

Guideline for the Management of Massive Blood Loss in Adults (MBL)

For Use in:	Theatres, Intensive Care, Accident and Emergency
By:	Medical and Nursing Staff, ODAs, OPDs, Laboratory Staff Blood, Paramedics and Transfusion Committee
For:	Patients undergoing massive blood transfusion
Division responsible for document:	Medical
Key words:	Blood Transfusion, Major Haemorrhage
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Assessed and approved by the:	Hospital Transfusion Committee Clinical Guidelines Assessment Panel (CGAP) Chairs action <input checked="" type="checkbox"/>
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Compliance links: (is there any NICE related to guidance)	None
If Yes - does the strategy/policy deviate from the recommendations of NICE? If so why?	

*** Please note there are separate guidelines/protocol for Children [Trustdocs ID 9960](#)

*** Please note there are separate guidelines/protocol for Obstetric patients [Trustdocs Id 852](#)

This guideline has been approved by the Trust's Clinical Guidelines Assessment Panel as an aid to the diagnosis and management of relevant patients and clinical circumstances. Not every patient or situation fits neatly into a standard guideline scenario and the guideline must be interpreted and applied in practice in the light of prevailing clinical circumstances, the diagnostic and treatment options available and the professional judgement, knowledge and expertise of relevant clinicians. It is advised that the rationale for any departure from relevant guidance should be documented in the patient's case notes. The Trust's guidelines are made publicly available as part of the collective endeavour to continuously improve the quality of healthcare through sharing medical experience and knowledge. The Trust accepts no responsibility for any misunderstanding or misapplication of this document

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Approved by: Hospital Transfusion Committee and CGAP chair Date approved: 17/08/2021 Review date: 17/08/2024

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Version and Document Control:

Version Number	Date of Update	Change Description	Author
V5	17/08/2021	New BCSH guideline on major haemorrhage information added	Stephen Wilson

This is a Controlled Document

Printed copies of this document may not be up to date. Please check the hospital intranet for the latest version and destroy all previous versions

Guideline for the Management of Massive Blood Loss in Adults (MBL) Quick Reference

Definition: Massive blood transfusion is defined as a blood loss of:

- greater or equal to 150 mL per min OR
- 100% blood volume per 24 hours OR
- 50% blood volume in 2 hours

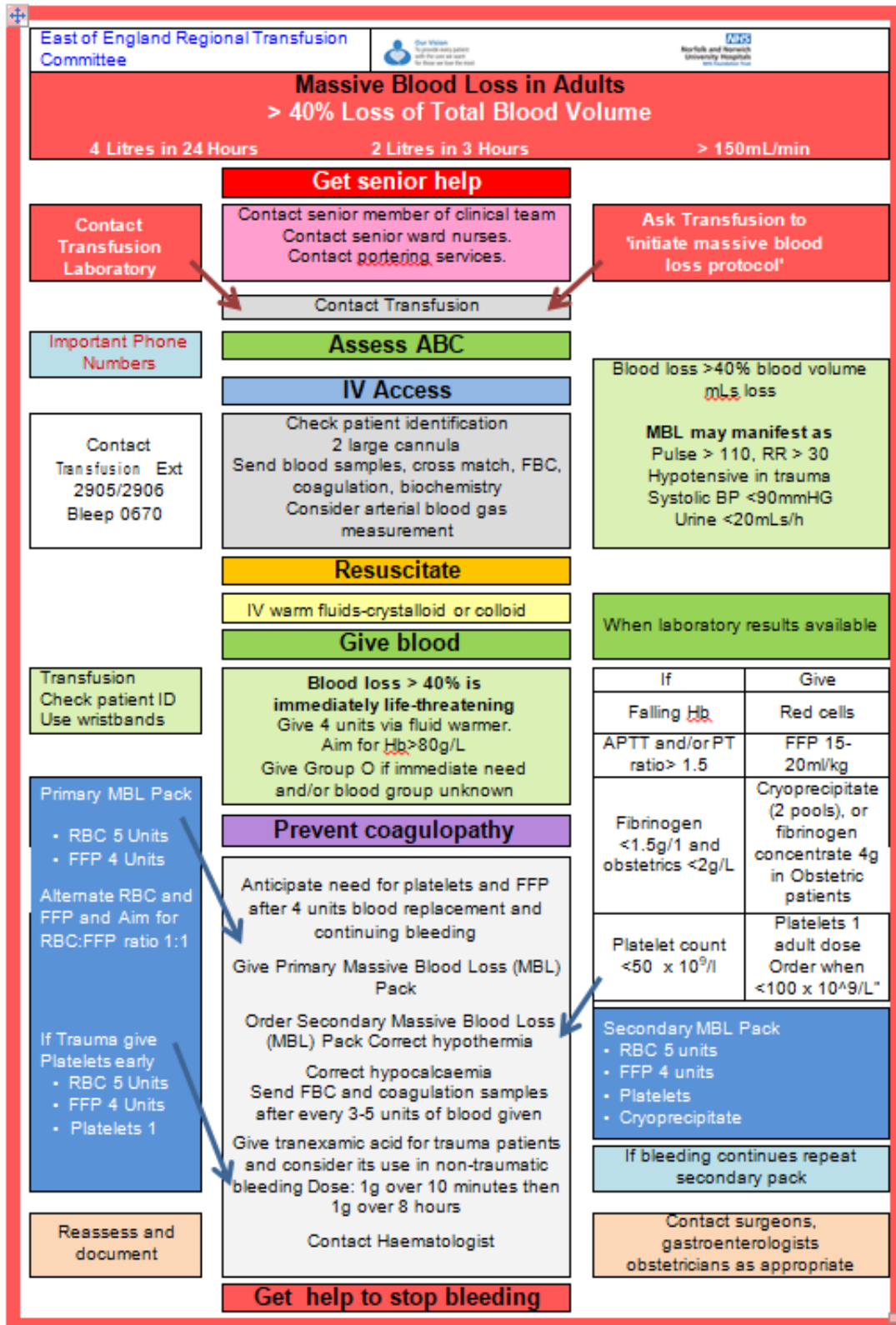
Where blood volume is:

Adult = 70ml per kg

Glossary

ABG	Arterial Blood Gas
APTT	Activated Partial Thromboplastin time
BV	Blood Volume
CNS	Central Nervous system
CVP	Central Venous Pressure
DIC	Disseminated Intravascular Coagulation
ECG	Electrocardiogram
EDTA	Ethylenediaminetetraacetic acid
FBC	Full Blood Count
FFP	Fresh Frozen Plasma
Hb	Haemoglobin
HES	Hydroxy Ethyl Starch
INR	International Nationalised Ratio
MBFFP	Methylene Blue Fresh Frozen Plasma
NCCG	Non-Consultant Career Grade
ODA	Operating Department assistant
pO ₂	Partial Pressure Oxygen
PT	Prothrombin Time
PRBCs	Packed Red Blood cells
PLTs	Platelets

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MBL RTC 139858.V5.0517 Management of Major Perioperative Blood Loss in Adults protocol
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N.B For A larger/ clearer version of this protocol [click here or see Trustdocs id 9321](#)

Table 1: Goals 1- 4 (Table 1) should be dealt with simultaneously

The massive blood loss protocol will be applied when there is an **‘actively bleeding patient in whom transfusion has started and needs to continue’**.

Blood bank must be informed using the trigger phrase to activate the massive blood loss protocol; ***“I want to trigger the massive blood loss protocol”***

All subsequent communications between clinical areas and laboratory staff should be preceded by the trigger phrase ***“This call relates to the massive blood loss protocol”***. A specific member of the team should be nominated **to co-ordinate communication with the laboratory staff and support services.**

Goal	Action	Comments
1. Restore circulating volume	<ul style="list-style-type: none"> • 2 wide bore cannulae • Send blood bank sample if not done: 6ml in pink EDTA bottle. • Also include FBC, APTT and INR. • Give adequate (warm) crystalloid or colloid e.g. HES, Gelofusin • Call for senior (on site) anaesthetist. • Maintain BP • Consider central venous line, arterial line • Measure urine output • Consider use of cell saver • Consider early use of Tranexamic Acid in • Consider reversal if on heparin/warfarin/other anticoagulants • Consider active warming to prevent hypothermia 	<p>It is essential that samples are sent to the blood transfusion lab as soon as possible e.g. 10-20 ml kg Trustdocs ID 1086</p> <p>Use pressure bags Blood loss is often under-estimated Shock, hypothermia and acidosis increase risk of DIC.</p> <p>Maximum benefit from Tranexamic Acid if given within first hour after injury. Do not give more than 3 hours after injury</p> <ul style="list-style-type: none"> • 1g Tranexamic Acid iv over 10 minutes followed by • 1g Tranexamic acid iv over 8 hours <p>Cell saver available in theatre; requires trained staff; most suitable in trauma/vascular bleeding See Trustdocs Id 1239</p> <p>Use a blood warmer and external patient warming device.</p>

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<p>2. Activate massive blood loss protocol and initiate transfusion</p>	<p>State: 'I want to trigger the massive blood loss protocol' to request major blood loss pack (MBL)</p> <p>Give 4 units blood via fluid warmer:</p> <ul style="list-style-type: none"> • Give Group O if immediate need and/ or blood group unknown • Blood transfusion lab will provide further group O / group specific / cross-matched red cells as required 	<p>Clearly state: "<i>I want to trigger the massive blood transfusion protocol</i>" Week day extension: 2905/2906</p> <p>Aim to maintain Hb >8g/dL</p> <p>O Neg blood available immediately</p> <p>Group specific blood available in 25 minutes. Group O will be available until group specific blood is available. This may be O Pos for men > 18 years old and women > 50 years old.</p> <p>Crossmatched blood available in 45 minutes</p>
<p>3. Continue transfusion with major blood loss packs</p>	<p>MBL pack A) 5 units blood FFP</p> <p>MBL pack B) If a second or subsequent Major Blood Loss Pack is required these will contain</p> <ul style="list-style-type: none"> • 5 units blood • 4 units FFP • 1 adult dose of platelets for adults, Cryoprecipitate <p>IF COAG SCREEN IS NOT TAKEN, PLEASE DO SO!</p>	<p>Aim to maintain Hb > 8 g/dL</p> <p>Aim for PT and APTT <1.5X the control (keep ionized Ca²⁺ > 1.13 mmol/L)</p> <p>FFP thawed in 20 – 30 min</p> <p>Anticipate PLTs < 50 X 10⁹/L after 2 BV replacement, therefore:</p> <p>Aim PLTs > 100 X 10⁹/L if there is ongoing active haemorrhage Cryoprecipitate replaces fibrinogen and factor 8 Aim for fibrinogen >1.5g/ L Fibrinogen < 0.5g/ L strongly associated with microvascular bleeding</p> <p>Cryoprecipitate thawed in 20 – 30 minutes</p> <p>NB. The blood bank will issue compatible FFP and PLTs which will not necessarily be the same group as patient.</p> <p>Ensure Electronic Blood Tracking system is used throughout</p>

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4. Contact senior personnel	<ul style="list-style-type: none"> • Consultant anaesthetist • Consultant surgeon, gastroenterologist, obstetrician as appropriate • Blood bank 	
5. Arrest bleeding	<ul style="list-style-type: none"> • Remember simple measures (pressure/elevation) can be useful • Early surgical intervention • Consider interventional radiology 	
6. Repeat blood tests	<ul style="list-style-type: none"> • If continued oozing repeat FBC and Coag. screen every 4 hours or after every 5 units of blood given • It is recommended to perform at least one set of tests <u>after</u> major transfusion • Serum Calcium and Potassium 	<p>Hypocalcaemia and hyperkalaemia can occur especially with hypothermia and acidosis.</p> <p>Monitor ECG.</p>
7. Suspect DIC	<ul style="list-style-type: none"> • Treat underlying cause (i.e. of blood loss) 	Shock, hypothermia and acidosis increase risk

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Objective

To ensure that a guideline is available to facilitate a multidisciplinary approach for the management of acute blood loss where immediate transfusion is required by employing a simple step by step flow chart. It is intended that the guideline is used alongside existing Trust policies for the checking and administration of blood and blood products. See [Trustdocs ID 1086](#))

Rationale for the recommendations

Avoidable deaths of patients with major haemorrhage are well recognised and locally agreed and/ or specialty specific guidelines are needed to ensure effective management.

This guideline is based on one produced in 1998 which was subsequently revised in 2008 in light of the guidelines issued by the British Committee for Standards in Haematology (National Blood Service) in 2006, which remains of value in those Trusts using it¹. It has been used as the basis for recent recommendations published by the UK Blood transfusion services.²

The recommendations contained in these guidelines must be regarded as level C, as they are based on uncontrolled observational studies and consensus of expert opinion (level 3 evidence). Well-designed case control studies and randomized clinical trials are lacking in this area.

National guidelines exist for the use of blood in the elective surgery³ and should also be consulted. (www.sign.ac.uk)

Broad recommendations

Massive blood loss has been defined as the loss of one blood volume over 24 hours⁴. Such definitions highlight the importance of early recognition of major blood loss and the need for effective action.

There is evidence that survival from massive transfusion continues to improve⁵ and recent reports have demonstrated success even in patients receiving in excess of 50 units in 48 hours⁶.

The initial priorities of treatment are:

- 1) Restoration of blood volume to maintain tissue perfusion and oxygenation
- 2) Achieving Haemostasis by
 - Early treatment of surgical bleeding

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- Correction of coagulopathy by the **early** use of blood component(s) therapy

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Detailed Recommendations

Restore circulating volume

Restoration of circulating volume will require the use of wide bore cannulae to access the circulation, and the rapid administration of (preferably warm) isotonic fluids and blood (once available).

Samples need to be sent urgently to blood bank if not already done so to provide blood and blood products of a correct group.

Blood loss is sometimes difficult to estimate and underestimates may be made if blood loss is within closed cavities. Monitoring the patient's CVP, arterial blood pressure and urine output (aim for >30mL/hour in adults,) may help in deciding on the adequacy of resuscitation and catheters should be inserted when appropriate by skilled medical personnel. Early consultation with senior colleagues (anaesthesia, surgery and blood bank) is mandatory.

Cell Salvage

Early consideration should be given to the use of cell saver equipment when appropriate. This is available in theatres and should be considered in most vascular and trauma cases. Contraindications are malignancy, contaminated fields and sickle cell anaemia. Cell salvage should be considered where more than 1000mLs intra-operative blood loss is anticipated.

Antifibrinolytics

Early use of Tranexamic Acid should be considered. Maximum benefit is obtained if this is given within the first hour after injury (1g Tranexamic Acid iv over 10 minutes followed but 1g Tranexamic Acid iv over 8 hours⁷). Tranexamic Acid should not be given more than 3 hours after injury⁸. Tranexamic Acid may also be considered when giving blood is likely to be a problem (e.g. difficult antibodies or religious objection)

FFP

Based on current recommendations, FFP should be used early during massive blood Transfusion^{9, 10}. This is based on several large civilian and military retrospective studies which have shown improved survival when FFP is used in ratios of more than 1:2 (FFP:PRBCs)^{11, 12}

Although FFP will be issued without clotting study results, samples should have been taken. A minimum dose of 12-15 mL kg⁻¹ (3 units in an adult) should be given¹³. FFP does not need to be Rhesus matched as there appears to be no risk of anti D immunization. Also note that group O FFP is being seriously restricted for group O patients only as it has caused haemolysis in non-O patients. In other patients you will receive from blood bank FFP which is compatible but not necessarily identical with the patients group¹⁴.

Guideline for the Management of Massive Blood Loss in Adults (MBL) Platelets

Recommendations suggest that platelet therapy may be unnecessary in major blood loss situations unless the count is $<100 \times 10^9$ with ongoing haemorrhage^{15, 16, 17, 18}. These guidelines, however, may not be easy to apply in a clinical setting¹⁹. Platelets are obtained from the NBS in Cambridge and take 1-2h to arrive. Stock platelets may be available immediately at the NNUH but if not the triggering of the major blood loss protocol will ensure blood bank staff order platelets for the patient proactively and before an FBC demonstrates thrombocytopenia. There may also be circumstances when it will be necessary to give platelets despite an “adequate” count e.g. when the patient has had aspirin or Clopidogrel.

Blood Tests

Ideally FBC and clotting studies need to be repeated 4 hourly or after every 5 units of blood. FFP and platelets contain citrate anticoagulant (red cells in solution contain only traces of citrate). In theory, infused citrate could lower plasma ionised calcium levels, but in practice rapid liver metabolism of citrate usually prevents this. However, patients who are hypothermic and/or acidotic, the combined effects of hypocalcaemia and hyperkalaemia may be cardiotoxic. Monitor acid base, serum calcium and potassium in these situations. If ECG shows evidence of hypocalcaemia, 5mL (10%) calcium gluconate (adult) should be given by SLOW IV injection. The problem is best avoided by keeping the patient warm.

Cryoprecipitate

Cryoprecipitate is indicated when the plasma fibrinogen is less than 1.5g litre-see [Trustdocs ID 1086](#) (Or $<2\text{g/L}$ Obstetric patients) and should be given in a volume of 1-1.5 packs per 10 kg body weight. Cryoprecipitate is now pooled (5u per pool) so adults need 2 pools. Throughout resuscitation and surgery it is important to maintain patient temperature by increasing the ambient temperature of theatre, the use of external patient warming devices and in line blood warmers.

For Obstetric patients, fibrinogen concentrate may be used instead of cryoprecipitate early in massive blood loss. This is kept in the Obstetric theatre fridge. Please see [Trustdocs ID 17727](#), Using Fibrinogen Concentrate as part of Major Obstetric Hemorrhage Protocol in Obstetric Theatres for further information

Disseminated intravascular coagulation

Disseminated intravascular coagulation occurs when an unregulated thrombin explosion causes release of free thrombin into the circulation. Widespread microvascular thrombosis leads to tissue ischaemia whilst the consumption of coagulation products and activation of fibrinolysis results in haemorrhagic complications. It is primarily a clinical diagnosis with laboratory tests being used to confirm the diagnosis and monitor replacement of blood products. In the peri-operative period the most likely cause of DIC will be either sepsis or trauma and treatment is that of the underlying cause. At the same time blood volume and tissue perfusion must be maintained whilst blood components are replaced in an attempt to correct the coagulopathy. Indications for treatment with heparin are not established.

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Clinical Audit Standards derived from guideline

The reserve of platelets/FFP and their ordering will be audited so that potential over ordering and cost can be established.

Delays in receiving platelets will be audited. All events which trigger the Massive Blood Loss protocol will be audited. 100% compliance with the guidelines will be used as the audit standard

Summary of development and consultation process undertaken before registration and dissemination

The guideline was drafted by the authors listed above on behalf of a guideline development group, which has agreed the final content. This revised version has gone through the Hospital Transfusion Team and the Hospital Transfusion Committee, presenting broad group of consultants across the Trust, Transfusion Clinical Nurse Specialist and Senior Operating Department Practitioners from Emergency Theatres.

During its original development it was circulated for comment to: consultant, NCCG and trainee anaesthetists, consultants, nursing staff and laboratory staff in Haematology and Blood Transfusion, consultant surgeons (General, Urological, Thoracic, Orthopaedic, Plastics, director and consultants Critical Care Complex) and consultants in Accident and Emergency,

The guideline was last reviewed in February 2013 by Dr D O'Hare supported by Dr G Turner, Consultant Haematologist, when minor changes were made to version 4 to reflect changes in the East of England Trauma Network guidelines for adults and publication of the Crash 2 study. The current revision follows publication of revised East of England Trauma Network guidelines for paediatrics when the decision was made to produce separate guidelines for adult and paediatric patients to enhance the clarity of the guidelines in clinical practice. No substantive changes have been made to the adult guidelines as a consequence of this revision. Guidelines for the management of massive blood loss in paediatric patients can be found

In March 2018 the updated Massive Blood Protocol [Trustdocs id 9321](#) was added to the guideline.

This version was reviewed in August 2021 by Dr S J Wilson with support from Dr Suzanne Doherty, Consultant Haematologist.

This version is endorsed by the Trust Blood Transfusion Committee, Anaesthetic Directorate and Theatre Standards Group and Clinical Guidelines Assessment Panel

Distribution list/dissemination method and references

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It is recommended that the guideline be widely available in all clinical areas in the Trust where major perioperative blood loss is managed. This will include the Trust Intranet.

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- 1 Guidelines on the management of massive blood loss, Stainsby D, MacLennan S, Thomas D, Isaac J, Hamilton PJ. Brit J Haematology 2006; 634-641
- 2 Handbook of blood transfusion (Blood transfusion services of the United Kingdom) McClelland DBL, 2001 pub: The Stationary Office
- 3 Scottish Intercollegiate Guidelines Network. Guideline 54. Perioperative Blood Transfusion for Elective Surgery. October 2001. www.sign.ac.uk/guidelines
- 4 Massive blood transfusion, ABC of Blood transfusion, ed Contreras M, 3rd edition 1998, BMJ publications
- 5 Philips TF, Soulier G, Wilson RF. Outcome of massive transfusion exceeding two blood volumes in trauma and emergency surgery. J Trauma 1987;903-910
- 6 Improved survival following massive transfusion in patients who have undergone trauma. Cinat M, Wallace W, Nastanski F. Arch Surg 1999;134:964-970
- 7 CRASH-2 trial collaborators. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial. Lancet 2010; 376: 23–32
- 8 The CRASH-2 collaborators. The importance of early treatment with tranexamic acid in bleeding trauma patients: an exploratory analysis of the CRASH-2 randomised controlled trial. Lancet 2011; published online March 24. DOI:10.1016/S0140-6736(11)60278-X.
- 9 Fresh frozen plasma (FFP) use during massive blood transfusion in trauma resuscitation, Mitra B, Mori A, Cameron PA, Fitzgerald M, Paul E, Street A. Injury. 2010 Jan;41(1):35-9
- 10 Massive Transfusion Protocols: The Role of Aggressive Resuscitation Versus Product Ratio in Mortality Reduction, Riskin DJ, Tsai TC, Riskin L, Hernandez-Boussard T, Purtill M, Maggio PM, Spain DA, Brundage SI. J Am Coll Surg. 2009 Aug;209(2):198-205
- 11 The relationship of blood product ratio to mortality: survival benefit or survival bias? Snyder CW, Weinberg JA, McGwin G Jr, Melton SM, George RL, Reiff

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- 12 Controversy in trauma resuscitation: do ratios of plasma to red blood cells matter? Stansbury LG, Dutton RP, Stein DM, Bochicchio GV, Scalea TM, Hess JR. Transfus Med Rev. 2009 Oct;23(4):255-65
- 13 British Committee for Standards in Haematology (1992) Guidelines for the use of fresh frozen plasma. Transfusion Medicine (2), 57-63
- 14 Guidelines for the use of fresh-frozen, cryoprecipitate and cryosupernatant. O'Shaughnessy DF, Atterbury C, Bolton Maggs P, Murphy et al. Br J Haematol., 2004 ;126: 11-28
- 15 BCSH (1992) Guidelines for platelet transfusions. Transfusion Medicine , 1992 (2), 311-318
- 16 British Society of Haematology 2005 (personal communication Dr. G Turner, in press)
- 17 Practice guidelines for blood component therapy (A report by the American Society of Anesthesiologists Task force on blood component therapy). Anesthesiology, 1996;84:732-47
- 18 A practical guideline for the haematological management of major haemorrhage. British Journal of Haematology 2015 170(6): 788-803
- 19 Editorial. Multiple trauma and massive transfusion. Horsey PJ. Anaesthesia 1997;52: 1027-1029

Guideline for the Management of Massive Blood Loss in Adults (MBL)

Source documents

Adult Patients Requiring Anticoagulation with Warfarin [Trustdocs Id 1239](#)

Major Obstetric Haemorrhage [Trustdocs Id 852](#)

Massive Blood Loss in Children (C-MBL) [Trustdocs ID 9960](#)

Massive Blood Loss Protocol (Adult) [Trustdocs Id 9321](#)

Monitoring the Patient during Blood Component Transfusion [Trustdocs ID 1086](#)