Platelet Use in Paediatrics and Neonates

Rachel Moss

Senior Transfusion Practitioner

Great Ormond Street Hospital NHS Foundation Trust

The child first and always

Disclaimer

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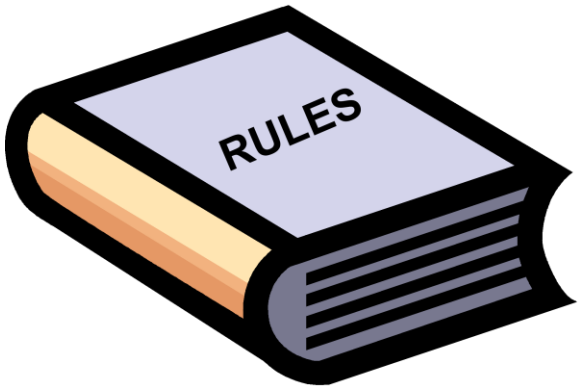
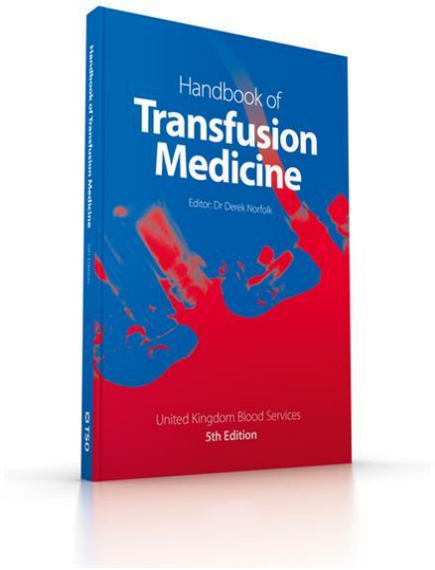
1. I'm not a Paediatrician
2. Dr Helen New is the expert on all things paediatrics and platelets (she wrote the guidelines) so she can follow up on difficult questions helen.new@nhsbt.nhs.uk
3. I'm not going to discuss IUT
4. Not all hospitals follow national guidelines

Rules

- More rules in paediatric transfusion than in adults –
  - Age of blood
  - Age of the child
  - Type of surgery
  - Weight of the child
  - Plasma sourced from outside the UK
  - MBFFP v SDFFP
  - Apheresis platelets



UK Paediatric Platelet Guidelines



NICE National Institute for Health and Care Excellence

***PLUS* Local guidelines**

BSH: Guidelines on transfusion for fetuses, neonates and older children

- 2016 BSH guideline; previously published in 2004
- “Although there has been little evidence on which to base paediatric clinical transfusion decisions in the past, there have been a number of studies and national audits published over recent years that contribute to decision-making in this area. In addition there have been changes to other guidance, including the management of neonatal jaundice (NICE, 2010) and the requirement for cytomegalovirus (CMV) seronegative components”
- Long guideline (91 pages…..)

Neonates

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- Transfusion triggers for neonates vary depending on the clinical context including their gestational age at birth
- Usual definition of a neonate <28 days but if EDD not known then may change (e.g. GOSH neonate defined as <6 months)
- In NICU most transfusions given to <32 weeks gestational age (NCA 2010)
- Guidelines tend to be the same whether pre-term or term
- Audits have shown most platelet transfusions are given as prophylaxis in the absence of bleeding

Neonatal thrombocytopenia

- Common problem amongst neonates on NICU
- Most platelets are given for prophylaxis not bleeding
- Varied thresholds, dose and follow-up
- Very little evidence
  - moderate thrombocytopenia (50-150 x 10^9/l) not detrimental (RCT Andrew et al, 1993)
  - unclear < 50 x 10^9/l

PlaNeT Studies

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- PlaNeT-1
  - observed current practice and outcomes
  - 169 neonates; platelets < 60 x 10^9/L
  - most transfusions prophylactic & to preterm neonates (Stanworth et al, 2009)
- PlaNeT-2
  - a randomised controlled trial of platelet transfusion thresholds
  - 25 vs 50 x 10^9/L

Needed more information so I asked Dr Simon Stanworth

Neonatal thrombocytopenia

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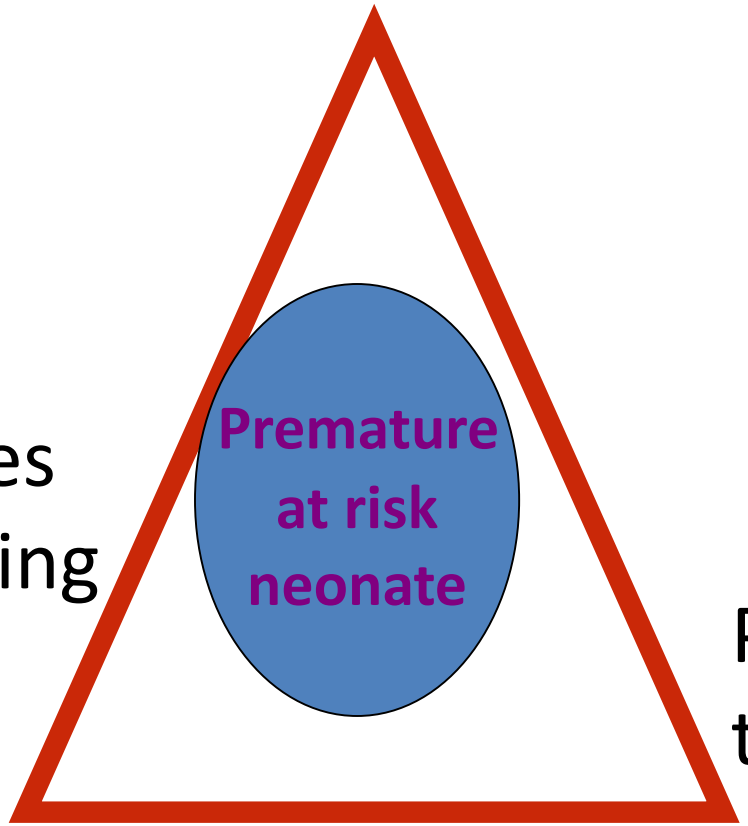
Prevalence: 1 - 5% of all infants
25% NICU admissions
5-10% severe thrombocytopenia

Thrombocytopenia



Outcomes & Bleeding

Platelet transfusions

Platelet transfusions - Use as prophylaxis

Results PLaNeT-1

- For 338/415 (81%) transfusions the main recorded reason for transfusion was low platelet count (prophylaxis)
- Many platelet transfusions were given as prophylaxis often well after 'risk period' for major haemorrhage has passed
- Variability in platelet counts pre-transfusion between 25 – 50 $x10^9$/L

PlaNeT-1 Study Group, Pediatrics, 2009

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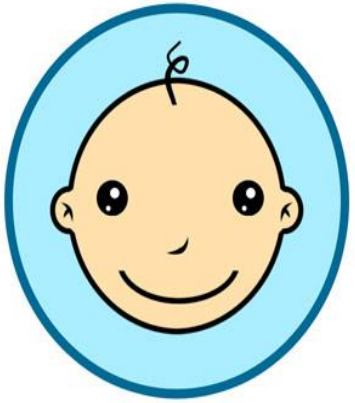
25 or 50!

Platelets for Neonatal Transfusion Study-2
(PlaNeT-2/Matisse)
A randomised trial of platelet transfusion thresholds



PlaNeT-2

MRC Medical Research Council

NHS National Institute for Health Research

NHS Blood and Transplant

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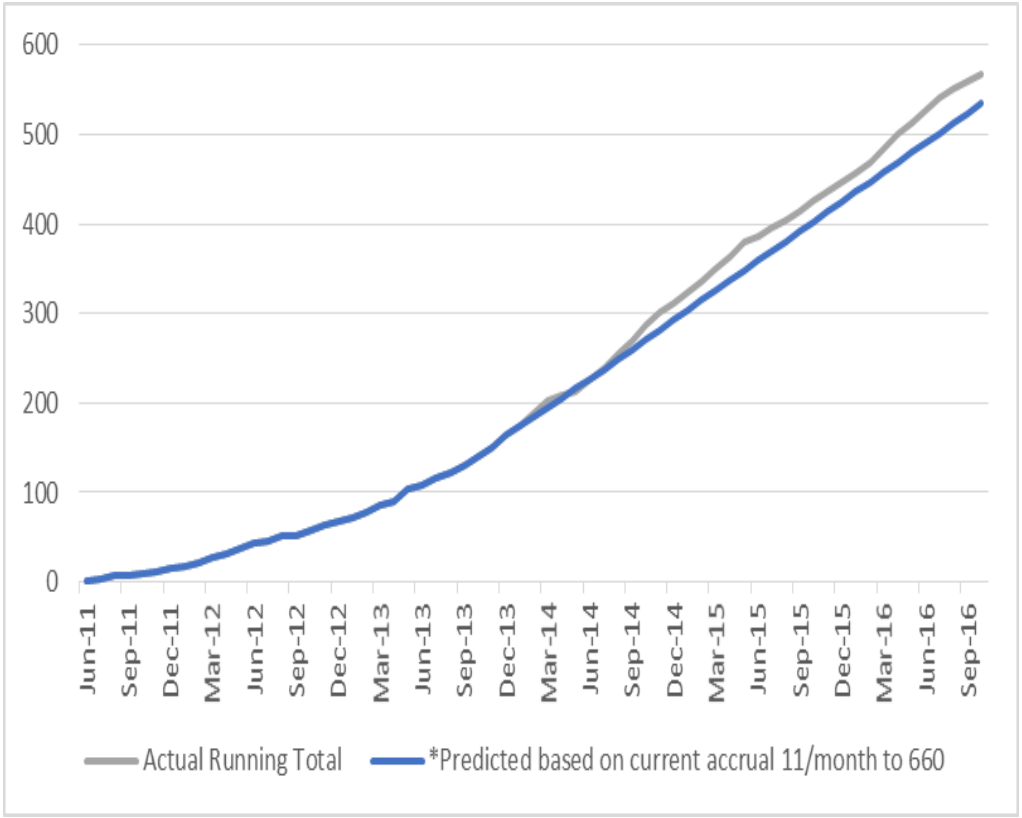
PlaNeT-2/MATISSE trial

- Define optimal and safe platelet transfusion support for severely thrombocytopenic pre-term neonates
- Compare clinical outcomes in neonates randomised to maintain platelet counts at or above either $25x10^9$/L or $50x10^9$/L
- www.planet-2.com

PlaNeT-2/MATISSE trial

- Randomisations: many challenges
- But study recruitment now complete
- Data currently being analysed



Neonatal platelets

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Platelet Count (x 10^9/l)	Indication for platelet transfusion
<25	Neonates with no bleeding (including neonates with NAIT if no bleeding and no family history of ICH)
<50	Neonates with bleeding, current coagulopathy, before surgery, or infants with NAIT if previously affected sibling with ICH
<100	Neonates with major bleeding or requiring major surgery (e.g. neurosurgery)

Neonatal platelet recommendations

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1. For preterm neonates with very severe thrombocytopenia (platelet count below 25 $x10^9$/L) platelet transfusions should be administered in addition to treating the underlying cause of the thrombocytopenia (Grade 2C)

2. Consider IVIg in NAIT refractory to platelets negative for HPA-1a/5b antigens or if antigen-matched platelets are unavailable (1C)

NAIT

- It is recommended all suspected NAIT is discussed with the haematologist
- NAIT results most commonly from maternally derived anti-Human Platelet Antigen (HPA) 1a or 5b platelet antibodies
- As shown previously bleeding history affects platelet trigger for transfusion
- UK Blood Services stock platelets negative for HPA-1a/5b antigens, antibodies to which are responsible for over 90% of cases
- Pre & post transfusion platelet counts are required for increment review
- Monitor for IVH

Older Children

- Most platelets are given to PICU, haem-onc and cardiac surgery patients
- Prophylactic platelets are common in post BMT patients
- Despite reviewing the literature the guideline states – “is insufficient evidence in children to significantly change recommendations made in the previous BCSH guidelines”
- Platelet thresholds are suggested dependant on clinical situation

Older children

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Platelet count (x 10^9/l)	Clinical situation to trigger platelet transfusion
< 10	Irrespective of signs of haemorrhage (excluding ITP, TTP/HUS, HIT)
< 20	Severe mucositis Sepsis Laboratory evidence of DIC in the absence of bleeding* Anticoagulant therapy Risk of bleeding due to a local tumour infiltration Insertion of a non-tunnelled central venous line
< 40	Prior to lumbar puncture**
< 50	Moderate haemorrhage (e.g. gastrointestinal bleeding) including bleeding in association with DIC Surgery, unless minor (except at critical sites) - including tunnelled central venous line insertion
< 75 -100	Major haemorrhage or significant post-operative bleeding (e.g. post cardiac surgery) Surgery at critical sites: central nervous system including eyes

note: routine screening by standard coagulation tests not advocated without clinical indication; for laboratory evidence of DIC

Lumbar Puncture

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- Suggested: < 40 Prior to lumbar puncture
- Caveat: It is accepted that prior to lumbar puncture some clinicians will transfuse platelets at higher counts (e.g. 50 x 10^9/L) in clinically unstable children, non ALL patients, or for the first LP in newly-diagnosed ALL patients to avoid haemorrhage and CSF contamination with blasts, or at lower counts (≤ 20 x 10^9/L) in stable patients with ALL, depending on the clinical situation
- These practices emphasise the importance of considering the clinical setting and patient factors

Recommendations

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1. Given a lack of studies in paediatrics, recommendations for platelet transfusions in critically ill children or those with haematological/oncological malignancies who develop severe thrombocytopenia are drawn from the wider adult literature and recommendations (2C)
2. As pragmatic guidance, it is suggested that for most stable children prophylactic platelet transfusions should be administered when the platelet count is below 10 x 10^9/L, excluding patients with ITP, TTP/HUS, and HIT who should only be transfused with platelets for life-threatening bleeding (2B).

Shared Care Haem-Onc protocol

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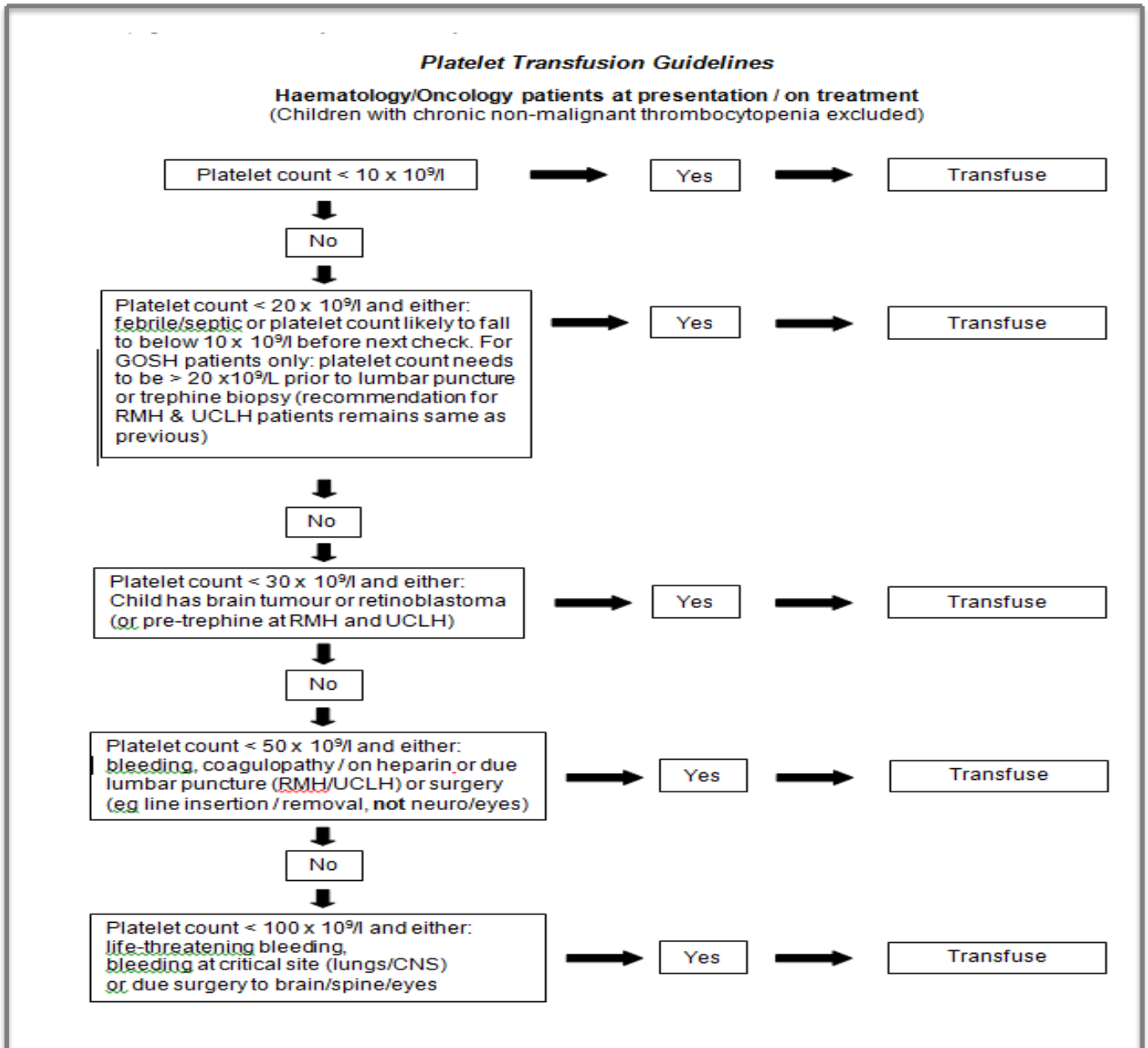

Platelet Transfusion Guidelines

Haematology/Oncology patients at presentation / on treatment
(Children with chronic non-malignant thrombocytopenia excluded)

Platelet count < 10 x 10^9/l → Yes → Transfuse

↓ No

Platelet count < 20 x 10^9/l and either: febrile/septic or platelet count likely to fall to below 10 x 10^9/l before next check. For GOSH patients only: platelet count needs to be > 20 x10^9/L prior to lumbar puncture or trephine biopsy (recommendation for RMH & UCLH patients remains same as previous) → Yes → Transfuse

↓ No

Platelet count < 30 x 10^9/l and either: Child has brain tumour or retinoblastoma (or pre-trephine at RMH and UCLH) → Yes → Transfuse

↓ No

Platelet count < 50 x 10^9/l and either: bleeding, coagulopathy / on heparin or due lumbar puncture (RMH/UCLH) or surgery (eg line insertion / removal, **not** neuro/eyes) → Yes → Transfuse

↓ No

Platelet count < 100 x 10^9/l and either: life-threatening bleeding, bleeding at critical site (lungs/CNS) or due surgery to brain/spine/eyes → Yes → Transfuse

Significant Bleeding

- Significant bleeding is typically considered at grades 2-4 (Stanworth et al, 2014; NICE, 2015).
- Although the WHO bleeding scale is more commonly used for clinical research in adults, BSH suggest that a pragmatic modification may be used to help guide transfusion decisions based on bleeding risk, taking into account the types of bleeding and changes in haemodynamic parameters appropriate for neonatal and paediatric patients in different clinical situations

Major haemorrhage

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- All guidance largely extrapolated from adult practice
- Trauma bleeding is relatively rare in children
- Surgical bleeding (e.g. cardiac surgery) more common
- 50kg seems to be an accepted cut-off point between adult bleeding algorithm and paediatric
- As in adults platelets are given as part of the major haemorrhage protocol
- 1:1 ratio e.g. 20mls/kg RBC:FFP

GOSH MHP

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Consider platelets 15 ml/kg

MAJOR HAEMORRHAGE PROTOCOL

Rapid blood loss with shock or with no likelihood of control
Anticipated or actual administration of 40 mL/kg of blood

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Call 2222 & state "MAJOR HAEMORRHAGE"
Give Ward Name/Location, Level and Building

THEN CALL THE BLOOD TRANSFUSION LABORATORY
Monday to Friday 08.30 – 17.30 Ext. 8527
Out of hours Bleep 0590

Information needed

- Have patient identification details and weight available
- Nominate a team leader *and* one person to communicate with the laboratory
- Nominate a member of the team to convey blood samples and blood components (Do not use CARPS, Porters are not part of the Major Haemorrhage Protocol)
- Consider getting help from other clinical areas / clinical teams

Send samples

- Group & screen as a priority if no valid sample & ideally before any transfusion (please use Blood Track to label the blood sample where possible)
- FBC and coagulation samples as a baseline and hourly

Treatment Plan

Components

- Use Emergency O Negative ("Flying Squad") blood until group specific available

Request Immediately:

- 30 ml/kg blood
- 30 ml/kg Octaplas
- **Give RBCs:Octaplas in 1:1 ratio** (*take account of emergency O Negative blood given before issued RBCs)*

For ongoing bleeding:

- Continue with RBC:Octaplas 1:1 ratio as above
- Consider Platelets 15 ml/kg
- Consider Cryoprecipitate 10 ml/kg
- Consider Tranexamic Acid – *10-15 mgs/kg bolus*
- Consider Fibrinogen Concentrate

- Continue to monitor and call the Blood Transfusion Laboratory to order further components if patient still bleeding
- Where available use a blood warmer for rapid infusion
- Inform the Laboratory when the MHP is stood down

Availability of Blood

Immediate

Emergency O Negative blood:

- Transfusion Laboratory - 2 units
- MSCB Theatres - 2 units
- NICU - 1 unit

10 minutes
Group specific blood

45 minutes
Crossmatched blood
(90 mins if no valid sample)

Octaplas (FFP)
45 minutes to thaw (if no Octaplas on stand-by)

Cryoprecipitate
15-30 minutes to thaw

Platelets
2 units on site (immediate):
Further delivery up to 3 hours

Please discuss ongoing management with the Haematology Clotting SpR (Bleep 0381/ via Switchboard OOH) and / or Haemophilia Consultant for specialist coagulation and dosing advice

Great Ormond Street Hospital NHS foundation Trust: MAJOR HAEMORRHAGE PROTOCOL July 2018 v4.0

NICE

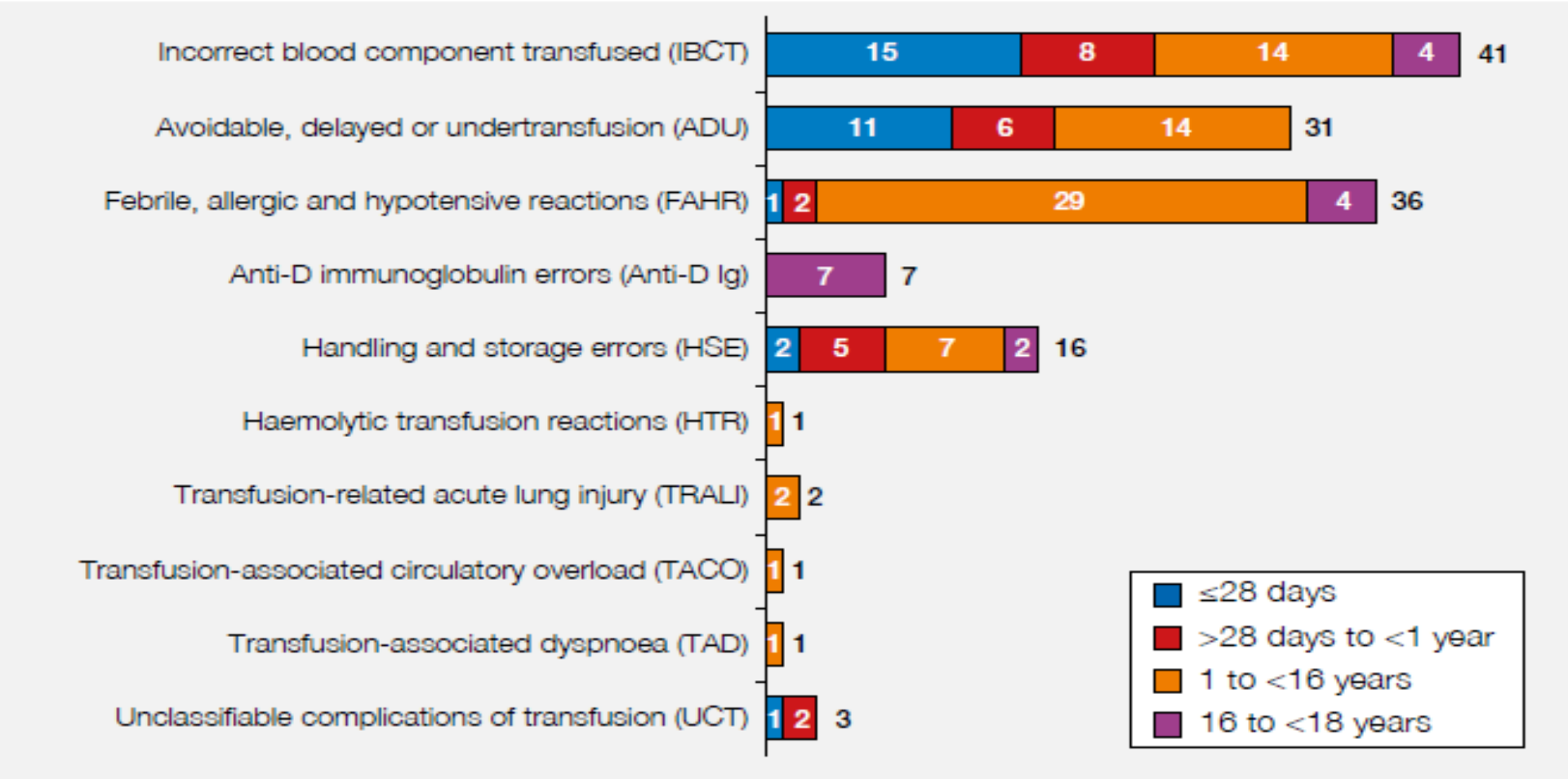
NICE guidance aimed at patients over 1 year old and adults

- Patients who are not bleeding or having invasive procedures or surgery
- Offer prophylactic platelet transfusions to patients with a platelet count below 10×10^9 per litre who are not bleeding or having invasive procedures or surgery, and who do not have any of the following conditions:
  - chronic bone marrow failure
  - autoimmune thrombocytopenia
  - heparin-induced thrombocytopenia
  - thrombotic thrombocytopenic purpura

SHOT Report 2017

SERIOUS HAZARDS OF TRANSFUSION SHOT

8% all SHOT reports relate to paediatrics

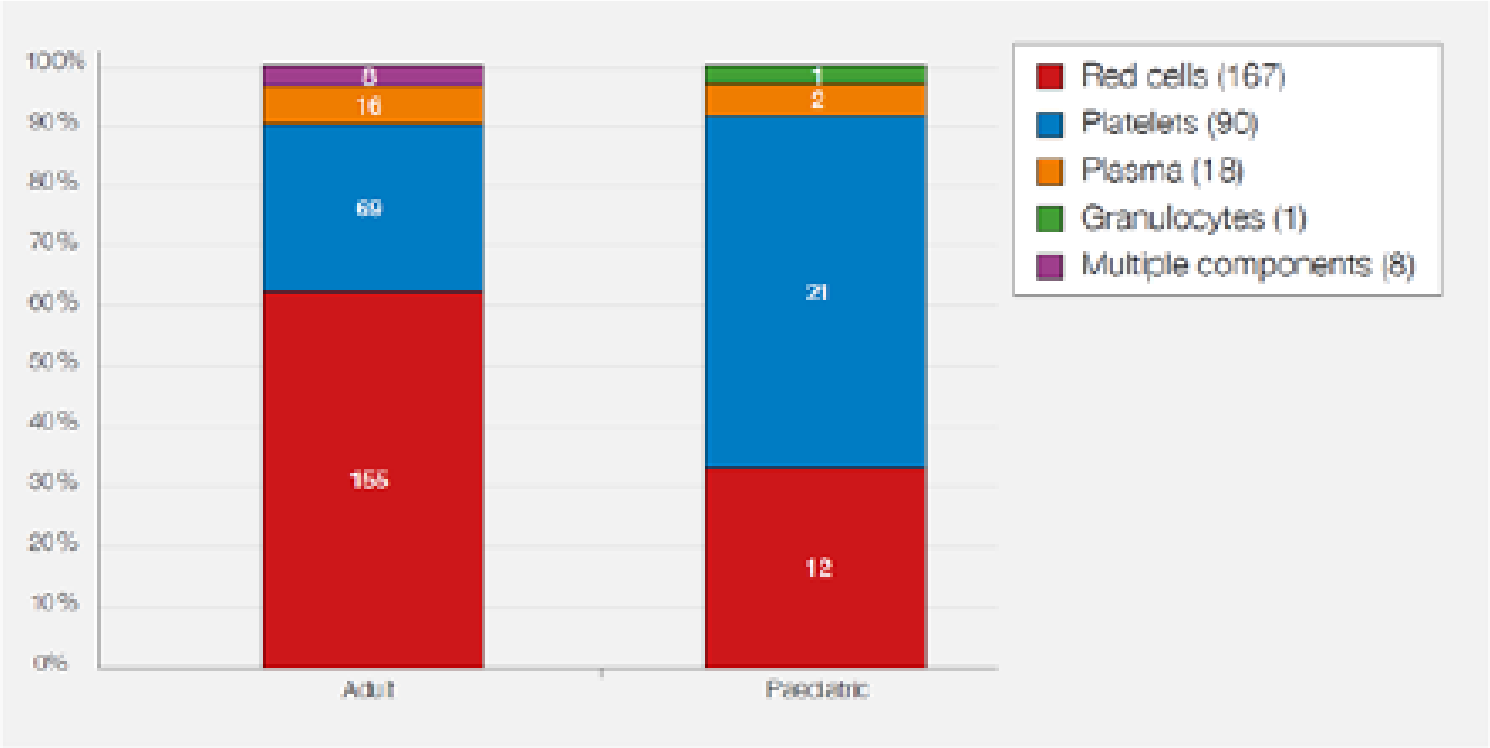


Fiona Regan speaking at 14.30 so not going to dwell on SHOT data

Reactions

- 23% of the reaction reports to SHOT were paediatric
- The proportion of FAHR (febrile, allergic & hypotensive) reactions (previously classed as ATR) *for platelets* is always high for paediatrics (primarily allergic)
- Awareness that plasma rich components (platelets & plasma) are associated with a higher proportion of allergic and anaphylactic reactions should be considered when considering prophylactic transfusions

Reactions



Paediatric reaction type by component 2017

SHOT Bites

Great Ormond Street Hospital for Children NHS
NHS Foundation Trust

SHOT Bite No 4: Lessons in Paediatrics (including neonates)

SERIOUS HAZARDS OF TRANSFUSION

0161 423 4208 shot@nhsbt.nhs.uk @SHOTHV1 www.shotuk.org

Paediatric SHOT cases comprise all reports for patients under 18 years of age, subdivided by recipient age groups: neonates are ≤28 days; infants are aged between 28 days and 1 year old; children are over 1 year to less than 16 years, and also those aged 16 to <18 years.

Paediatric cases make up approximately 8% of the total reported to SHOT. They are disproportionately represented in the error categories: incorrect blood component transfused-wrong component transfused (IBCT-WCT), IBCT-specific requirements not met (IBCT-SRNM), and avoidable, delayed or undertransfusion (ADU). This partly reflects the increased complexity of paediatric transfusions. Neonates and children are vulnerable patient groups and may have special transfusion requirements.

Neonates are often intensively transfused and are especially vulnerable to potential adverse effects of transfusion, having immature immune and metabolic systems, and are still undergoing rapid development.

Acute side effects from transfusion may be greater for children than for adults, as a single unit of transfused blood with the potential to cause harm may represent a much greater proportion of their blood volume than in an adult.

Consideration of long-term side effects of transfusion for children is particularly important, as the majority will live for several decades afterwards.

In general paediatric wards, the transfusion of blood and blood components is not common, and this may result in reduced awareness of transfusion-related hazards.

Components provided for transfusion to children less than one year of age have a particular specification, with additional safety features including being from a donor who has given blood (and been tested) at least once before, is CMV negative, HbS negative and Kell negative (see 2016 BSH guidelines[1] for further details). Red cells for neonatal exchange and intrauterine transfusions have a haematocrit that must fall between strictly defined limits. Laboratory information technology systems should be set up that they are able to automatically flag up age-related specific requirements.

Because of their small size children, especially neonates, need smaller volumes of blood than adults. In the UK, small volume 'paedipacks,' where (usually) six small packs of red cells or four smalls packs of platelets are produced from a single adult-sized donation. These packs provide enough blood for a typical neonatal transfusion and at the same time ensure that red cell transfusions can come from the same donor over a period of several weeks.

It may be that in an emergency, delay while waiting for an exact specification would be harmful to the patient and the risk of delay must be balanced against clinical need – an acceptable substitute component may have to be used and there should be pre-agreed local policies in place, but use of non-irradiated, non-leucodepleted maternal blood is NEVER an option.

Neonates should not be resuscitated with an adult O D-negative red cells unless there is no available paedipack. Mitigations put in place by hospitals to reduce the chance of selecting the hospitals to reduce the chance of selecting the incorrect component by clinical staff include having neonatal and adult red cell units placed in containers with visual identifiers to help staff distinguish between them. (Image supplied by Rachel Moss).

July 2018

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Positive Patient Identification

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- Risk of confusion over maternal and baby samples
- Multiple births (especially using consecutive identification numbers)
- Babies without first names
- Failure to apply wristbands
- Removal of wristbands by children and/or parents
- During procedures or wristbands not accessible during surgery

Components

- Standard platelets: Pooled in PAS
- Paediatrics-
  - Apheresis where possible
  - Slightly reduced risk of vCJD
  - Maximum 1 ADT
- Neonates/infants
  - Neonatal donors
  - Split packs – approx. 55mls

Slide courtesy of Helen New

Platelet groups

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Patient's ABO Group	ABO Group of Plasma Components to be Transfused		
	Platelets	*MB FFP & SD FFP¥*	*MB Cryoprecipitate¥*
O			
1st choice	O	O*	O*
2nd choice	A, B or AB	A or B or AB	A or B or AB
A			
1st choice	A	A	A
2nd choice	AB	AB	AB
3rd choice	B†	B¥	B¥
4th choice	O†	-	-
B			
1st ch			
2nd ch			
3rd ch			
4th ch			
AB			
1st ch			
2nd ch			
3rd ch			
4th choice	O†	-	-
U			
1st ch			
2nd c			
3rd c			
4th choice	O†	-	-

† Tested and negative for HT antibodies

If a patient requires HLA-matched platelets, HLA match usually takes precedence over ABO group

Group B or AB platelets may not be available. However, the use of group O platelets for non-O patients should be avoided as much as possible. Platelets should be compatible for D

Apheresis Platelets Myth Buster

NHS Blood and Transplant

Which platelets MUST be apheresis?

1. Human Leucocyte Antigen / Human Platelet Antigen (HLA/HPA) selected platelets for a named patient
2. Platelets for intra-uterine and neonatal transfusions
3. Platelets from an IgA deficient donor

For IgA deficient patients order by arrangement with an NHSBT Consultant

Platelet changes • Change in provision of apheresis platelets

Are apheresis platelets preferred in children and young people?

Those born after 1/1/96 may benefit from apheresis platelets to reduce the risk of variant Creutzfeldt-Jakob Disease (vCJD). The evidence to support this is very low quality. If this would delay treatment or the patient is at an increased risk of an allergic reaction pooled platelets which are suspended in Platelet Additive Solution (PAS) should be used.

Platelet changes • Change in provision of apheresis platelets • BSH Clinical guidelines

Risk of HLA sensitisation from platelets

The TRAP study shows no significant difference in the rate of alloimmunisation between apheresis and pooled platelets. Both apheresis and pooled platelets are leucodepleted reducing the risk of HLA sensitisation.

What about cytomegalovirus (CMV)?

CMV negative blood is rarely required.

Do not order CMV negative components unless the patient requires them

- Intra-uterine transfusions
- Neonates up to 28 days post expected date of delivery
- Elective transfusions during pregnancy (not during labour or delivery)

DO NOT DELAY EMERGENCY TRANSFUSION IF CMV NEGATIVE COMPONENTS ARE NOT AVAILABLE

Cytomegalovirus Tested Blood Components • CMV Factsheet

Myth: "Apheresis platelets should be used for patients who are not demonstrating a good post-transfusion platelet increment."

Fact: There is no benefit from giving randomly selected apheresis platelets in these cases. Instead, take an immediate platelet increment (10-30mins post transfusion) after administering ABO matched platelets. If the increment result is poor, perform investigations for HLA-antibodies

Clinical guidelines • Slichter SJ et al • TRAP study

Myth: "Apheresis platelets are a better component than pooled platelets and should be held as stock."

Fact: NHSBT does not recommend holding apheresis platelets as stock unless this is to support a children's hospital.

Platelet changes • Change in provision of apheresis platelets

Myth: "Apheresis platelets cause fewer allergic reactions."

Fact: There is evidence that apheresis platelets are likely to cause more allergic reactions. Allergic reactions are usually caused by plasma proteins therefore pooled platelets suspended in a 70:30 PAS:plasma ratio rather than apheresis platelets suspended in 100% plasma are preferred in patients at an increased risk.

SHOT

Janet Birchall, Helen New, Emily Carpenter on behalf of the NHSBT Patient Blood Management (PBM) Practitioner and Clinical Team

Version 2.0 July 2017

ABO & RhD

- In Paediatrics all children receive RhD matched platelets – RhD positive platelets are very rarely given to males under the age of 18 (& never to females)
- The use of group O apheresis platelets for non group O neonates and children is not recommended because of the risk of haemolysis

Special requirements

- Irradiated cellular components are supplied for fetal transfusions and specific recipient groups (at GOSH all platelets irradiated)
- CMV negative 28 days post EDD
- All cellular blood components of fetal/neonatal/infant specification for use up to 1 year of age are currently CMV negative

Dr Colin Brown speaking on HLA matched platelets at 13:45 so not discussing them

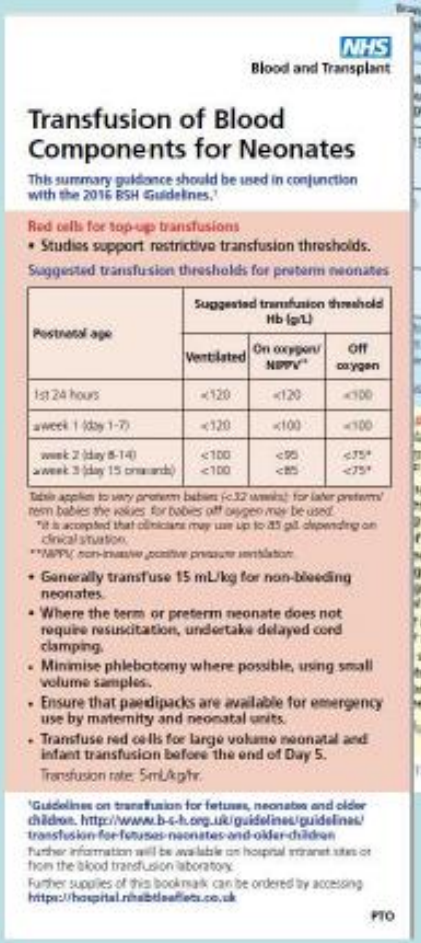
Platelet prescribing

- **10 – 20 mls/kg** up to a maximum of 1 ADT
- Administered over 30- 60 minutes (10–20 mls/kg/hr)
- Double doses rarely required

BSH Recommendations

1. Prescription for paediatric transfusion should be in mL unless there are local risk-assessed protocols for prescribing in units for older children, *and the maximum volume should not be greater than prescribed for adults* (1C).
2. As for recommendations in adults a second sample collected at a different time should be tested for confirmation of the ABO group of a first time patient prior to transfusion unless secure electronic patient identification systems are in place, as long as this does not delay urgent transfusion (1C)

Guideline Bookmarks



NHS Blood and Transplant

Transfusion of Blood Components for Neonates

This summary guidance should be used in conjunction with the 2016 BSH Guidelines.[1]

Red cells for top-up transfusions

- Studies support restrictive transfusion thresholds.

Suggested transfusion thresholds for preterm neonates

Postnatal age	Suggested transfusion threshold Hb (g/L)		
	Ventilated	On oxygen/ NIPPV**	Off oxygen
1st 24 hours	<120	<120	<100
≥week 1 (day 1-7)	<120	<100	<100
week 2 (day 8-14)	<100	<95	<75*
≥week 3 (day 15 onwards)	<100	<85	<75*

Table applies to very preterm babies (<32 weeks); for later preterm/ term babies the values for babies off oxygen may be used.

**It is accepted that clinicians may use up to 85 g/L depending on clinical situation.*

***NIPPV, non-invasive positive pressure ventilation*

- **Generally transfuse 15 mL/kg for non-bleeding neonates.**
- **Where the term or preterm neonate does not require resuscitation, undertake delayed cord clamping.**
- **Minimise phlebotomy where possible, using small volume samples.**
- **Ensure that paedipacks are available for emergency use by maternity and neonatal units.**
- **Transfuse red cells for large volume neonatal and infant transfusion before the end of Day 5.**

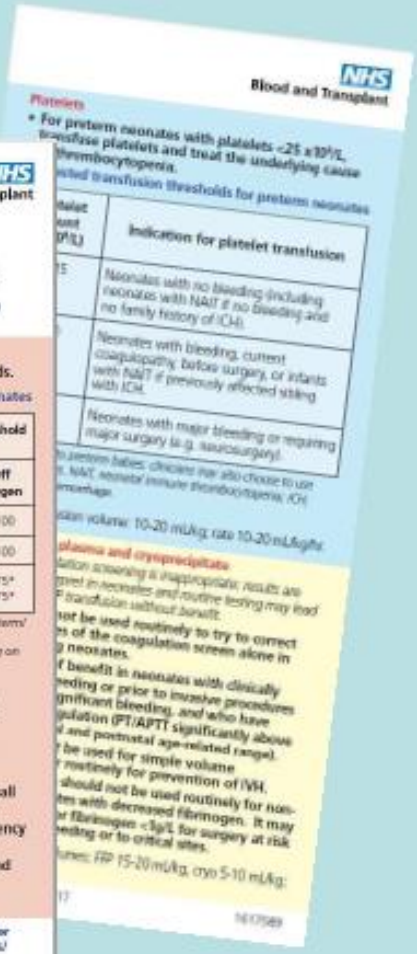
Transfusion rate: 5mL/kg/hr.

[1]Guidelines on transfusion for fetuses, neonates and older children. http://www.b-s-h.org.uk/guidelines/guidelines/transfusion-for-fetuses-neonates-and-older-children

Further information will be available on hospital intranet sites or from the blood transfusion laboratory.

Further supplies of this bookmark can be ordered by accessing **https://hospital.nhsbtleaflets.co.uk**

PTO



NHS Blood and Transplant

Platelets

- **For preterm neonates with platelets <25 x10⁹/L, transfuse platelets and treat the underlying cause thrombocytopenia.**

ested transfusion thresholds for preterm neonates

latelet unt (PT/L)	Indication for platelet transfusion
5	Neonates with no bleeding (including neonates with NAIT if no bleeding and no family history of ICH).
	Neonates with bleeding, current coagulopathy, before surgery, or infants with NAIT if previously affected sibling with ICH.
	Neonates with major bleeding or requiring major surgery (e.g. exsanguinating).

In preterm babies, clinicians may also choose to use it. NAIT, neonatal immune thrombocytopenia; ICH, intracranial haemorrhage.

sion volume: 10-20 mL/kg; rate 10-20 mL/kg/hr.

plasma and cryoprecipitate

ulation screening is inappropriate; results are ained in neonates and routine testing may lead f transfusion without benefit.

ot be used routinely to try to correct s of the coagulation screen alone in neonates.

f benefit in neonates with clinically eeding or prior to invasive procedures gnificant bleeding, and who have gulation (PT/APTT significantly above and postnatal age-related range).

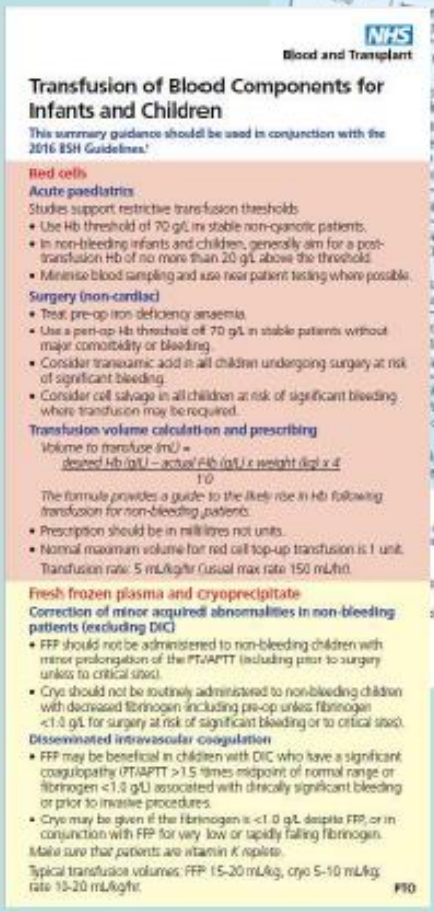
be used for simple volume routinely for prevention of IVH.

should not be used routinely for non- es with decreased fibrinogen. It may r fibrinogen <1g/L for surgery at risk eeding or to critical sites.

umes: FFP 15-20 mL/kg, cryo 5-10 mL/kg;

17

NHS7589



NHS Blood and Transplant

Transfusion of Blood Components for Infants and Children

This summary guidance should be used in conjunction with the 2016 BSH Guidelines.[1]

Red cells

Acute paediatrics

Studies support restrictive transfusion thresholds

- Use Hb threshold of 70 g/L in stable non-cyanotic patients.
- In non-bleeding infants and children, generally aim for a post-transfusion Hb of no more than 20 g/L above the threshold.
- Minimise blood sampling and use near patient testing where possible.

Surgery (non-cardiac)

- Treat pre-op iron deficiency anaemia.
- Use a peri-op Hb threshold of 70 g/L in stable patients without major comorbidity or bleeding.
- Consider tranexamic acid in all children undergoing surgery at risk of significant bleeding.
- Consider cell salvage in all children at risk of significant bleeding where transfusion may be required.

Transfusion volume calculation and prescribing

Volume to transfuse (mL) =

$$\frac{\text{desired Hb (g/L)} - \text{actual Hb (g/L)} \times \text{weight (kg)} \times 4}{1.0}$$

The formula provides a guide to the likely rise in Hb following transfusion for non-bleeding patients.

- Prescription should be in millilitres not units.
- Normal maximum volume for red cell top-up transfusion is 1 unit.

Transfusion rate: 5 mL/kg/hr (usual max rate 150 mL/hr).

Fresh frozen plasma and cryoprecipitate

Correction of minor acquired abnormalities in non-bleeding patients (excluding DIC)

- FFP should not be administered to non-bleeding children with minor prolongation of the PT/APTT (including prior to surgery unless to critical sites).
- Cryo should not be routinely administered to non-bleeding children with decreased fibrinogen including pre-op unless fibrinogen <1.0 g/L for surgery at risk of significant bleeding or to critical sites).

Disseminated intravascular coagulation

- FFP may be beneficial in children with DIC who have a significant coagulopathy (PT/APTT >1.5 times midpoint of normal range or fibrinogen <1.0 g/L) associated with clinically significant bleeding or prior to invasive procedures.
- Cryo may be given if the fibrinogen is <1.0 g/L despite FFP, or in conjunction with FFP for very low or rapidly falling fibrinogen.

Make sure that patients are vitamin K replete.

Typical transfusion volumes: FFP 15-20 mL/kg, cryo 5-10 mL/kg; rate 10-20 mL/kg/hr.

PTO

NHS Blood and Transplant

Platelets

- *For most stable children, transfuse prophylactic platelets when platelet count <10 x 10⁹/L (excluding ITP, TTP/HUS and HIT) where platelets are only transfused for life-threatening bleeding.*

Suggested transfusion thresholds for platelets

Platelet count (x 10⁹/L)	Clinical situation to trigger platelet transfusion
<10	ective of signs of haemorrhage ding (ITP, TTP/HUS, HIT)
	mucositis
	ity evidence of DIC in the absence ding*
	atient therapy eeding due to a local tumour
	of a non-tunnelled CVL
	ular puncture***
	aemorrhage (e.g. gastrointestinal luding bleeding in association
	s minor (except at critical sites) d-tunnelled CVL insertion
	rhage or significant post- ding (e.g. post cardiac surgery) al sites; CNS including eyes
	ding without clinical indication; nicians will transfuse platelets 50 x 10⁹/L) depending on the
	ng (single pack for children e 10-20 mL/kg/hr.

[1]Guidelines on transfusion for fetuses, neonates and older children. http://www.b-s-h.org.uk/guidelines/guidelines/transfusion-for-

rther information will be available on hospital intranet sites or from the blood transfusion laboratory.

rther supplies of this bookmark can be ordered by accessing

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Thank You

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