

Transfusion Reactions
The risks of a transfusion reaction, such as acute transfusion reaction (ATR), transfusion transmitted infection (TTI), delayed transfusion reaction (DTR), or transfusion related acute lung injury (TRALI) are small compared with the mortality of this patient group.

Hypocalcaemia
High infusion rates of products containing citrate can decrease calcium concentrations, particularly in patients with hypothermia or liver failure (who are unable to metabolise citrate). FFP and platelets contain high citrate concentrations. Therefore serum calcium levels must be monitored during massive transfusion.

Calcium chloride should be administered during massive transfusion if ionised calcium levels are low or electrocardiograph (ECG) suggests hypocalcaemia. The recommended dose is 10mls of 10% calcium chloride IV.

Hyperkalaemia
Hyperkalaemia may occur, due to the high extracellular potassium concentration in stored red cell units.

This may be compounded by oliguria associated with shock.

If > 6 mmol/l, refer to the hospital policy for the treatment of raised potassium levels.

Early haemofiltration is likely to be required after arrest of bleeding in the most severe cases.

Hypomagnesaemia
Hypomagnesaemia is often associated with massively transfused patients and will need monitoring and correction.

For the treatment of hypomagnesaemia (<0.6 mmols/l)
Give 2g (8 mmols Mg2+) over 30 minutes or 5g (20 mmols Mg2+) over 1 hour IV.

Acid base disturbances.
Transfused citrate will produce an alkalosis once it is metabolised.
**Disseminated Intravascular Coagulation (DIC)**
This is a disorder resulting from inappropriate excessive activation of the haemostatic system. It may be manifested by both thrombotic and haemorrhagic pathology.

The main trigger for DIC is the exposure of blood to a source of tissue factor (TF) that initiates coagulation, for example from sepsis, tissue injury or malignant cells.

A consequence of coagulation activation is thrombin generation and fibrin formation, which may result in micro thrombus formation.

Due to on-going activation of coagulation, there is a reduction in levels of nearly all clotting factors, and thrombocytopenia develops. When combined with fibrinolysis and the generation of fibrin degradation products, this results in the generalised and continued bleeding that is characteristic of DIC.

Management includes dealing with the trigger, and giving replacement therapy.

**Transfusion Related Acute Lung Injury (TRALI)**

TRALI is a serious complication of blood transfusion which is thought to arise as a result of the interaction of specific leucocyte antibodies with leucocytes in most cases. TRALI has been reported to occur after transfusion of all the following blood components; red blood cells, plasma, platelets and cryoprecipitate.

Patients present with dyspnoea, hypoxia and symptoms and signs of pulmonary oedema. Diagnosis is made on clinical grounds, which may later be supported by demonstrating the presence of donor leucocyte antibodies.

**Transfusion Associated Circulatory Overload (TACO)**

TACO is a serious but under-recognised complication of blood transfusion.

TACO is currently defined as having any 4 of the following signs/symptoms within 6 hours of transfusion

- Acute respiratory distress
- Tachycardia
- Increased blood pressure
- Acute or worsening pulmonary oedema
- Evidence of positive fluid balance

TACO can be associated with rapid or massive transfusion of blood/Blood products, especially in patients with diminished cardiac function or chronic anaemia. Patients over the age of 60 years of age, infants and those with severe anemia, are particularly susceptible.
13 Pharmacological Agents

Antifibrinolytics
Fibrinolysis is the process whereby established fibrin clot is broken down. This can occur in an accelerated fashion, destabilising effective coagulation in massive haemorrhage situations, including multiple trauma, obstetric haemorrhage and major organ surgery, including transplant surgery.

Accelerated fibrinolysis can be identified by laboratory assay of d-dimers or fibrinogen degradation products, or by the use of near patient coagulation testing monitors such as TEG or ROTEM.

Tranexamic acid (TXA)
Tranexamic acid inhibits plasminogen activation, and at high concentration inhibits plasmin, which inhibits fibrinolysis. It should be used in clinical situations where increased fibrinolysis can be anticipated, such as, acute severe trauma.

There is strong evidence that the effect of tranexamic acid on death due to bleeding varied according to the time from injury to treatment. Early treatment (<1 hour from injury) significantly reduced the risk of death due to bleeding events. Treatment between 1 – 3 hours also reduced the risk of death due to bleeding. However treatment with tranexamic acid given after 3 hours may significantly increase the risk of death due to bleeding.

Therefore tranexamic acid should be given as early as possible to bleeding patients as recommended in NICE guidelines 2016.

A loading dose of 1g over 10 minutes followed by 1g over 8 hours is recommended. There are few adverse events or side effects associated with the early use of tranexamic acid in massive haemorrhage.

Repeat doses should be used with caution in patients with renal impairment, as the drug is predominantly excreted unchanged by the kidneys.

It may be considered in bleeding associated with the direct oral anticoagulants such as Rivaroxaban, Apixaban and Edoxaban.

Tranexamic acid is contraindicated in patients with subarachnoid haemorrhage, as anecdotal evidence suggests that cerebral oedema and infarction may occur.

Factor concentrates
Coagulation factor concentrates may be required for patients with inherited bleeding disorders such as haemophilia and von Willebrand disease. They should only be used under the guidance of a haemophilia centre.

Desmopressin (DDAVP)
The use of Desmopressin is not routinely recommended in the bleeding trauma patient. It could be considered in refractory microvascular bleeding if the patient had been treated with platelet-inhibiting drugs such as acetylsalicylic acid.
A consultant haematologist should be contacted for advice on appropriate pharmacological agents.

14 Non Pharmacological Management of Massive Haemorrhage

Radiological aided arterial embolisation (Interventional Radiology)
These techniques are now available 24 hours a day, seven days a week and successful control of bleeding can be achieved by embolisation of bleeding arteries following angiographic imaging. The technique may eliminate the need for any surgical intervention, particularly in major obstetric haemorrhage.

The suitability of such interventions needs to be assessed in each individual case and should be discussed at an early stage with an interventional radiologist. Referral for interventional radiology must be made to the on call consultant for interventional radiology by a senior member of the team providing care.

Cell salvage
The use of intraoperative cell salvage can be very effective at both reducing demand on allogeneic supplies and providing a readily available red cell supply in massive haemorrhage. For further information, please refer to the Policy for the Use of Intraoperative Cell Salvage 2017

Use of Rapid infusion devices (Belmont Rapid infusers)

Key Emergency areas are equipped with rapid infusion devices (ED, Emergency Theatres and Obstetric Theatres)
These rapid infusion devices can be utilised to rapidly administer red blood cells, FFP and fluids in the massive blood loss scenario.

The Rapid infusion devices have a dual purpose:

- The ability to infuse fluids, up to a maximum rate of 750mls/minute
  Rapid infusion of fluids/RBC and FFP is crucial to restore circulating volume

- Warming the fluid.

Haemostasis is strongly influenced by body temperature, and hypothermia is associated with increased risk of severe bleeding.

Platelets may not be infused via these rapid infusion devices.

The Rapid Infusion devices cannot be operated at pressure to infuse fluids through an intraosseal (IO) access needle. However the rapid infusion device can be used to warm the fluid, before drawing off fluids into a syringe and delivering through the IO access needle.

Operation of the Rapid infusion devices must only be performed by individuals trained and deemed competent to operate the device.
15 References


12. Rossaint R et al 2010 Management of bleeding following major trauma; an updated European guideline Critical Care 14;R52
Appendix 1  Massive Transfusion Protocol for Paediatric Trauma

Is major haemorrhage likely?
CALL BLOOD BANK HOTLINE ON 52528 OR OOH Bleep 0871
Say "I want to trigger the Pediatric Massive Trauma Transfusion Protocol in the Emergency Department in an x year old."

What is the cause and can we terminate the bleeding? Contact surgeons/ radiologist.
O negative blood is always available in the blood fridge

Request “shock pack”**, give 5ml/kg aliquots of red cells (RC) and 5ml/kg aliquots of FFP* at 1:1 ratio to 20ml/kg of each
*note: FFP takes 30 minutes to defrost, therefore RC alone may be used initially

Give Tranexamic acid 15mg/kg (max 1g) over 10 minutes, then 2mg/kg/hr infusion

Reassess for ongoing bleeding; use pH and clinical state

Second phase:
• Continue 20ml/kg RC & FFP (equivalent of one 4u shock pack in adults) in 5ml/kg aliquots.
• Give platelets 10ml/kg, *2
• Give cryo 5ml/kg,
• Give calcium chloride 0.2ml/kg

Is the child stable?

STABLE:
Move to definitive care

UNSTABLE:
Move to Damage Control Surgery and continue 20ml/kg RC and 20ml/kg FFP in 5ml/kg aliquots. Use ROTEM to guide platelets, cryoprecipitate and CaCl

PAEDIATRIC TRAUMA
MASSIVE TRANSFUSION PROTOCOL

Remember to record products given

Transfusion end points
Arresting bleeding, HR, BP, cap refill, Blood Gas, lactate. Beware Hb (behind the curve)

*1 "Shock pack" is standard 4u PRC and 4u FFP, use 5ml/ kg aliquots of each up to total 20ml/kg each as equivalent of adult 4u shock pack
*2 Don’t forget to use lab results when available to catch up further with blood product resuscitation.
Appendix 2  Trauma Transfusion Protocol v 3.0

NB: The Trauma Transfusion Protocol applies to the Emergency Department only.

START HERE

- On receipt of ATMIST pre-alert suggesting Massive Transfusion required
- Between 0800 – 1730, RING Blood Bank Hotline on 52828
- Between 1730 – 0800 BLEEP 0871

- Say to the laboratory, “I want to trigger the Trauma Transfusion protocol for ED”
  You will be asked to state your location and patient name (if known);
  If patient is unknown, you must state if it is an ADULT or CHILD, Male or Female,
- Any future communication during this time should be preceded by, “this call relates to the Trauma Transfusion in ED”.

At earliest opportunity take bloods to include;
- FBC  U&E  Clotting  ABG
- and take blood sample for crossmatch to Blood Bank.
All samples must be hand delivered.
IO Samples must be clearly labelled as Intraosseous Samples

Tranexamic Acid
Give TXA bolus if within 3 hrs of injury (if not already given at scene).

Haemorrhage control
- Stabilise fractures.
- Pelvic splint.
- Surgery.
- Interventional radiology.
- Prevent hypothermia.

Haemostatic drugs
- Octaplex for Warfarinised Patients, (especially with Neuro trauma)
- Give Tranexamic Acid infusion.

Intra Operative Cell Salvage
- Transfuse 1 x FFP every 250 ml blood.
- Transfuse 1 x ATD Platelets every 1000mls blood.

Use results to guide further blood component therapy.
Aim for:
- Hb 80-100 g/L
- Platelets >100 x 10^9/l
- PT <17 secs
- APTT <40 secs
- Fibrinogen >1.5 g/l
- Ca^2+ (on ABG) >1.0 mol/l

PATIENT BLEEDING?
Call Blood bank for Pack 2

Trauma Transfusion Pack 2

4 x Group Specific RBC
4 x Group Specific FFP/Octoplas
1 x ATD Platelets

Group Specific Products will be available in 45 minutes from receipt of sample.
If group specific blood not available; further emergency blood units will be supplied
If Fibrinogen <1.5 g/l; Give 2 x packs of Cryoprecipitate

Blood Bank Hotline ☏ 52828 (out of hours, weekends and bank holidays bleep 0871)
To contact on-call Consultant Haematologist ☏ switchboard.
Transfusion Practitioners ☏ 31487 Bleep 0604/0909

APTT- Activated Partial Thromboplastin Time
ABBG- Arterial Blood Gas
BMS- Bio Medical Scientist
RBC- Red Blood Cells
TXA- Tranexamic acid

ATD- Adult Therapeutic Dose
FFP- Fresh Frozen Plasma
HB- Haemoglobin
PT- Prothrombin Time

Re-assess
Suspected continuing haemorrhage or patient
Requiring further transfusion?
Contact Haematologist who will ask:
What is patient pH?
What is patient temperature?
Recheck FBC, PT/APTT, Fibrinogen, ABG/VBG

STILL BLEEDING?
Call Blood Bank for further products

Revised: April 2008

Toxicology Haemostasis Unit
Medical Director: Dr. Michael Timpson
Head: Dr. John Harte

Appendix 2  Trauma Transfusion Protocol v 3.0

NB: The Trauma Transfusion Protocol applies to the Emergency Department only.
Appendix 3 Obstetric Massive Transfusion Protocol

START HERE

- On suspicion of or actual haemorrhagic shock or if need for fluid resuscitation is identified:
  - Between 0800 – 1730, RING Blood Bank Hotline on 52828
  - Between 1730 – 0800 BLEEP 0871

- Say to the laboratory, “I want to trigger the Massive Transfusion protocol for Obstetrics”
  You will be asked to state your location and patient’s forename, surname, hospital number and date of birth.
- Any future communication during this time should be preceded by, “this call relates to the Massive Haemorrhage in...”

STOP THE BLEEDING

- Rub up contraction
- Indwelling Catheter
- IV Syntocinon
  - 5 iu bolus/ 40 iu infusion
- Bimaular compressions
- 250mcg to 500mcg (IV/IM) Ergometrine
- 250mcg Carprofest/ Haemobate (deep IM only)
  - Repeat every 15 minutes up to 8 times
- 800mcg to 1mg Misoprostol
- Tranexamic Acid (TXA)

TAKING TO THEATRE for EUA/laparotomy.
Consider:
- B Lynch suture
- Uterine Artery Embolisation
- Uterine Artery Ligation
- Novo Seven (talk to haematology)
- Rusch Intrauterine Catheter
- Hysterectomy

Intra Operative Cell Salvage
- Transfuse 1 x FFP every 250 ml blood.
- Transfuse 1 x ATD Platelets every 1000mls blood.

Massive Transfusion Pack 1

- 2 x O Rh D Neg (Emergency) RBC
  - (Available in Maternity blood fridge)
- 4 x A FFP

NB: FFP to be collected from lab reception,
FFP takes 30 minutes to defrost.

At earliest opportunity take bloods to include;
- FBC, U&E, Clotting
- ABG
- and take blood sample for crossmatch to Blood Bank.
  All samples must be hand delivered.

STILL BLEEDING?
Call Blood Bank for Pack 2

Massive Transfusion Pack 2

- 4 x Group Specific FFP
- 4 x Group Specific RBC

This should be available in 40 minutes from receipt of sample.

Re-assess

- Suspected continuing haemorrhage requiring further transfusion?
  - Contact on call Haematologist via switchboard
  - Consider Haemacue (in maternity anaesthetic room)

STILL BLEEDING?
Call Blood Bank for Pack 3

Massive Transfusion Pack 3

- 4 x Group Specific RBC
- 4 x Group Specific FFP
- 1 x ATD Platelets

- Give location of the patient.
- Confirm when product available.
- Arrange collection.
- Consider Ca++

If group specific blood not available:
- Further O Rh negative blood will be supplied
- Use results to guide further blood component therapy.
  Aim for:
  - Hb 80 - 100 g/L
  - Platelets >100 x 10^9/l
  - PT<17 secs
  - APTT<40 secs
  - Fibrinogen >1.5 g/l
  - Ca++ (on ABG)>1.0 mol/l

If Fibrinogen <2.0 g/l;
- 2 x packs of Cryoprecipitate

Once Pack 3 administered check;
- FBC, PT/APTT, Fibrinogen
- ABG, PT, Transfused plasma
- Hb, U+E

Blood Bank Hotline: \#52828 (out of hours, weekends and bank holidays bleep 0871)
Blood Bank: \#52465
To contact on-call Consultant Haematologist: \#switchboard.
Transfusion Practitioners: \#31487 Bleep 0604/0909

<table>
<thead>
<tr>
<th>Blood Bank Hotline</th>
<th>Consultant Haematologist</th>
<th>Switchboard</th>
<th>Transfusion Practitioners</th>
<th>Bleep 0604/0909</th>
</tr>
</thead>
<tbody>
<tr>
<td>#52828</td>
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<td>#31487</td>
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</table>

<table>
<thead>
<tr>
<th>APTT</th>
<th>Activated Partial Thromboplastin Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMS</td>
<td>Bio Medical Scientist</td>
</tr>
<tr>
<td>Hb</td>
<td>Haemoglobin</td>
</tr>
<tr>
<td>RBC</td>
<td>Red Blood Cells</td>
</tr>
<tr>
<td>FBC</td>
<td>Full Blood Count</td>
</tr>
<tr>
<td>TXA</td>
<td>Tranexamic acid</td>
</tr>
<tr>
<td>SBP</td>
<td>Systolic Blood Pressure</td>
</tr>
<tr>
<td>ABG</td>
<td>Arterial Blood Gas</td>
</tr>
<tr>
<td>ATRD</td>
<td>Adult Therapeutic Dose</td>
</tr>
<tr>
<td>FFP</td>
<td>Fresh Frozen Plasma</td>
</tr>
<tr>
<td>PT</td>
<td>Prothrombin Time</td>
</tr>
<tr>
<td>U+E</td>
<td>Urea and Electrolytes</td>
</tr>
</tbody>
</table>

TRW.HGV.POL.933 6.1 Massive Transfusion Policy
Appendix 4  Massive Transfusion Protocol

START HERE
- On suspicion of or actual haemorrhagic shock or if need for fluid resuscitation is identified:
  Between 0800 – 1730, RING Blood Bank Hotline on 52828
  Between 1730 – 0800 BLEEP 0871
- Say to the laboratory, “I want to trigger the Massive Transfusion protocol!”
  You will be asked to state your location and patient’s forename, surname, hospital number and date of birth.
- Any future communication during this time should be preceded by, “this call relates to the Massive Haemorrhage in...”

Massive Transfusion Pack 1

4 x O Rh D Neg (Emergency) RBC
4 x A FFP

NB: FFP to be collected from lab reception, FFP takes 30 minutes to defrost

At earliest opportunity take bloods to include:
- FBC  U&E  Clotting  ABG
- and take blood sample for crossmatch to Blood Bank.
  All samples must be hand delivered.

STILL BLEEDING?
Call Blood bank for Pack 2

Massive Transfusion Pack 2

4 x Group Specific FFP
4 x Group Specific RBC

This should be available in 40 minutes from receipt of sample.

Re-assess
Suspected continuing haemorrhage requiring further transfusion?
Contact Haematologist who will ask:
What is patient pH?
What is patient temperature?

STILL BLEEDING?
Call Blood Bank for Pack 3

Massive Transfusion Pack 3

4 x Group Specific RBC
4 x Group Specific FFP
1 x ATD Platelets

- Give location of the patient.
- Confirm when product available.
- Arrange collection.
- Consider Ca²⁺

If group specific blood not available: further O Rh negative blood will be supplied

Use results to guide further blood component therapy.

Aim for:
- Hb 80-100 g/L
- Platelets >100 x 10⁹/l
- PT<17 secs
- APTT<40 secs
- Fibrinogen >1.5 g/l
- Ca²⁺ (on ABG)>1.0 mol/l

If Fibrinogen <1.5 g/l;
2 x packs of Cryoprecipitate

Once Pack 3 administered
check:
- FBC
- Fibrinogen
- PT/PTT
- ABG

Blood Bank Hotline ☎ 52828 (out of hours, weekends and bank holidays bleep 0871)
Blood Bank ☎ 52465
To contact on-call Consultant Haematologist ☏ switchboard.
Transfusion Practitioners ☏ 31487 Bleep 0604/0909

APTT - Activated Partial Thromboplastin Time  ABG - Arterial Blood Gas  ATD - Adult Therapeutic Dose
BMS - Bio Medical Scientist  FBC - Full Blood Count  FFP - Fresh Frozen Plasma
Hb - Haemoglobin  TXA - Tranexamic acid  PT - Prothrombin Time
RBC - Red Blood Cells  SBP - Systolic Blood Pressure  U+E - Urea and Electrolytes
# Appendix 5 Transfusion Clinical record sheet

## Transfusion Clinical Record Sheet

Consultant: ........................................

Department: ........................................

---

<table>
<thead>
<tr>
<th>TRANSFUSION CLINICAL RECORD – use for Blood, FFP, Platelets or Cryo</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reason(s) for transfusion:</strong></td>
</tr>
<tr>
<td>Please note that consent, or refusal to consent, can only be obtained from a person who has the capacity to do so. This includes the unconscious patient.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk</th>
<th>Benefit</th>
<th>Alternative</th>
<th>Refuse consent</th>
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</thead>
<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

**Has the patient given their verbal consent?:**
- Yes
- No

**Date:**

**Time:**

**Dr/Nurse Sig:**

**Signature:**

**PRINT NAME:**

---

**Outcome of transfusion:**
- Hb 9:
- Clinical improvement:
- Post transfusion Hb:
- Transfusion reaction

**Date:**

**Time:**

**Doctor or Nurse Practitioner signature:**

**Signature:**

**PRINT NAME:**

---

**Transfusion label(s):**
- Blood, FFP, Platelets or Cryo
  - UNIT 1 label
  - UNIT 2 label

---

More labels can be placed on the reverse side

---

Page 1 of 2
### Appendix 6  Linked Policies

- Emergency Blood Management Plan (including Platelets)
- Hospital Transfusion Policy
- Injectable Drug Administration Policy
- Refusal of Blood/Blood Products Policy
- No 9 Post-Partum Haemorrhage (not available on public folders)
- No 18 Management of Major Obstetric Haemorrhage: antenatal and intrapartum (not available on public folders)
- Policy for the Use of Intraoperative Cell Salvage 2017
- Unidentified Patients - Operational Procedure for their Safe Management and Treatment
- Venous Thromboprophylaxis Policy
- Paediatric early warning system
- APLS advanced paediatric life support
- PICU paediatric intensive care unit
## Appendix 7 Dissemination Plan

### Core Information

<table>
<thead>
<tr>
<th>Document Title</th>
<th>Massive Transfusion Policy – including Trauma and Obstetrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Finalised</td>
<td>September 2017</td>
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<tr>
<td>Dissemination Lead</td>
<td>Caroline Lowe</td>
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</table>

### Previous Documents

<table>
<thead>
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<th>Yes</th>
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<tbody>
<tr>
<td>Action to retrieve old copies.</td>
<td>Users informed through vital signs</td>
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</table>

### Dissemination Plan

<table>
<thead>
<tr>
<th>Recipient(s)</th>
<th>When</th>
<th>How</th>
<th>Responsibility</th>
</tr>
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<tbody>
<tr>
<td>HTC membership</td>
<td>September 2017</td>
<td>e-mail</td>
<td>SPOT</td>
</tr>
<tr>
<td>Blood Bank Committee members</td>
<td>September 2017</td>
<td>e-mail</td>
<td>SPOT</td>
</tr>
<tr>
<td>Appendix 8</td>
<td>Review and Approval Checklist</td>
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<td></td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------</td>
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<tr>
<td><strong>Review</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>Title</strong></td>
<td>Is the title clear and unambiguous? ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is it clear whether the document is a policy, procedure, protocol, framework, APN or SOP? ✓</td>
<td></td>
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<tr>
<td></td>
<td>Does the style &amp; format comply? ✓</td>
<td></td>
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<tr>
<td><strong>Rationale</strong></td>
<td>Are reasons for development of the document stated? ✓</td>
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</tr>
<tr>
<td><strong>Development Process</strong></td>
<td>Is the method described in brief? ✓</td>
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<tr>
<td></td>
<td>Are people involved in the development identified? ✓</td>
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<td></td>
<td>Has a reasonable attempt has been made to ensure relevant expertise has been used? ✓</td>
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<tr>
<td></td>
<td>Is there evidence of consultation with stakeholders and users? ✓</td>
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</tr>
<tr>
<td><strong>Content</strong></td>
<td>Is the objective of the document clear? ✓</td>
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<td></td>
<td>Is the target population clear and unambiguous? ✓</td>
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<td></td>
<td>Are the intended outcomes described? ✓</td>
<td></td>
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</tr>
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<td></td>
<td>Are the statements clear and unambiguous? ✓</td>
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<tr>
<td><strong>Evidence Base</strong></td>
<td>Is the type of evidence to support the document identified explicitly? ✓</td>
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</tr>
<tr>
<td></td>
<td>Are key references cited and in full? ✓</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Are supporting documents referenced? ✓</td>
<td></td>
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</tr>
<tr>
<td><strong>Approval</strong></td>
<td>Does the document identify which committee/group will review it? ✓</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>If appropriate have the joint Human Resources/staff side committee (or equivalent) approved the document? N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the document identify which Executive Director will ratify it? ✓</td>
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<td></td>
</tr>
<tr>
<td><strong>Dissemination &amp; Implementation</strong></td>
<td>Is there an outline/plan to identify how this will be done? ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the plan include the necessary training/support to ensure compliance? ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Document Control</strong></td>
<td>Does the document identify where it will be held? ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Have archiving arrangements for superseded documents been addressed? ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Monitoring Compliance &amp; Effectiveness</strong></td>
<td>Are there measurable standards or KPIs to support the monitoring of compliance with and effectiveness of the document? ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is there a plan to review or audit compliance with the document? ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Review Date</strong></td>
<td>Is the review date identified? ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is the frequency of review identified? If so is it acceptable? ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overall Responsibility</strong></td>
<td>Is it clear who will be responsible for co-ordinating the dissemination, implementation and review of the document? ✓</td>
<td></td>
<td></td>
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### Appendix 9 Equalities and Human Rights Impact Assessment

<table>
<thead>
<tr>
<th>Core Information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager</td>
<td>Specialist Practitioner of Transfusion (SPOT)</td>
</tr>
<tr>
<td>Service Line</td>
<td>Clinical Support Services</td>
</tr>
<tr>
<td>Date</td>
<td>March 2017</td>
</tr>
<tr>
<td>Title</td>
<td>Massive Transfusion Policy – including Paediatrics, Trauma and Obstetrics</td>
</tr>
</tbody>
</table>

**What are the aims, objectives & projected outcomes?**

Ensure a safe, appropriate and efficient transfusion service to all patients.

That the massive haemorrhage policy is intended to supplement current Resuscitation guidelines and specialist policies.

That the policy gives up to date and agreed standardisation on triggering a massive haemorrhage response.

The massive haemorrhage event is controlled via an agreed algorithm/protocol that guides all parties.

To consider alternatives to transfusion wherever possible.

---

**Scope of the assessment**

**Collecting data**

| Race | There is no evidence to show an impact in this area. This policy can be made available in different languages on request. |
| Religion | There is no known impact other than to the Jehovah’s Witnesses. |
| Disability | There is no known evidence to show an impact in this area. |
| Sex | There is no known evidence to show an impact in this area. |
| Gender Identity | There is no known evidence to show an impact in this area. |
| Sexual Orientation | There is no known evidence to show an impact in this area. |
| Age | There is no known evidence to show an impact in this area. |
| Socio-Economic | There is no known evidence to show an impact in this area. |
| Human Rights | There is no known evidence to show an impact in this area. |

**What are the overall trends/patterns in the above data?**

No trends or patterns identified at this stage.

**Specific issues and data gaps that may need to be addressed through consultation or further research**

There are no other issues or data gaps. Should any arise then an early and prompt adjustment to the policy will be made through the control of the Hospital Transfusion Committee.

**Involving and consulting stakeholders**

**Internal involvement and consultation**

Hospital Transfusion Team

Hospital Transfusion Committee.

**External involvement and consultation**

Jehovah’s Witness Hospital Liaison Committee.

**Impact Assessment**

**Overall assessment and analysis of the evidence**

This is regularly monitored and overseen by the Hospital Transfusion Committee.

**Action Plan**

<table>
<thead>
<tr>
<th>Action</th>
<th>Owner</th>
<th>Risks</th>
<th>Completion Date</th>
<th>Progress update</th>
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</thead>
<tbody>
<tr>
<td>Continual monitoring to collect any data requiring changes to the policy</td>
<td>SPOT</td>
<td>None known</td>
<td>September 2017</td>
<td>As required</td>
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