National Patient Safety Agency

Rapid Response Report NPSA/2010/017

The transfusion of blood and blood components in an emergency

October 2010

Supporting information

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1. Introduction

The National Patient Safety Agency (NPSA) has issued a Rapid Response Report (RRR) *The transfusion of blood and blood components in an emergency* [NPSA/2010/RRR017]. This supporting information contains further contextual information and guidance including incident data.

2. Background

Excessive blood loss potentially jeopardises the survival of patients in many clinical settings including acute medical settings as well as trauma, surgical and obstetrics. This is a challenge for front line clinicians as well as for those providing haematology and transfusion support within the hospital. In order to prevent hypovolaemic 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.

The provision of blood in the emergency situation of a patient with massive haemorrhage requires the use of a protocol specifically designed for the emergency management of the bleeding patient. It is imperative that this local protocol includes robust and clearly understood communication channels between staff in the clinical area and those in the blood transfusion laboratory. As a minimum the local protocol should address the following points:

- The immediate availability of uncrossmatched group O red cell units for patients with massive haemorrhage; in large NHS organisations this may be facilitated by siting blood fridges in relevant clinical areas.
- Procedures in the blood transfusion laboratory for the rapid provision of 'group compatible' red cell units (i.e. red cell units identical to or compatible with the patient's blood group, but not crossmatched) (British Committee for Standards in Haematology, 2006).
- Procedures in the blood transfusion laboratory for the rapid provision of thawed plasma and platelet concentrates for patients with massive haemorrhage.

The clinical area must ensure that the laboratory is made aware of a patient with massive haemorrhage as soon as possible. There must be a locally agreed and well understood trigger term to request initiation of the massive haemorrhage protocol. This may be a phrase such as *"I want to trigger the massive blood loss protocol"* which should also be used in subsequent calls. The location, for example, *delivery suite or emergency department*, must be stated and the name and contact numbers of a member of the clinical team nominated to be responsible for liaising with the transfusion laboratory (British Committee for Standards in Haematology 2006). This avoids the potential for miscommunication and repeated calls to the laboratory by different people with varying messages. Portering services must be aware of the absolute priority of the collection of blood in emergencies over other tasks. Consequently, a designated porter should be identified for the duration of the emergency situation. Similarly, if the blood is to be transported to another site a designated driver must be identified for the duration of the emergency.

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 (O'Keeffe et al. 2008) and wastage.

While the need for rapid access to blood and blood components is well understood in clinical practice, a review of the National Reporting and Learning System (NRLS) data has shown that the systems to ensure the rapid provision of these components can fail due to misunderstandings at every point in the process. Reasons include lack of understanding of the urgency of the situation (this applies to clinical, laboratory and support staff), over-zealous application of rules and protocols aimed at non-urgent situations and poor communication of exact requirements or specific problems. It is important to monitor laboratory test results frequently during massive transfusion although administration of blood / components should not wait for these.

Other guidance exists that should be considered alongside this RRR, including a national guideline on the management of massive blood loss (British Committee for Standards in Haematology 2006) that establishes which blood components should be available and in what timescales. This is reinforced in obstetric settings by advice from the Confidential Enquiry into Maternal and Child Health CEMACH (2007) and the Royal College of Obstetricians and Gynaecologists (2008). The latter document includes specific reference to anticipating massive blood loss in obstetrics. The focus of this RRR is on the practical implementation of this guidance at a systems level, with a particular emphasis on the communication between staff involved in the urgent supply of blood and blood components.

The NPSA has previously issued an RRR entitled *Emergency support in surgical units: dealing with haemorrhage* (NPSA 2007). This was aimed at improving patient safety in satellite units undertaking planned surgery, where the prospect of a major haemorrhage during routine surgery had not been contemplated or adequately planned for. The issue addressed in this RRR differs in that the incidents upon which it is based have taken place in acute hospitals which have protocols for management of major haemorrhage. Despite this there are occasions when there has been a delay in administration of blood components to the patient within the required timescale, with causes at each stage of the transfusion process.

3. Scale of the patient safety issue

Searching the National Reporting and Learning System (NRLS)

A key word search ('blood bank', ‘laboratory’, ‘haemato’, ‘haemoto’, 'emergency', 'critical', 'exsanguinat', 'lab' and ‘haemorrhage’, ‘haemorrage’, ‘haemorage’, ‘haemorhage’, ‘heamorrhage’, ‘pph", ‘o neg’, ‘clotting factor’, ‘units’, ‘packed cell’, ‘platelet’, 'aph') of the NRLS was made for incidents submitted between 1 Oct 2006 and 30 September 2010, to identify incidents where there was delay in accessing blood or blood components for patients who urgently required them. These searches were carried out on 2 March 2009, 14 April 2010 and 5 October 2010.

Context of clinical activity levels

The following incidents need to be considered in a context in which approximately 2.4 million units of blood and blood components are transfused in England alone each year (NHS Blood and Transplant, 2009).

Evidence of harm from the NRLS

94 reported incidents were reviewed. It is very difficult to estimate the impact of the delay in blood or blood components on the eventual outcome for the patient (given that they were all

suffering life threatening haemorrhage in order to need urgent access to blood/blood components). Of the incidents reviewed:

- 11 patients died;
- 83 patients suffered, sometimes major, morbidity with, for example, some requiring ITU admission or return to theatre.

The coding of incidents as no harm, low harm, and moderate harm is a challenge since attributing the impact of delay in blood transfusion on the outcome is very difficult for patients who are already critically ill.

In conclusion, these 94 incidents relevant to delays in access to blood or blood components in patients with a critical or very urgent need for them were identified, but as a wide search strategy was required and only a sample could be reviewed, this is likely to be an underestimate.

Insight from SHOT on sample incidents

Some sample reported incidents are given below. These are intended to show the range of issues and clinical problems associated with accessing blood/components in the emergency situation. Problems arising may relate to knowledge, experience, judgment and communication. For example the incidents raise issues such as whether or not an agreed major haemorrhage protocol was in existence and whether the clinicians recognised the need to activate it. Or, was the transfusion laboratory clearly working to a 'routine' protocol inappropriately in an urgent situation which demanded a switch to an agreed major haemorrhage protocol.

There may have been confusion around the term 'crossmatch' which is a routine procedure. Clinicians frequently use the word crossmatch, without realising that they are requesting a time consuming procedure which is not optimal in an emergency. These issues all emphasise the need for essential information to be communicated effectively and for the involvement of sufficiently experienced staff.

Another incident reinforces the importance of a dedicated transfusion laboratory porter and for porters to be trained and aware of the critical tasks they may be asked to carry out.

Questions to consider as part of an investigation

Whilst each incident that needs investigation will vary in its focus, the following questions are intended to act as a guide to some of the crucial areas that may need addressing

- Does the Trust have an agreed major haemorrhage protocol?
- Was this available in the clinical area involved and the transfusion laboratory?
- Was there a senior / experienced clinician involved in the management of the patient?
- Did the clinicians / transfusion laboratory staff involved recognise the need to activate this protocol?
- Was the communication between the clinical area and the transfusion laboratory clear and unambiguous regarding the nature of the emergency and the blood / components that were required?
- Which blood / components were requested?

- Was emergency uncrossmatched group O Rh D negative blood requested or was an ‘urgent crossmatch asked for?
- Were there previous blood results that impacted on the decision to request certain components?
- Was a dedicated porter available for the duration of the emergency to transport blood from the transfusion laboratory to the clinical area?
- Was the porter aware of the important role they play in the emergency situation?
- Were all staff aware of the location of satellite blood fridges that need to be accessed during an emergency?

Sample incidents

The incident below triggered exploration of this issue. It relates to a refusal to issue blood components on the basis of former haematology results and not the patient’s clinical condition at the time:

“A patient bled in excess of half her circulating volume from her chest via a drain in a little over 15 minutes and developed all the classical symptoms of hypovolaemic shock. Within minutes she had been transfused 4 units of packed red cells and transferred to theatre. She received a further 12 units of packed red cells and 6 litres of other fluids. There are no clotting factors in any of this. Initial requests to the hospital transfusion laboratory for blood components led to a referral to Dr [Staff Name] who initially refused on the basis that the previous coagulation tests had been normal.”

Possible questions to address in an investigation

- Does the Trust have an agreed major haemorrhage protocol?
- Was this available in the clinical area involved and the transfusion laboratory?
- Was there a senior / experienced clinician involved in the management of the patient?
- Did the clinicians involved recognise the need to activate this protocol?
- Was the communication between the clinical area and the transfusion laboratory clear and unambiguous regarding the nature of the emergency and the blood / components that were required?
- Which blood / components were requested?
- Was emergency uncrossmatched group O Rh D negative blood requested or was an ‘urgent’ crossmatch asked for?
- Were there previous blood results that impacted on the decision to request certain components?

Within these 94 incidents there were incidents relating to:

- **laboratory protocol**, including refusing the release of blood or blood components on the basis that former Hb or clotting results were not abnormal, or refusing until the on call haematologist had approved:

“A patient showed signs of haemorrhagic shock and haemoglobin was 4.0 g/dl. Urgent blood transfusion and surgical review was indicated. Despite the clinical condition of the patient the hospital transfusion policy allowed them to issue only one unit at a time. Two units were issued once it was made clear that the patient was going to theatre.”

Possible questions to address in an investigation

- Does the Trust have an agreed major haemorrhage protocol?
- Was this available in the clinical area involved and the transfusion laboratory?
- Was the communication between the clinical area and the transfusion laboratory clear and unambiguous regarding the nature of the emergency and the blood / components that were required?

- **delays within the lab for reasons which were unclear**, but may have related to how workload was prioritised, or whether adequate staff were available, for example:

"A patient in ITU was suffering from torrential bleeding. The treating clinician spoke to the transfusion laboratory staff and requested a crossmatch of 6 units urgently. At 08:30 the request was changed to uncrossmatched units as the crossmatched blood was not yet available."

Possible questions to address in an investigation

- Does the Trust have an agreed major haemorrhage protocol?
- Was this available in the clinical area involved and the transfusion laboratory?
- Was there a senior / experienced clinician involved in the management of the patient?
- Was emergency uncrossmatched group O Rh D negative blood requested or was an 'urgent' crossmatch asked for?

- **portering issues** (usually failure to prioritise fetching blood as an urgent task), for example:

"A patient became acutely unwell on the ward and at 1015 we became aware that Hb was 3.8 g/dl. The medical team requested that 10 units be crossmatched at 1020hrs and the porters were immediately asked to urgently collect 4 units and bring to the ward. Despite 3 follow up calls the blood wasn't signed out of the lab until 1047 and didn't reach the ward until 1105hrs, some 50 minutes after the request call. Only 1 unit was brought not the 4 needed for rapid transfusion".

Possible questions to address in an investigation

- Was a dedicated porter available for the duration of the emergency to transport blood from the transfusion laboratory to the clinical area?
- Was the porter aware of the important role they play in the emergency situation?

- **various other reasons**, for example:

"A baby was born prematurely by emergency caesarean section following an abruption. The satellite fridge in which neonatal blood was usually found was out of order so a member of staff went to the transfusion laboratory to collect emergency 'O Negative' blood. Meanwhile an ODA collected some blood from the theatre fridge. The infant died, so in fact no blood was transfused."

Possible questions to address in an investigation

- Were all staff aware of the location of satellite blood fridges that need to be accessed during such an emergency?

Type of blood product

Of the 94 incidents:

- 22 related to delay in accessing emergency supplies of O RhD negative blood;
- 63 related to timely supply of cross-matched blood;
- 4 related to fresh frozen plasma (FFP);
- 5 related to platelets

Volumes required ranged from two to 23 units.

Length of delay

This ranged from 15 minutes to 120 minutes.

Location of patient

Of the 94 incidents:

- 14 were in A&E;
- 23 were in obstetrics including obstetric theatres;
- 18 were in general theatres;
- 27 were on wards;
- 8 were in the Intensive Care Unit (ICU);
- 2 were in an angioplasty suite;
- 2 were in Neonatal Intensive Care Unit (NICU).

For A&E, theatre and obstetric settings, the number of incidents is likely to be due to the much higher frequency of major haemorrhage occurring in these environments.

National Health Service Litigation Authority (NHSLA) data

A review of the NHSLA data searching for the terms 'blood' and 'access' or 'emergency', carried out on 15 February 2010, did not identify any relevant cases

Evidence of scale of harm in the literature

The critical importance of rapid access to blood and blood components in massive haemorrhage is well recognised (see below) and the literature acknowledges that problems

and delays occur unless local systems are very well designed and robust. Individual cases where delay in access to blood or blood components was a factor in a maternal death can be identified within CEMACH reports (CEMACH 2007). However, no quantitative data on the harm caused by delays in access to blood or blood components could be located.

4. Currently available guidance

British Committee for Standards in Haematology

The most relevant currently available guidance is the British Committee for Standards in Haematology guidelines on the management of massive blood loss (British Committee for Standards in Haematology 2006). The guidelines summarise current opinions regarding the management of massive blood loss and emphasise the role of the hospital transfusion committee (HTC) in ensuring the optimum and safe use of blood components as well as developing protocols for management of massive transfusion. It recommends that the HTC provides a forum in which a rapid communication cascade can be agreed and massive transfusion episodes are critically reviewed. Every hospital should have a massive haemorrhage protocol which covers both the clinical and laboratory management of major blood loss. This should include immediate provision of an agreed quantity of blood components on triggering of the protocol, before the requirement for further test results or permissions. In addition, every hospital should have an emergency blood management plan in place that provides guidance on clinical priorities for the use of large volumes of blood components.

Confidential Enquiries into Maternal and Child Health (CEMACH)

“Saving mothers’ lives, reviewing maternal death to make motherhood safer - 2003-2005” recommends a protocol for the management of massive haemorrhage, which is updated annually. Management of haemorrhage is high on the training programme for all staff: theoretical teaching occurring at six-monthly compulsory training sessions. Clinical knowledge and behaviour should be taught and assessed regularly at multidisciplinary emergency scenario sessions attended by all grades of staff (CEMACH, 2007).

Serious Hazards of Transfusion (SHOT) Scheme

SHOT has collected, analysed and reported on adverse reactions to transfusion and errors in the process of giving transfusions. More recently SHOT has expanded its reporting categories and these now include under and over transfusion. The analysis of such reports has the potential to inform guidance in the future.

Royal College of Obstetricians and Gynaecologists (RCOG)

The college issued in 2007 and updated in 2008 a document entitled *Blood transfusion in obstetrics* (The Royal College of Obstetricians and Gynaecologists, 2008) which includes a section on major obstetric haemorrhage covering the anticipation of obstetric haemorrhage and management of major obstetric haemorrhage. The document emphasises a number of the principles addressed within this RRR.

5. Summary and conclusion

The safe and timely provision of blood/blood components for patients suffering a massive haemorrhage is dependent on a number of work processes by various clinical and laboratory teams and requires prompt input by support (particularly portering) services. It is important that there are clear arrangements for the provision of group O RhD negative blood in emergencies and that there is a protocol for issuing multiple packs of red cells, plasma and platelets in cases of massive haemorrhage.

Local protocols should also enable the issue of blood and blood components without the approval of a haematologist, as this may result in delays in its provision. Speed of recognition of the situation and appropriate communication within and between the clinical team managing the patient, the transfusion laboratory and portering services, of the urgency of the situation is crucial as is the accurate communication to the transfusion laboratory of the specific blood / blood component requirements.

The NRLS data indicate, however, that there are a number of systems and communication failures that impact adversely on the timely provision of blood and blood components in an emergency.

The key factors addressed in this RRR focus on these systems and human factors issues; they include a review of local protocols under the auspices of the HTC. The protocols should include all the actions required by the clinical teams, laboratory and portering staff to ensure accurate and unambiguous communication about the situation and the required processes to ensure urgently required blood is delivered in a timely manner. The RRR does not attempt to provide specific advice about *how* NHS organisations should provide blood in emergencies as this will vary depending on the size of the organisation and the services provided. Individual organisations should also give consideration to the availability and locations of group O RhD negative blood across a hospital site. The reporting of incidents involving delay in the provision of blood in the emergency situation should be made to both the NPSA and SHOT. Any adverse blood reactions or event should be reported to MHRA's Serious Adverse Blood Reactions and Events (SABRE) system and SHOT.

This RRR also recommends that each event triggering the massive blood loss protocol is recorded and reviewed by the Hospital Transfusion Committee as a standing agenda item to ensure local protocols are applied appropriately and effectively. This review could usefully include numbers of returned unused units of blood/components.

6. References

British Committee for Standards in Haematology: Writing Group: D. Stainsby, S. MacLennan, D. Thomas, J. Isaac and P. J. Hamilton. Guidelines on the management of massive blood loss. *Br J Haematol.* 2006; 135, 634–641

Confidential Enquiry into Maternal and Child Health (CEMACH). *Saving mothers' lives. Reviewing maternal death to make motherhood safer - 2003-2005.* (2007). Available at: http://www.cmace.org.uk/publications/CEMACH-publications/Maternal-and-Perinatal-Health.aspx

NHS Blood and Transplant www.blood.co.uk Homepage accessed on 1/10/09

NPSA. (2008). Rapid Response Report 3: *Emergency support in surgical units: dealing with haemorrhage.* Available at: http://www.nrls.npsa.nhs.uk/resources/

O'Keeffe T, Refaai M, Tchorz K, Forestner JE, Sarode R. (2008). A massive transfusion protocol to decrease blood component use and costs. *Archives of Surgery.* Jul; 143(7): 686 – 90

Royal College of Obstetricians and Gynaecologists. (2008). *Green-top guide 47: Blood transfusion in obstetrics*. Available at: http://www.rcog.org.uk/womens-health/clinical-guidance

Appendix: suggested compliance checklist

The table below gives suggested evidence that NHS organisations may wish to use locally as assurance of compliance with this RRR.

	Action	Rationale	Suggested assurance of compliance
1.	The hospital transfusion committee (HTC) reviews the local protocols and practices for requesting and obtaining blood in the emergency situation (including out of hours) ensuring they include all the actions required by clinical teams, laboratories and support services e.g. portering and transport staff / drivers and any specific actions pertinent to sites without an on-site transfusion laboratory.	Collaboratively written protocols ensure that there is an understanding across the relevant staff groups about the correct processes to follow in the situation of a massive haemorrhage requiring urgent access to blood/blood components. The HTC will be aware of the advice and guidance from other bodies e.g. the British Committee for Standards in Haematology, CEMACH, RCOG and this RRR that should inform local practices.	Copy of appropriate protocols covering access to blood in emergency systems, with evidence these have been approved by the HTC and appropriate local clinical governance processes (e.g. minutes of meeting where they were approved or approval stamp on protocol).
2.	Local protocols enable the release of blood/blood components without the initial approval of a haematologist although they should be advised of the situation at the earliest opportunity.	Local protocols should enable the release of blood/ components without the approval of a haematologist as this may be a step in the process that prevents other steps progressing with resultant delays in the provision of blood.	Copy of appropriate protocols covering access to blood in emergency systems, with evidence these have been approved by the HTC and appropriate local clinical governance processes (e.g. minutes of meeting where they were approved or approval stamp on protocol).
3.	Staff (clinical, laboratory and support staff) know where to find the massive blood loss protocol in all relevant clinical and laboratory areas and are familiar with it, supported by training and regular drills.	Drills enable staff to implement learning in practice, and the protocols form a basis upon which training and practice drills can be based.	A list of areas where paper and / or poster versions have been distributed and displayed. A note of the location the protocols are posted on local intranets. The name of a nominated clinical director responsible for overseeing training and drills. Evidence that this topic is covered at the induction of all staff groups. A schedule of training and drills carried out and/or planned. Evidence that training and drill attendance is and will be monitored (e.g. minutes of HTC).
4.	The blood transfusion laboratory staff are informed of patients with massive haemorrhage at the earliest opportunity.	Reported incidents have shown that in the emergency situation of a massive haemorrhage clinical staff	Copy of local memo or alert reminding staff of this.

		have, on occasions, failed to alert the laboratory to the situation.	
5.	Clinical teams dealing with patients with massive haemorrhage nominate a specific member of the team to co-ordinate communication with the laboratory staff and support services for the duration of the incident.	The identification of a nominated individual to the communication co-ordination role should reduce the incidence of frequent calls to the laboratory by differing staff with varying messages about the same situation.	Results of a brief verbal audit of a sample of staff working in clinical areas where massive haemorrhage may occur (even if infrequently) to check they understand the liaison role.
6.	There is a clear and well understood trigger phrase to activate the massive blood loss protocol such as *"I want to trigger the massive blood loss protocol [and state location e.g. delivery suite]"* and all subsequent communications between clinical areas and laboratory staff should be preceded with the use of a locally agreed trigger phrase such as *"this call relates to the massive blood loss protocol [and location]".*	The use of clear and well understood trigger phrases will remove any elements of ambiguity that exist in communicating the urgency of the situation in the case of a massive haemorrhage situation in a clinical area. In a large organisation it is possible that there is more than one incident of massive haemorrhage at the same time.	Results of a brief verbal audit of a sample of staff working in clinical areas where massive haemorrhage may occur (even if infrequently) to check they know the trigger phrase.
7.	All incidents where there are delays or problems in the provision of blood in an emergency are reported and investigated locally, and reported to the NPSA and the Serious Hazards of Transfusion (SHOT) scheme. (www.shotuk.org).	Local investigation is essential to establish causative factors in the delays to enable corrective actions to be taken. Both NPSA and SHOT have a remit to collect and analyse incident reports in order to collate, disseminate and facilitate learning to achieve safer patient care. Local organisations should consider reviewing at least one case per month to establish how a real massive haemorrhage was handled i.e. what went well or where there were any problems implementing the local procedure. The review should be carried out by the HTC and the relevant clinical team and the support services.	Evidence from meeting notes or investigation records indicating reports of incidents related to the provision of blood in the emergency situation have been reviewed and any corrective actions implemented. Upload logs or incident records indicating that any such incidents have been reported to NPSA and SHOT.
8.	Each event triggering the massive blood loss protocol is recorded and reviewed by the hospital transfusion committee to ensure local protocols are applied appropriately and effectively.	This review will enable a proactive approach to be taken to confirming the effectiveness of, or need for amending, systems and processes based on real examples.	Evidence from meeting notes indicating a review of incidents related to the activation of the massive blood loss protocol have been conducted and any corrective actions implemented.