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Trust Guidelines for the use of Blood Products in Newborn Infants

A clinical guideline recommended for use:

In:	NICU
By:	Medical and Nursing staff
For:	Newborns in NICU and SCBU requiring blood product support
Division responsible for document:	Women and Children's Services
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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.

Version and Document Control:

Version No.	Date of Update	Change Description	Author
6	13/09/2021	Slightly amended thresholds for using platelet transfusions in newborns as a result of recently published trial.	Dr M P Dyke

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Trust Guidelines for the use of Blood Products in Newborn Infants

Contents

1. Objective/s

To facilitate the safe use of blood products in the newborn infant admitted to NICU-SCBU

2. Rationale

Newborn infants may suffer from a variety of conditions for which blood products are indicated. In the past blood products have been very widely used in neonatal intensive care, raising concerns about donor exposure and the risks of transmissible agents.

There is published evidence confirming that the use of guidelines restricting transfusion can safely reduce the numbers of transfusions, volumes of blood and donor exposure for each infant.

Short term benefits (such as a reduction, following transfusion, in cardiac output which had become elevated due to anaemia) is only seen when “restrictive” transfusion policies are followed i.e. Hb values allowed to fall significantly before transfusing.

Long term risk-benefit ratios are not well documented but “restrictive” policies have no adverse effects on death or hospital discharge and may be protective of long term neurodevelopment. This guideline draws on US and UK consensus statements on the rational use of blood products and some randomised controlled trial data, to offer a consistent approach by which we might reduce the risks of under- or over-treatment.

3. Broad recommendations

Many infants admitted to NICU develop conditions for which the use of blood products might be considered. The following notes should guide management:

- Infants should **NOT** receive a blood product unless it is absolutely necessary. If in doubt consult a senior colleague.
- Whenever practicable, the planned use of blood products should be discussed with parents in advance.
- All efforts should be made to minimise the necessity for blood products:
    - Delayed cord clamping should be encouraged.
    - Crystalloid infusions may be used instead of colloid or blood in many circumstances.
    - Blood sampling should be kept to the minimum required for safe practice.
    - Blood drawn to “clear” an arterial line should be returned to the patient after sampling.

4. Blood products

4.1 Red Cell Transfusion

4.1.1 Indications for red cell (rbc) transfusion

[this should be recorded in the notes]

Red cell transfusion may be required for the following conditions:

- Blood loss with hypovolaemic shock.
  - This situation requires **urgent fluid volume resuscitation,** usually with crystalloid infusion initially, followed by blood (either type-specific cross-matched or Gp O RhD Neg).
  - **Massive Blood Loss [MBL]** is uncommon in neonatal practice but requires urgent attention to additional measures over and above rbc transfusion:
    - MBL should be considered when blood loss is estimated to be:
      - ≥3ml/kg/min.
      - ≥40ml/kg over 3 hours.
      - ≥80ml/kg over 24 hours.
    - Details of the Children's MBL protocol [C-MBL] and how to put it into action are contained in the Trust Guideline for the Management: of Massive Blood Loss in Children (C-MBL) Trustdocs ID: 9960.
- Top-up transfusion for infant requiring respiratory support.
  - The Hb should be maintained Hb >120g/L (PCV >40) for infants on a ventilator or on nCPAP or Vapotherm with significant oxygen requirement (FiO_2 >0.4).
  - The Hb should be maintained Hb >100g/L (PCV >35).
    - For infants on ventilator or nCPAP/vapotherm with FiO_2 < 0.4.
    - For infants off respiratory support but with high O_2 requirements (e.g. >0.75L/min via nasal cannula).
- In infants with other symptoms thought to be due to anaemia (e.g. frequent apnoea requiring resuscitation, poor feeding, poor weight gain, signs of congestive cardiac failure) consider transfusion if Hb<70g/L.
- In an asymptomatic infant with an Hb <70g/L, check reticulocyte count and discuss with consultant (NB our unit policy is NOT to test FBC routinely in asymptomatic infants).

Exchange transfusion for Haemolytic Disease see
Performing Exchange Transfusion in Newborn Trustdocs id 1304

4.1.2 Procedure for cross-matching

- On admission, take a 1mL EDTA specimen for Group and Save from all infants requiring intensive care.
- Ensure, where possible, that a 7mL EDTA specimen of maternal blood has been sent for Group, antibody screening and cross-match.
- Register all the following details on the ICE request:
  - Patients full name.

- Hospital number.
- Date of birth.
- Any special circumstances (e.g. intra-uterine transfusions, suspicion of NAITP or immuno-deficiency).

4.1.3 Management of Specific situations

4.1.3.1 Top-up transfusion

- Inform Blood bank (NNUHFT) of infant's weight. Blood will be allocated from a **satellite-pack** ie a unit from single donor divided into multiple small volume units which are reserved for one infant to minimise donor exposure.
  - Infants >1.5kg will have a 3-unit pack.
  - Infants <1.5kg will have a 6-unit pack.
- Request the required **volume** of packed red cells from NNUH blood bank (including volume for priming the lines). See box below for details.
- Ensure that the blood supplied is:
  - ABO compatible with mother and infant.
  - RhD compatible with infant.
  - Irradiated if the infant has received intra-uterine transfusion or has congenital defect of cellular immunity eg Di George syndrome (Trust Guideline for the Use of Irradiated Blood and Blood Products, Trustdocs ID: 1286).
- Except when blood transfusion is required as an emergency, the planned transfusion should be discussed in advance with the parents and consent obtained
- Give packed red cell transfusion using the formula:

1. For infants on a ventilator/ nCPAP/Vapotherm with FiO_2 >0.4), aim for an Hb ~160g/L

Volume of transfusion (mLs) = 0. 4 x desired rise in Hb (g/L) x weight (kg) (usually in range 20-25ml/kg)

e.g. 0.75kg infant with Hb of 110g/L **Volume** = 0.4 x (160-110=50) x 0.75 = 15mLs

NB Remember to request an additional 4mLs to "prime" the line

2. For infants on ventilator/nCPAP/vapotherm with $FiO_2 \leq 0.4$ OR for infants off respiratory support but with high O_2 requirements (eg >0.75L/min via nasal cannula) aim for an Hb ~120-140 g/dL

Volume of transfusion (mLs) = 0.4 x desired rise in Hb (g/L) x weight (kg)

eg 1.5kg infant with Hb of 80g/L **Volume** = 0.4 x (120-80=40) x 1.5 = 24mLs

NB Remember to request an additional 4mLs to "prime" the line

3. For other infants with symptoms [e.g. apnoea] etc aim for an Hb ~100-120g/dL

Volume of transfusion (mLs) = 0.4 x desired rise in Hb (g/L) x weight (kg)

eg 2kg infant with Hb of 65 g/L **Volume** = 0.4 x (110-65 = 45) x 2 = 36mLs

NB Remember to request an additional 4mLs to "prime" the line

- Infuse over a maximum of 4 hours (shorter duration if treating hypovolaemia).
- **Furosemide** confers no clinical benefit in most infants and is not routinely required but may be given (at Consultant discretion) for an infant who:
  - Is in heart failure.
  - Has severe chronic lung disease (e.g. requiring ventilation).
  - Is ventilated and receiving active treatment for a PDA.

  [When required, Furosemide dose = 1mg/kg].

4.1.4 Other practical points on rbc transfusion

- The circulating blood volume of an infant is approximately 80-90 mL/kg.
- All cellular blood products are capable of causing graft-versus-host disease. This risk is reduced by leucodepletion and may be reduced further by irradiation of blood products where required.
- Irradiation shortens shelf-life to 14 days in satellite packs used for top up transfusions and to 24 hours in blood used for exchange transfusion. Only request irradiated blood for infants who:
  - Have suspected congenital defects of cellular immunity (e.g. Di George Syndrome).
  - Have received in-utero transfusions.
  - Are receiving directed donation from 1st degree relatives.
  - Are receiving an Exchange Transfusion.
- The supply of irradiated products may introduce a delay before transfusion can commence. In situations where this delay may pose a greater risk to the infant than the use of non-irradiated products, a decision to proceed with non-irradiated products may be in the best interests of the infant. This decision should be made at Consultant level after discussion with the NNUH Consultant Haematologist on-call.
- The preferred route of administration is a peripheral venous cannula or umbilical venous catheter. Transfusion via umbilical arterial catheter carries higher risk and should be used only at Consultant discretion.
- Observations of temperature, heart rate, respiratory rate, BP and Oxygen saturations should be carried out at the start of the transfusion then every 15 minutes for the first hour then hourly throughout the remainder of the transfusion.

4.2 Platelets

4.2.1 Normal range = 150-450x10^9/L

4.2.2 Incidence of thrombocytopenia is 1-4% of all newborns, 20-35% of all NICU admissions and 40-72% of sick preterm infants.

4.2.3 Causes of thrombocytopenia in newborn are:

- Prematurity.
- Placental disease (associated with pre-eclampsia, small for gestational age infant, maternal HELLP syndrome).
- Sepsis.
- Disseminated Intravascular Coagulopathy (DIC).
- Neonatal Allo-immune thrombocytopenic purpura (NAITP).
- Large Haemangioma (Kasabach-Merritt syndrome).
- Maternal Idiopathic Thrombocytopenic Purpura (ITP).
- Rhesus Haemolytic disease.
- Congenital infection.
- Necrotising entero-colitis (NEC).

4.2.4 Risk

- There is no single “safe platelet count” applicable to all infants – the risk of bleeding may depend on causation, gestation, associated coagulopathy and age at presentation.
- Whilst there is an association between severe thrombocytopenia and episodes of bleeding, a causal relationship remains unproven.
- The role of prophylactic platelet transfusion in preventing new episodes of bleeding and/or the extension of existing haemorrhage is unproven.
- Most thrombocytopenia occurs in preterm (+/- small for gestation) infants.
- Most thrombocytopenia is asymptomatic, mild, of early-onset (<72 hours) and only slowly progressive.
- Late-onset thrombocytopenia (>72 hours) is often more severe and rapidly progressive. It is also more likely to be associated with other pathology such as sepsis or NEC.
- The finding of NAITP carries a considerably higher risk of haemorrhage than other causes of thrombocytopenia and particularly when diagnosed ante-natally.
- NAITP should be considered in any infant with significant thrombocytopenia (see 4.2.6 below) particularly when other risk factors for thrombocytopenia are absent.

4.2.5 Platelet transfusions

- Are required in only the minority of thrombocytopenic infants ie those who have symptoms or severe thrombocytopenia (see sections 4.2.6.1 (NAITP). and 4.2.6.2.2 (others)).
- Should **not** be given without consultant approval.

- Should be given as 20 mL/kg infusion of standard platelet suspension over 30 mins (except in NAITP (see 4.2.6.1 below)).

4.2.6 Management of Specific Conditions

4.2.6.1 Neonatal Allo-immune thrombocytopenic purpura (NAITP)

- NAITP is rare (approximately 1:1000 pregnancies) but may cause severe haemorrhage (fetal intra-cerebral haemorrhage [ICH] rates of 2-20% in an affected pregnancy) and death.
- There are at least 19 recognised platelet-specific antigens of which 14 have been characterised at molecular level. Of these, HPA-1a, HPA-5b and HPA-3a are the most important in the aetiology of NAITP.
- 98% of the population are HPA-1a antigen positive; only 2% HPA-1a antigen negative.
- An HPA-1a negative mother with HPA-1a positive fetus may form anti-HPA-1a antibodies (in a manner similar to that seen with red cells in Rhesus haemolytic disease). However, in practice, only around 1 in 10 do so.
- Anti-HPA IgG antibodies cross the placenta and facilitate platelet destruction. Only about 40% of those with antibodies have thrombocytopenia and, of those, fewer than 50% will have platelet counts $<50x10^9$/L.
- Unlike Rhesus disease, it is not uncommon for first pregnancies to be affected.

4.2.6.1.1 NAITP Clinical presentation

- In-utero:
  - Symptomatic: cerebral haemorrhage, hydrops or hydrocephalus.
  - Asymptomatic: by screening following a previous pregnancy in which NAITP was either confirmed or strongly suspected (eg unexplained 2nd or 3rd trimester IUD or recurrent late miscarriage).
- In newborn:
  - Bleeding, bruising, petechiae.
  - Platelet count performed for other reasons.

4.2.6.1.2 NAITP Investigation

- It is extremely important to make the diagnosis for the management of future pregnancies as well as the immediate clinical problem.
- Discuss platelet antigen investigations with Consultant Neonatologist and/or Haematologist on-call.
- Send to NNUH Blood Bank for Group and Platelet Antigen Screen:
  - Infant – 1mL EDTA specimen (cord blood if antenatally-diagnosed case).
  - Mother – 3x6mL EDTA and 6mL Clotted.
  - Father – 3x6 mL EDTA.

4.2.6.1.3 NAITP Management

- Obstetric management is dealt with in a separate guideline (see NNUHFT Intranet Obstetric Dept Guideline page Ref:AO23)

Known NAITP

- Avoid intramuscular injections (e.g. vitamin K) unless platelet count is known to be >50x10^9/L.
- Severe thrombocytopenia (Platelet count <25x10^9/L).
  - Give urgent platelet transfusion with **ABO/RhD-compatible HPA1a- and HPA5b-negative platelets** if available (may take up to several hours). If severely haemorrhagic, a transfusion of random donor platelets may be available more quickly and may produce a short-lived increment of clinical benefit.
  - If platelets are unavailable, IVIg 1g/kg/dose given as an infusion over 6 hours on two consecutive days will often raise the platelet count but may take 24-48hours to be effective. Contact pharmacy and complete the request form for Immunoglobulin available from intranet (http://intranet/committees/DTMM/index.htm).
- Moderate thrombocytopenia (Platelet count 25-50x10^9/L).
  - Asymptomatic – monitor count daily until rising trend is established and continue to monitor until count >50x10^9/L. If count falls <25X10^9/L transfuse as above.
  - Symptomatic – transfuse as above.
- Mild thrombocytopenia (Platelet count >50x10^9/L).
  - Monitor daily until rising trend established.
  - Transfuse as above if significant bleeding occurs.

Suspected but unproven NAITP

- Severe thrombocytopenia (Platelet count <30x10^9/L).
  - Discuss the suspected diagnosis with the NNUH Haematology Consultant and Blood Bank as soon as possible.
  - Perform serology and antigen status on infant and parents (see 4.1.6.1.2) but do not await results before treating.
  - Give urgent platelet transfusion with **ABO/RhD-compatible HPA1a- and HPA5b-negative** platelets if available [may take several hours]. If severely haemorrhagic, a transfusion of random donor platelets may be available more quickly and may produce a short-lived increment.
  - Monitor platelet count daily initially until rising trend established and continue to monitor until count >50x10^9/L.
- Moderate thrombocytopenia (Platelet count 25-50x10^9/L)
  - Asymptomatic – monitor daily initially until rising trend established and continue to monitor until count >50x10^9/L. If count falls <25X10^9/L then transfuse as above.

- Symptomatic – transfuse as above.

4.2.6.1.4 NAITP Follow-up

- Recovery of normal platelet counts usually takes 10-14 days but delays of 3-4 weeks are described.
- Monitor platelet count daily until rising trend is established and then less frequently until count >50x10^9/L.
- Appropriate counselling should be arranged for the mother with a Consultant Obstetrician and Consultant Haematologist to cover implications for future pregnancies and transfusion requirements.

4.2.6.2 Thrombocytopenia from other causes

4.2.6.2.1 Investigations

- Consider list of causes (**4.2.3**) and investigate appropriately based on history, examination and time of onset.

Classification of Thrombocytopenia by most common time of onset	
Time of onset	**Condition**
Fetal	**Alloimmune** **Congenital infection** **Aneuploidy** **Maternal Autoimmune (ITP, SLE)** Severe Rh Disease Congenital/inherited (eg Wiskott-Aldrich)
Early-onset <72 hours	**Placental insufficiency** **Perinatal asphyxia** **DIC** **Alloimmune** **Maternal Autoimmune** Congenital infection Thrombosis BM replacement eg leukaemia Kasabach-Merritt Congenital/inherited (eg TAR)
Late-onset ≥ 72 hours	**Sepsis** **NEC** Congenital infection Kasabach-Merritt Congenital/inherited (eg TAR)

- Clotting studies should be performed:
  - If platelet count <25x10^9/L.
  - If there is active bleeding.
  - With signs of severe sepsis or NEC.

4.2.6.2.2 Management

Transfuse 20 ml/kg of type-specific platelets over 30 minutes if:

- Severe thrombocytopenia (Platelet count <25x10^9/L).
- Mild (>50x10^9/L) or moderate thrombocytopenia (25-50x10^9/L) **and** active bleeding.

Consider platelet transfusion if:

- Indometacin or Ibuprofen to be used (e.g. for PDA closure) and platelet count <50x10^9/L.
- Invasive procedure required (e.g. surgery, lumbar puncture, suprapubic aspiration of urine) and platelet count <50x10^9/L.

If auto-immune disease is suspected (maternal ITP/SLE) **IVIg 1g/kg/dose** for two consecutive days may be effective.

4.3. Fresh Frozen Plasma (for coagulopathy)

4.3.1 Notes on Clotting studies

There is some evidence for “normal range” values for term infants but those for preterm and sick new-borns are not clearly established. Commonly, such infants have some prolongation of PT and APTT; also Fibrinogen levels are lower than in older patients. However, there is no evidence to suggest that underlying derangement of clotting function is implicated in most periventricular or other forms of haemorrhage, including surgical bleeding

4.3.1.1 Indications for clotting studies

Clotting studies are not routinely indicated in well infants, including those who require surgery. They should be performed:

- Where there is clinical evidence of bleeding (pulmonary, umbilical, intraventricular haemorrhage grade 3 or above).
- In clinical situations where the risk of DIC is significant and platelet count is low (see **4.2.6.2.1**).
- In acute liver failure.
- Where there is a known inheritable defect of coagulation factors (e.g. Haemophilia).
- After significant peri-partum hypoxia-ischaemia.

NB if fibrinogen levels are required, a separate request must be made on ICE

4.3.1.2 Sampling

- Fill a blue topped bottle with blood exactly to the required mark (approximately 1.8 mLs).

- Ideally the blood should not be drawn from a heparinised line, but if alternative routes are impractical, then draw back approximately 5 mLs to "clear" the line, draw the sample and replace the "cleared" blood. Identify source of sample on ICE request.

4.3.1.3 Normal values

Test	Gestation in weeks			Age
	28-31	32-36	term	adult
PT (secs)	23	17 (12-21)	16 (13-20)	12-14
APTT (secs)	N/A	70 (58-82)	55 (45-65)	44
Fibrinogen	2.43 (1.5-3.8)			

Nathan & Oski Hematology of Infancy and Childhood 4th Ed: Saunders 1992 Roberton 4th Ed

4.3.2 Specific conditions

4.3.2.1 Vitamin K Deficiency Bleeding (VKDB) is preventable with a single dose of parenteral Vitamin K.

- Vitamin K should be given to all newborn infants admitted to NICU.
- A second dose is rarely required in the first few weeks of life and should not be given unless there is good evidence of deficiency.
- Suspected Vitamin K deficiency should be treated with parenteral vitamin K and, if active bleeding occurs, with FFP 20 mL/kg.
- Where vitamin K deficiency is suspected, this should be confirmed by measuring PIVKA-II levels (elevated in VKDB).

4.3.2.2 Disseminated Intravascular Coagulopathy (DIC)

- Is the most common coagulopathy in preterms and sick newborns.
- Treat underlying cause whenever possible (e.g. sepsis, acidosis, hypoxia).
  - If coagulopathy is severe (INR > 2) give 20mLs/kg fresh frozen plasma (FFP) over 1 hour (**after discussion with consultant**).
  - If fibrinogen falls below 0.8g/L give cryoprecipitate 10ml/kg over 30 minutes.
  - Repeat clotting studies after treatment (with FFP or cryoprecipitate).

4.3.2.3 Severe liver failure is usually accompanied by profound coagulation derangements, including hypo-fibrinogenaemia. These children will need blood product support with cryoprecipitate (if the fibrinogen is less than 0.8 g/l) and FFP, until the liver recovers or the child has a liver transplant.

4.3.2.4 Other coagulation defects are rare and should be discussed with a NNUHFT Consultant Haematologist for advice on appropriate investigation and Factor replacement. FFP may occasionally be needed if active bleeding requires urgent treatment before specific diagnosis or treatment is available.

4.3.2.5 Surgery

- Well infants do not require routine pre-operative testing of clotting studies.
- Clotting studies should be performed in infants with:

- Previous significant bleeding.
- Sepsis.
- Other conditions with high risk of DIC eg severe hypoxia-ischaemia.

- Whilst there is no published evidence on which to base recommendations about "safe" levels of clotting values for infants scheduled for surgery, local consensus [haematology, neonatal, surgical and anaesthetic] suggests the use of FFP should be considered with values around 1.5 x normal ie PT > 24 secs or APTT > 66 secs.

4.4 Cryoprecipitate

- May, occasionally, be required in cases of hypofibrinogenaemia (eg DIC).
- If fibrinogen falls below 0.8g/L give cryoprecipitate 10ml/kg over 30 minutes.

4.5 Human albumin solution

4.5.1 Hypovolaemia: Colloid infusions (human albumin, FFP etc) are not indicated in the resuscitation of infants requiring fluid volume expansion for suspected hypovolaemia. Instead, give 0.9% saline 10mLs/kg infused over 20mins.

4.5.2 Metabolic acidosis requires appropriate steps to identify and treat the cause. Occasionally, hypoperfusion due to hypovolaemia will be the suspected cause and a single infusion of saline (as above) may be justified. Colloids should not be used.

4.5.3 Hypoalbuminaemia:

- Low serum albumin levels and peripheral oedema are extremely common in preterm infants (mean values rise from 19g/dl at 26 weeks GA to 31g/dl at term).
- There is no controlled trial evidence of clinical benefit from albumin infusion in hypoalbuminaemic preterm infants.
- 4.5% human albumin solution (HAS) should not be used as it contains insufficient albumin to effect a rise in serum values.
- 20% HAS (10ml/kg or 2g/kg) may be considered for use when severe hypoalbuminaemia (<15g/dl) is associated with:
  - Pulmonary oedema.
  - Hypovolaemia causing circulatory compromise.
  - Gross tissue oedema compromising wound healing post-surgery.

4.6 Intravenous Immunoglobulin (IVIg)

The use of Intravenous immunoglobulin may be indicated in the following conditions:

- Immune-mediated thrombocytopenia.
- NAITP - see section 4.2.6.1.
- Maternal ITP - see section 4.2.6.2.2.
- Maternal SLE - see section 4.2.6.2.2.

- Haemolytic Disease of the Newborn (see Trust Guideline for the Management of Haemolytic Disease of Newborn including Exchange Transfusion Ref: CA4053 V2).

NB. Supplies of IVIg are variable and usage may be limited at times of shortage.

5. Clinical audit standards

1. All blood products given should have a clear clinical indication recorded in the notes, compatible with advice in this guideline.
2. All infants with thrombocytopenia should have platelet counts monitored at intervals compatible with advice in this guideline.
3. Platelet transfusions should only be given for thrombocytopenia which is either severe or associated with significant bleeding.
4. Where coagulopathy requires treatment with FFP or cryoprecipitate, the clinical indication for treatment should be clearly documented.
5. Where coagulopathy requires treatment with FFP or cryoprecipitate, clotting studies should be repeated after treatment.

6. Glossary

FiO_2	Fractional Inspired Concentration of Oxygen
FFP	Fresh Frozen Plasma
GA	Gestational age
Hb	Haemoglobin
HELLP	Haemolysis, Elevated Liver enzymes, Low platelets
HPA	Human Platelet Antigen
NAITP	Neonatal Alloimmune Thrombocytopenic Purpura
PCV	packed cell volume
RBC	Red blood cell
SLE	Systemic Lupus Erythematosus

7. Summary of development and consultation process undertaken before registration and dissemination

The original guideline (CA 2045) was drafted by Drs Dyke, Wimperis and Turner on behalf of the Neonatal and Haematology Departments. It was circulated for comments to Neonatal Consultants Specialist Registrars, ANNPs and SHOs and discussed at the Departmental Guidelines meeting where amendments were made to incorporate suggestions and comments. The neonatal unit pharmacist also reviewed it. The main author undertook an audit of practice against this guideline in 2009, reviewed the published literature to inform guideline updates in 2009 and 2012 and has incorporated some new evidence, after which revised versions have been approved [at a Departmental Guideline meeting in Jan 2009 and via circulation [August 2012].

Following a clinical incident review in 2017 a further amendment was made to guidance on clotting studies in surgical cases, based on a literature review and multi-disciplinary consensus meeting [Drs Arora, Dyke, Lyall, Mr England, Mr Mathur]. In 2019 the

document was reloaded to incorporate the hyperlinks to relevant forms. In 2021 a further revision was made to platelet transfusion thresholds based on the publication of RCT evidence

This version has been endorsed by the Clinical Guidelines Assessment Panel.

8. Distribution list/ dissemination method

- Hospital intranet.
- Neonatal Unit.

9. References

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10 Source documents

Performing Exchange Transfusion in Newborn Trustdocs id 1304

Trust Guideline for the Management: of Massive Blood Loss in Children (C-MBL) Trustdocs ID: 9960

Trust Guideline for the Use of Irradiated Blood and Blood Products, Trustdocs ID: 1286

Appendix 1

Source and preparation of Neonatal Blood products

Components for neonates are prepared from blood donated by donors who have given at least 1 donation in the past 2 years, and which was negative for all mandatory markers. Ideally the donors should be male.

Red cells should be:

- Preferably suspended in SAG-M (except for those used for exchange transfusion).
- ABO and RhD compatible with infant.
- K negative.
- Free from clinically significant antibodies including high titre anti A and anti B.
- CMV antibody negative.
- HbS screen negative if large volumes are used.
- Irradiated if necessary.

Platelet transfusions should be:

- Free from clinically significant antibodies including high titre anti A and anti B.
- CMV antibody negative.
- Preferably collected by apheresis to limit donor exposure; pooled platelets may be used if apheresis not available.
- Irradiated if necessary.

Fresh frozen plasma should be

- Manufactured from whole blood or apheresis plasma from volunteer male donors.
- Sourced from abroad (currently USA).
- Treated with methylene blue to inactivate viruses.

Cryoprecipitate

- For neonates and infants is derived from US sourced plasma that has been MB treated.

Appendix 2

*****For form see**

NICU Blood Transfusion Form (Trustdocs id 11360) or click here

Form developed by Karen Hinchley, Neonatal Nurse

Our Vision
To provide every patient with the care we want for those we love the most

Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

NICU Blood Transfusion form

D

Name:.....

Hospital Number:..... Date ...../...../20

Affix label	Pre transfusion Hb: .....g/L Target Hb: 160g/L (in most cases) Desired rise in Hb g/L x 0.4 x Wt (Kg) or 20 mL/Kg Amount to be transfused (use greater amount)..... Pack number

Yes/No	
	Does the patient need a new cross match for change of name?
	Parents informed?
	Has blood been ordered and written up?
	Do you have a site to give blood through?
	Do you need furosemide?
	Is there an ID barcode on cot/baby?
	Pick up slip from EBT)
	Once blood collected n EBTS
	Is the NNST due and lours post last transfusion)

				spirations	Saturations	BP
Pre transfusion observations						
Observations 15 minutes into transfusion.						
Observations 30 minutes into transfusion.						
Observations 45 minutes into transfusion.						
Observations 1 hour into transfusion.						
Observations 2 hours into transfusion.						
Furosemide administered? Yes/No						
Observations 3 hours into transfusion.						
Observations when transfusion complete.						

Pump number:

Time	Rate	Total	Site

Yes/No	
	Time completed documented on drug chart
	Any reaction noted?
SIGN	
	Completed transfusion on EBTS (ended)

Appendix 3

For actual document click here [Trustdocs ID 16379]

Our Vision
To provide every patient with the care we want for those we love the most

Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

NICU FFP form

D

Name:.....

Hospital Number:..... Date: dd/mm/yyyy ...../...../20

Affix label	*Circle* **Doctor / ANNP** **Clinical indication for FFP.....** **Pre transfusion INR: .....** **Amount to be transfused (20mls/kg).....** **Discussed with Consultant/documented** ☐

Yes / No	**Nursing staff**
	Does the patient need a new cross match for change of name?
	Parents informed?
	Has FFP been ordered and written up?
	Do you have a site to give FFP through?
	Is there an ID barcode on cot/baby?
	Pick up slip from EBTS (Electronic Blood Tracking System)
	Once FFP collected double check and start transfusion on EBTS
	Pack number

Example

Nursing Staff				espirations	Saturations	BP
Pre transfusion observations						
Observations 15 minutes into transfusion.						
Observations 30 minutes into transfusion.						
Observations 45 minutes into transfusion.						
Observations 1 hour into transfusion.						
Observations at end of transfusion						

Pump number:

Time 24 hour clock	Rate	Total	Site

Yes/No	
	Time completed documented on drug chart
	Any reaction noted?
Print name and Signature	
	Completed transfusion on EBTS (ended)
Doctor/ANNP	**Post FFP transfusion clotting studies performed** ☐