Paediatric Blood Transfusion Guideline (for the Administration of Blood & Blood Products and the Management of Transfused Patients)

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Guideline to be followed by (target staff):

Medical and nursing staff in all areas where paediatric patients receive blood or blood product transfusions (Neonatal guidelines should be used for any baby under 4 months or who is an inpatient on the neonatal unit regardless of age)

To be read in conjunction with the following documents:

- Milton Keynes University Hospital NHS Foundation Trust. *Blood transfusion policy for administration of blood, blood components and blood products and the management of transfused patients*. PATH/GL/03. Version 9.2, 2019.
- Milton Keynes University Hospital NHS Foundation Trust. *Treatment of patients refusing blood and blood components policy*. PATH/GL/04. Version 7.2, 2020.
- Milton Keynes University Hospital NHS Foundation Trust. *Haematological Management of Major Haemorrhage In Adults.* PATH/GL/05. Version 8.1, 2020.
- Oxford University Hospitals NHS Trust (2019) *Sickle cell guideline*. Version 1.2. July 2019. [Online].
- Oxford University Hospitals NHS Trust (2017) *Blood transfusion guidelines for the use of special blood components in paediatric haematology/oncology*. Version 5.0, July 2017. [Online].

Are there any eCARE implications?

CQC Fundamental standards:

Regulation 9 – person centred care
Regulation 10 – dignity and respect
Regulation 11 – Need for consent
Regulation 12 – Safe care and treatment
Regulation 13 – Safeguarding service users from abuse and improper treatment
Regulation 14 – Meeting nutritional and hydration needs
Regulation 15 – Premises and equipment
Regulation 16 – Receiving and acting on complaints
Regulation 17 – Good governance
Regulation 18 – Staffing
Regulation 19 – Fit and proper

Disclaimer

Since every patient's history is different, and even the most exhaustive sources of information cannot cover every possible eventuality, you should be aware that all information is provided in this document on the basis that the healthcare professionals responsible for patient care will retain full and sole responsibility for decisions relating to patient care; the document is intended to supplement, not substitute for, the expertise and judgment of physicians, pharmacists or other healthcare professionals and should not be taken as an indication of suitability of a particular treatment for a particular individual.

The ultimate responsibility for the use of the guideline, dosage of drugs and correct following of instructions as well as the interpretation of the published material **lies solely with you** as the medical practitioner.

Index

Guideline Statement

This is a general guideline to guide staff in safe transfusion of blood products to children. The definition of a child is <18 years but in many cases, children are admitted to adult wards from the age of 16 years and for these patients the Adult- Blood Transfusion Policy for Administration of Blood, Blood Components and Blood Products and the Management of Transfused Patients may be followed.

There are some patients that will fall outside the parameters described in this document and for these patients who require an individualised clinical decision it will remain the responsibility of the senior medical clinician to make an appropriate decision. For example:

- For a child with an Oncology condition, it may be appropriate to refer to the Oxford Paediatric Oncology Guidelines (which is available as a link on the trust intranet)

- For child with Sickle Cell disease please refer to refer to the Oxford Sickle Cell Protocol (available as a link on the Trust intranet).

A blood transfusion, however small, is a potentially hazardous procedure which should only be given when the clinical benefits to the patient outweigh the potential risks of transfusion. These risks include transfusion of an incorrect blood component due to errors such as mistaken patient identity, or unpredictable transfusion reactions.

Specialized components are available for transfusion to different paediatric groups and for different clinical indications. Indications for transfusions should be followed carefully to ensure that transfusion are not given unnecessarily. The BSH guideline on transfusion for children 2016 (New et al., 2016) recommends the volume of red cells transfused should be minimized, taking into account the likelihood of requiring subsequent transfusions.

Executive Summary

Aims of Transfusion
- Maintenance of haemoglobin
- Maintenance of adequate oxygen delivery

Stringent procedures must be followed to ensure that the correct blood is given and that any adverse reactions are dealt with promptly and efficiently.

The serious hazards of transfusion (SHOT) reporting scheme has shown that children as well as adults may be affected by transfusion errors, and are at particular risk when there has been a:

- Failure to apply wristbands, particularly in children who are too young to state their identity and date of birth.
- Failure to communicate special transfusion needs during shared care e.g. Irradiated products, CMV negative products

(Bolton-Maggs, et al., 2016)

This guideline aims to support staff by clearly identifying the procedures necessary to ensure patient safety. They cover ordering, prescribing, administration of blood components/products and the management of any complications.

Every procedure has potential risks and this includes blood product transfusion, which is a procedure that has been identified as of especially high risk. The Trusts aim and the aim of this guideline is to reduce these risks and to make blood product transfusions in Paediatrics at MKUH as safe as possible.

Definitions

- SHOT – Serious Hazard of Transfusion (UK Hemovigilance Scheme)
- MKUHFT – Milton Keynes University Hospital NHS Foundation Trust
- CMV – Cytomegalovirus
- BSH – British Society of Haematology
- SCD – Sickle Cell Disease
- EDM – Electronic Data Management
- NBTC – National Blood Transfusion Committee
- S(a)BTO – Safety of Blood, Tissues and Organs
- BNFC – British National Formulary Children
- FFP – Fresh frozen plasma
- RBC – Red blood cells
- TACO – Transfusion Associated Circulatory Overload
- DIC – Disseminated intravascular coagulation
- INR – international normalized ratio
- PCC – Prothrombin complex concentrate
- ITP – Immune thrombocytopenic purpura
- CIG – Clinical Improvement Group
- MHRA – Medicines and Healthcare products Regulatory Agency
- SABRE – Serious Adverse Blood Reactions & Events
- IV – Intravenous
- GP – General practitioner
- HTC – Hospital Transfusion Committee
- CSC – Care Standards Committee
- RCPCH – The Royal College of Paediatrics and Child Health
- (A)PTT – (Activated) partial thromboplastin time
- PT – Prothrombin time
- Hb – Haemoglobin
- Rh – Rh (D) factor
- ABO – Landsteiner's blood grouping system
- Ig - Immunoglobulin

1.0 Roles and Responsibilities

Medical Staff are responsible for adhering to Trust Guidelines:

- Being competent in blood transfusion procedures
- Explaining the risks and benefits of blood transfusion
- Provide the parents / carers copies of national blood transfusion information packs. (Available from the Blood Transfusion practitioner or via the following web site

http://hospital.blood.co.uk/patient-services/patient-blood-management/patient-information-leaflets/

- Obtaining and recording valid informed consent from the paediatric patients if appropriate, or, their parent/ carers.
- In an emergency, if parents are not within the hospital and are not contactable, or not fit to consent, the Consultant Pediatrician on Call will make this decision in the baby/ child/ or young person's best interest.
- Prescribing blood or blood products in accordance with Trust recommendations.
- Requesting blood on e-care or using the appropriate form should e-care be down
- Providing sufficient information on requests as defined in Trust procedures.
- Identifying the patient before blood sample collection and before transfusion.
- Obtaining blood samples for crossmatch following Trust procedures.
- Reviewing crossmatch and compatibility information prior to prescribing of transfusion.
- Using the appropriate procedures for cannulation and preparation of the patient.
- Reporting of transfusion reactions on a Blood/Blood Components Reaction Form and returning it to the blood transfusion department.
- Being competent in dealing correctly with any types of transfusion reaction in accordance with current Trust Guidelines.
- Reporting of all incidents relating to Blood Transfusion Department via Datix.
- Documentation in patient notes.

Nursing staff and theatre practitioners are responsible for adhering to Trust Guidelines

- Up to date two yearly mandatory attendance Trust Blood Transfusion Training (either by classroom session or relevant trust e-care package, accessed via ESR).
- Being competent in blood transfusion procedures as defined by the NBTC Guidance and National Standards issued by the National Blood Transfusion Committee (NBTC) in 2016 who set out the necessary requirements for transfusion training (National Blood Transfusion Committee, 2016a; 2016b)
- Ensuring valid informed consent has been obtained and is documented in the patient's records

- Providing sufficient information on requests as defined by Trust procedures.
- Ensuring correct identification of the patient before blood sample collection and before transfusion.
- Obtaining blood samples for crossmatch following Trust procedures.
- Requesting collection of blood.
- Reviewing crossmatch and compatibility information prior to transfusion.
- Monitoring of the patient during transfusion and documentation of observations in nursing notes.
- Stop the transfusion and inform medical staff **immediately** if a suspected transfusion reaction occurs
- Reporting of transfusion reactions and all other incidents relating to Blood Transfusion Department via Datix
- Being competent in correctly dealing with any types of transfusion reaction

Please refer to the adult policy for full listing of roles and responsibilities ensuring that where it denotes patient, the parents/ carers of the patient concerned are fully informed in the process.

2.0 Implementation and dissemination of document

This guideline will available on the Trust intranet under Blood Transfusion, Pathology and Paediatric sections. It will be discussed at the Paediatric and Divisional CIGs and will be shared with the nursing and medical teams at their relevant department meetings. All staff attending Blood Transfusion Mandatory update sessions or completing a trust e-learning package will be informed of this guideline.

3.0 Processes and procedures

3.1 Consent for Transfusion

A transfusion should only be given after consultation and informed consent has been obtained and documented from the patient (if deemed competent), parent or carer unless in an emergency situation, in which case the medical team must act in the best interest of the patient.

All Children who need regular/frequent transfusion (e.g. SCD, children with cancer) should have a signed consent form 2 (by parents/legal guardian) before the start of transfusion treatment and the copy of consent form should be uploaded on EDM.
https://www.gov.uk/government/publications/patient-consent-for-blood-transfusion

Before commencing a transfusion, informed consent MUST be sought from the child's Parent or Legal guardian. To ensure that they are able to fully understand the implications of a blood transfusion and therefore are able to give informed consent please ensure that they receive a copy of the Paediatric Blood Transfusion Information Packs prior to ordering the transfusion. (SaBTO 2020)

Copies can be obtained from the Transfusion Practitioner or follow the link below

http://hospital.blood.co.uk/patient-services/patient-blood-management/patient-information-leaflets/

There is consent information to complete on the Transfusion Prescription and Administration Record and the discussion regarding consent should be documented in the patient's medical record / eCARE.

3.2 Indications for Transfusion of Packed Red Blood Cells

- All children starting regular transfusions should be vaccinated against Hepatitis B as early as possible.

- Those on chronic transfusion regimes should have an extended red cell phenotype/genotype including those with dyserythropoietic anemia, aplastic anemia, and other bone marrow failure syndromes.

The following are the main groups of children with specific transfusion needs.

3.3 Transfusion Support for Children with Haemoglobinopathies

3.3.1 Thalassemia Major/Sickle Cell Disease

To maintain average Hb of 120g/L and pre transfusion of 90 – 100 g/L.

Refer to Sickle Cell Oxford Protocol link below:

Oxford University Hospitals NHS Trust (2019) Sickle cell guideline.
Available from: http://nssg.oxford-haematology.org.uk/red-cell-paeds/red-cell-paeds.html

NB. The guideline is in the Patient Pathway section – each section opens as a separate document.

3.3.2 Transfusion support for stem cell transplant/oncology

There is insufficient evidence to make recommendations for pre-transfusion thresholds in paediatric haematology /oncology patients and those undergoing stem cell transplantation.

Refer to: Oxford University Hospitals NHS Foundation Trust (2020) Paediatric haematology/oncology guidelines. [Online]. Available from: http://ouh.oxnet.nhs.uk/PaedHaemOnc/Pages/HaematologyOncologyGuidelines.aspx [Accessed 18 January 2021].

(Also see Appendix 2).

3.3.2.1 ABO incompatible stem cell transplant

As recommended by Transplant Unit.

Recommendations for CMV and irradiated products are obtained in Appendix 3 of this document.

3.3.3 Surgical Patients

The preoperative Hb should be optimized by treating iron deficiency anaemia.

A perioperative Hb transfusion threshold of 70g/l should be used in stable patients without major co-morbidity or bleeding.
(New, et al., 2016, p.793)

Tranexamic acid (as per BNFc) should be considered in all children undergoing surgery at risk of significant bleeding.

3.4 Sampling and Identification

Guidelines for pre-transfusion compatibility procedures in blood transfusion laboratories' (BSH, 2017) state "a second sample collected at a different time for confirmation of the ABO group of a first time patient prior to cross matching is required as long as this does not delay urgent transfusion".

- To ensure patient safety, for those patients requiring a blood transfusion blood bank requires the patient to have been tested on more than one occasion prior to issuing red blood cells.

- The two separate samples for Group and Save must have been taken at different times, i.e. at different phlebotomy sessions.

Acceptance of Samples in Pathology Department

Please refer to Milton Keynes University Hospital NHS Foundation Trust. Acceptance of samples in Pathology department. PATHOLOGY/GL/14. Version 2.3, 2017.

3.5 Prescribing Blood Products

The recommendations of the BSH Guidelines 2016 on the administration of blood components (New et al., 2016) should be followed.

All prescriptions for Paediatric blood components should be requested and prescribed in mls, i.e. as a volume, not in units. This is because there is a well-recognised risk of over transfusion leading to transfusion associated circulatory overload as the result of doctors inappropriately prescribing the volume by units rather than millilitres (mls) to infants and young children (Bolton-Maggs, et al., 2015, p.154)

All blood products are prescribed on Transfusion Prescription and Administration Record (see appendix 1).

3.5.1 Volume Calculation for top up blood transfusion

In order to prevent over transfusion of blood components all prescriptions should be ordered and prescribed in millilitres rather than units

In a non-bleeding child, it is important to take into account the pre-transfusion Hb in relation to the transfusion threshold,

The following transfusion formula may be used:

$$\text{Volume to transfuse (ml)} = \frac{\text{Desired Hb (g/L)} - \text{Actual Hb (g/L)} \times \text{Weight (kg)} \times 4}{10}$$

In order to prevent over transfusion, it is recommended that clinicians double check that the final volume calculated is not more than 20ml/kg for top-up transfusion.

- A unit of blood is usually 250mls but can be between 230-300mls
- A top up transfusion is usually between 15-20 mls/kg (max 20ml/kg)

With all blood / blood products prescribed in volume (mls) the transfusion laboratory will issue a unit as close to the prescribed dosage as possible.
(New, et al., 2016, p.803)

3.5.2 Rate of Transfusion

Red cells should be transfused **no faster than 5ml/kg/hour**, and ideally 15-20ml/kg total should be given over 3-4 hours for a routine top-up.

Each unit must be completed within a maximum of 4 hours from removal from the temperature-controlled blood fridge.

3.5.3 Blood Components and Specifications (see appendix 3 for links)

In the UK, blood components and their specifications are described in the Guidelines for the Blood Transfusion Services in the UK (the 'Red Book') which can be found at:
https://www.transfusionguidelines.org/red-book

Infants under 12 months

Blood components for infants under 12 months old have particular specifications as these recipients are a vulnerable group due to small circulating volume and immunological immaturity. The products are prepared from donors who have given at least one previous donation within the previous two years, which was negative for all mandatory microbiological markers.

CMV seronegativity

Please note that many clinicians consider components that are leukodepleted (routine practice throughout UK since 1999) to be CMV safe.

For more information, see the 2012 report from the SaBTO Cytomegalovirus Steering Group at
https://www.gov.uk/government/publications/sabto-report-of-the-cytomegalovirus-steering-group

Irradiated blood

For more information, see the 2020 British Society for Haematology guideline on the use of irradiated blood components at https://b-s-h.org.uk/guidelines/guidelines/guidelines-on-the-use-of-irradiated-blood-components/

3.6 Furosemide

There is limited evidence to support the use of furosemide. (http://europepmc.org/article/MED/33402857).

Diuretics should be used only when clinically indicated as per consultant advice (dose per BNFc).

3.7 Emergency Situations / Major Haemorrhage

In emergency situations it may not be possible to meet all the standard paediatric specifications and the risk of delays in transfusion have to be balanced against the risk of using components of alternative specification. If the child has a life-threatening haemorrhage and no suitable paediatric component is available, then the next best adult component should be used until the situation is stabilized.

It is recommended that component ratios should be pragmatically given on a volume basis rather than units due to the various sizes of children.

Ensure Major Haemorrhage Team activated via Bleep 2222 and immediately calling extension 85774 clearly stating location, child and gender if known. Blood Bank are also available on bleep 1412.

In early resuscitation of major a haemorrhage until Laboratory results are available it is recommended to give FFP: RBCs in a ratio of at least a 1:2.

For trauma give FFP: RBCs in a 1:1 ratio.
(New, et al., 2016, p.802)

Flow rates and volumes would be different for acute haemorrhage and resuscitation.

See appendix 4 for Major Haemorrhage Algorithm for children <50kg

Children >50kg should be managed according to adult guidelines.

3.8 Post Red Cell Transfusion

NICE guidance on blood transfusion recommends that it is essential to ensure that, having given a transfusion, a check is made on the contribution the transfusion made to improve the patient's clinical outcome. (NICE, NG24, 2015. Section 1.2.6)

A post transfusion Hb MUST be recorded in the patient notes along with a record of a clinical assessment of the child's condition post transfusion.

In-patients should be observed for late reactions during the subsequent 24 hours. Day patients and short stay transfusion patients should be counselled about the possibility of late adverse

reactions and provided with a post advice leaflet (available on the intranet – under pathology, pathology-Forms.

3.9 Fresh Frozen Plasma (FFP)

3.9.1 FFP Volume to transfuse

Fresh Frozen Plasma is given at a dose of 15-20mls per kg (as per BSH 2016) and this dose is then transfused at a rate of 10-20ml/kg/hr with careful monitoring for acute reaction or TACO (Transfusion Associated Circulatory Overload).

For management of major bleeding the recommended dose for FFP is 15 to 20 ml/kg (Hunt et al, 2015).

FFP may need to be given more than once daily in the face of severe consumption and coagulopathy in association with bleeding e.g. DIC.

FFP is stocked frozen in blood bank and takes approximately 30 minutes to thaw.

3.10 Congenital and Acquired Coagulopathies

3.10.1 Congenital

FFP can be used for immediate emergency treatment in a newly presenting child, while awaiting specific coagulation factor assays. Thereafter, specific coagulation factor concentrates is the appropriate treatment.

3.10.2 Acquired coagulopathies

Vitamin K deficiency Response to systemic vitamin K (dose as per BNFc) is rapid (within 30 – 120 minutes).

If bleeding is present, it may be necessary to also give FFP or, consider prothrombin complex concentrate. It is important to repeat coagulation tests regularly over 24 – 48 hours to ensure correction complete. Please discuss with paediatric haematologist in Oxford.

3.10.3 Disseminated intravascular coagulation

FFP at dose 15 - 20 ml/kg.

Cryoprecipitate at a dose of 5–10mls/ kg body weight *(United Kingdom Blood Services, 2014, p.38)* if fibrinogen < 1.0g/L.

Maximum dose 300mls, i.e., 2 units each of which contain 5 pools.
(New, et al., 2016)

Consider Platelets if significant thrombocytopenia.

If necessary, discuss with Haematology consultant via switchboard.

3.10.4 Severe Liver Disease

Support with FFP, cryoprecipitate and platelets as appropriate until the recovery or child has a liver transplant.

3.10.5 Anticoagulant Reversal

There are few published data on anticoagulation in children.

The principles of anticoagulant reversal in children are the same as for adults.

If high INR and bleeding immediate reversal can be obtained with FFP or prothrombin complex concentrate (though there is no published data in children using PCC).

The INR should be checked after 2-6 hours and further doses given as required.

Treatment of these children should be discussed with the paediatric consultant at the relevant tertiary hospital.

3.11 Platelets

Apheresis platelets are no longer a requirement for all children<16 years old. In practice, platelets with neonatal / infant specification will likely be apheresis to ensure they fulfil other requirements, e.g., second time donors.
(SaBTO, 2019)

Rh Negative females should receive Rh Negative platelets if possible.

Note: If Rh positive platelets have to be given, anti-D immunoglobulin should be administered (a dose of 250IU intramuscularly or intravenous - as per BNFc, should cover up to 5 apheresis platelet donations given within 6 weeks period). NOTE - Milton Keynes University Hospital currently only stocks 1500 IU. There is no risk associated with receiving a larger dose of Anti-D Ig than is recommended. Under no circumstances must the 1500IU vials be split.

3.11.1 Volume to transfuse

Children < 15kg 10-20mls/kg.

Children > 15 kg single pack (approx. 260mls). Each pack has a different volume, but a child should only receive a maximum of one adult platelet unit.

Infusion rate 10-20mls/kg/hour. (usually 30-60 mins).
(United Kingdom Blood Services, 2014, p.125) (BSH, 2016)

3.11.2 Indication

The indication to give platelets is often on an **individual basis** and the threshold at which to transfuse a patient can vary depending on their previous bleeding history and the current clinical setting.

Oncology patients: refer to the following guideline:
http://ouh.oxnet.nhs.uk/BloodTransfusion/Document%20Library/Local%20Guidelines/Blood%20Transfusion%20Guidelines%20for%20the%20use%20of%20special%20bloodblood%20components%20in%20paediatric%20haematology%20oncology.pdf

NB. Ensure clotting screen normal

Note: For cases of ITP refer to Paediatric ITP Guidance

3.12 Cryoprecipitate

Dose 5-10mls/kg.
(NICE, NG24, 2015, Section 1.5) (BSH, 2016)

Rate of infusion 10-20ml/kg/hour
(United Kingdom Blood Services, 2014, p.40) (BSH, 2016)

Maximum dose 300mls, i.e., 2 units each of which contain 5 pools.
(New, et al., 2016)

This may be indicated in the context of deranged coagulation and bleeding, especially if there is DIC with low fibrinogen.

Please discuss with Consultant Haematologist on call (via switchboard) or Paediatric Haematology Consultant at Tertiary Hospital.

3.13 Medication to Stop Bleeding

If bleeding occurs, consider a local cause and local remedy (e.g. cauterization for epistaxis).

Other pharmacological interventions include:

- Vitamin K - As per BNFc.

- Tranexamic acid early use in trauma may reduce mortality. An initial dose of 15mg/kg (MAX 1000mg) IV over 10 minutes given as soon as possible and within 3 hours of trauma followed by 2mg/kg/hour for at least 8 hours or until the bleeding stops has been recommended by the Royal College of Paediatrics and Child Health and the Neonatal AND Paediatric Pharmacists Group. (RCPCH, 2012)

3.14 Special Requirements for Blood/Blood Products

See Appendix 3.

3.15 Children (under the age of 16) of Jehovah's Witnesses

Please see Policy for the Treatment of Patients Refusing Blood and Blood Components.

3.15.1 Children and young adults with diminished mental capacities

Children and young adults with diminished mental capacities – should be treated in a similar manner to the unconscious patient in line with the Mental Capacity Act 2005. Reasonable efforts should be made to determine if an advance care plan exists, this includes discussions with relatives and or the individual's GP.

3.16 Collection, Checking and Administration of Blood or Blood products

Refer to Blood Transfusion Policy (PATH-GL-03).

3.17 Management of Transfusion Reactions

Blood Bank must be informed of all suspected moderate and/or severe transfusion reactions and complete a Blood/ Blood Components Reaction Form.

Refer to Blood Transfusion Policy PATH-GL-03.

See Appendix 5 (Anaphylaxis Algorithm) and See Appendix 6 (Management of Transfusion Reaction Flowchart).

3.18 Reporting of Incidents

Any unexpected event that has an actual or potential short-term or long-term detrimental effect on an individual patient or member of staff must be reported according to the Trust's Guidelines on Policy for Adverse Incident Reporting and to the Blood Transfusion Laboratory.

It is a legal requirement to investigate and report any serious adverse reaction or incident that occurred during any part of the transfusion process. This is done by the transfusion team These are reported to SHOT and MHRA via SABRE.

Incident reporting should include 'near miss' episodes involving procedural errors that were detected in time to prevent a serious complication of blood transfusion.

4.0 Statement of evidence/references

4.1 Statement of evidence

4.2 References

Bolton-Maggs, P.H.B. (ed) et al. on behalf of the Serious Hazards of Transfusion (SHOT) Steering Group. (2016) *The 2015 Annual SHOT Report*. [Online]. Available from: https://www.shotuk.org/wp-content/uploads/myimages/SHOT-2015-Annual-Report-Web-Edition-Final-bookmarked.pdf [Accessed 18 January 2021]

Bolton-Maggs, P.H.B. (ed) et al. on behalf of the Serious Hazards of Transfusion (SHOT) Steering Group. (2015) *The 2014 Annual SHOT Report*. [Online]. Available from:

https://www.shotuk.org/wp-content/uploads/myimages/report-2014.pdf [Accessed 18 January 2021]

British Committee for Standards in Haematology (2012) *Guidelines for pre-transfusion compatibility procedures in blood transfusion laboratories*. [Online]. Available from: https://b-s-h.org.uk/guidelines/guidelines/pre-transfusion-compatibility-procedures-in-blood-transfusion-laboratories/ [Accessed 18 January 2021]
See also the April 2017 update to this guideline at https://b-s-h.org.uk/media/15725/monoclonal-antibodies-addendum.pdf

Department for Constitutional Affairs (2007) *Mental Capacity Act 2005: Code of Practice*. Issued by the Lord Chancellor on 23 April 2007 in accordance with sections 42 and 43 of the Act. [Online]. Available from: https://www.gov.uk/government/publications/mental-capacity-act-code-of-practice [Accessed 19 January 2021]

Foukaneli, T., et al., on behalf of the British Society for Haematology Guidelines Transfusion Task Force (2020) *Guidelines on the use of irradiated blood components*. [Online]. Available from: https://b-s-h.org.uk/guidelines/guidelines/guidelines-on-the-use-of-irradiated-blood-components/ [Accessed 19 January 2021]

Furosemide. In: Paediatric Formulary Committee (2020) *British National Formulary for Children (BNFC).* [Online]. London: BMJ Group, Pharmaceutical Press and RCPCH Publications. Last updated 02-Dec-2020. Available from: https://bnfc.nice.org.uk/drug/furosemide.html [Accessed 19 January 2021]

Joint United Kingdom (UK) Blood Transfusion and Tissue Transplantation Services Professional Advisory Committee (2013) *Guidelines for the Blood Transfusion Services in the UK*. 8th ed. Last updated January 2021 – Change Notification No.3 -2021. [Online]. Available from: https://www.transfusionguidelines.org/red-book [Accessed 18 January 2021]

National Blood Transfusion Committee (2016a) *Requirements for training and assessment in blood transfusion.* [Online]. Available from: https://www.transfusionguidelines.org/document-library/documents/nbtc-requirements-for-training-and-assessment-final/download-file/NBTC%20Requirements%20for%20Training%20and%20Assessment%20FINAL.pdf [Accessed 18 January 2021]

National Blood Transfusion Committee (2016b) *Appendix 1 – NBTC national standards for the clinical transfusion process.* [Online]. Available from: https://www.transfusionguidelines.org/document-library/documents/nbtc-requirements-for-training-and-assessment-appendix-final/download-file/NBTC%20Requirements%20for%20Training%20and%20Assessment%20APPENDIX%20FINAL.pdf [Accessed 18 January 2021]

National Institute for Health and Care Excellence (2015) *Blood transfusion*. NICE guideline [NG24]. [Online]. Available from: https://www.nice.org.uk/guidance/NG24 [Accessed 18 January 2021]

National Institute for Health and Care Excellence (2016) *Blood transfusion*. Quality Standard [QS138]. [Online]. Available from: https://www.nice.org.uk/guidance/QS138 [Accessed 18 January 2021]

New, H.V. et al, on behalf of the British Committee for Standards in Haematology (2016) *Guidelines on transfusion for fetuses, neonates and older children*. [Online]. Available from:

https://b-s-h.org.uk/guidelines/guidelines/transfusion-for-fetuses-neonates-and-older-children/ [Accessed 18 January 2021]
See also the August 2020 addendum to this guideline at https://b-s-h.org.uk/media/18619/addendum-for-gl-on-transfusion-for-fetuses-neonates-and-older-children-aug-21-2020.pdf

NHS Blood and Transplant (2010) *National comparative audit of the use of red cells in neonates and children 2010*. [Online]. Available from: https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/14936/nca-red_cells_neonates_children.pdf [Accessed 18 January 2021]

NHS Blood and Transplant. Patient information leaflets. *NHS Blood and Transplant* [Online]. https://hospital.blood.co.uk/patient-services/patient-blood-management/patient-information-leaflets/ [Accessed 18 January 2021]

Oxford University Hospitals NHS Foundation Trust (2017) *Blood transfusion guidelines for the use of special blood components in paediatric haematology/oncology*. Version 5.0, July 2017. [Online]. Available from: http://ouh.oxnet.nhs.uk/BloodTransfusion/Document%20Library/Local%20Guidelines/Blood%20Transfusion%20Guidelines%20for%20the%20use%20of%20special%20bloodblood%20components%20in%20paediatric%20haematology%20oncology.pdf [Accessed 18 January 2021]

Oxford University Hospitals NHS Foundation Trust (2020) *Paediatric haematology/oncology guidelines*. [Online]. Available from: http://ouh.oxnet.nhs.uk/PaedHaemOnc/Pages/HaematologyOncologyGuidelines.aspx [Accessed 18 January 2021]

Phytomenadione. In: Paediatric Formulary Committee (2020) *British National Formulary for Children (BNFC).* [Online]. London: BMJ Group, Pharmaceutical Press and RCPCH Publications. Last updated 02-Dec-2020. Available from: https://bnfc.nice.org.uk/drug/phytomenadione.html [Accessed 19 January 2021]

Resuscitation Council (UK) (2008) *Emergency treatment of anaphylactic reactions: guidelines for healthcare providers*. [Online]. Available from: https://www.resus.org.uk/sites/default/files/2020-06/EmergencyTreatmentOfAnaphylacticReactions%20%281%29.pdf [Accessed 19 January 2021]

Royal College of Paediatrics and Child Health (2012) *Major trauma and the use of tranexamic acid in children*. Evidence statement. November 2012. [Online]. Available from: https://www.rcem.ac.uk/docs/External%20Guidance/10k.%20Major%20trauma%20and%20the%20use%20of%20tranexamic%20acid%20in%20children%20Evidence%20statement%20(RCPCH,%20Nov%202012).pdf [Accessed 18 January 2021]

Safety of Blood, Tissues and Organs Expert Advisory Committee (SaBTO) (2020) *Guidelines from the expert advisory committee on the Safety of Blood, Tissues and Organs (SaBTO) on patient consent for blood transfusion*. [Online]. Available from: https://www.gov.uk/government/publications/blood-transfusion-patient-consent [Accessed 18 January 2021]

Safety of Blood, Tissues and Organs Expert Advisory Committee (SaBTO) (2012) *Report of the Cytomegalovirus Steering Group*. [Online]. Available from: https://www.gov.uk/government/publications/sabto-report-of-the-cytomegalovirus-steering-group [Accessed 18 January 2021]

Tinegate, H., et al. (2012) *Guideline on the investigation and management of acute transfusion reactions. Prepared by the BCSH Blood Transfusion Task Force*. [Online]. Available from: https://b-s-h.org.uk/guidelines/guidelines/investigation-and-management-of-acute-transfusion-reactions/ [Accessed 19 January 2021]

Tranexamic acid. In: Paediatric Formulary Committee (2020) *British National Formulary for Children (BNFC).* [Online]. London: BMJ Group, Pharmaceutical Press and RCPCH Publications. Last updated 02-Dec-2020. Available from: https://bnfc.nice.org.uk/drug/tranexamic-acid.html [Accessed 18 January 2021]

United Kingdom Blood Services (2014) *Handbook of transfusion medicine*. 5th ed. [Online]. Available from: https://www.transfusionguidelines.org/transfusion-handbook [Accessed 18 January 2021]

5.0 Governance

5.1 Document review history

Version number	Review date	Reviewed by	Changes made
4	08/2020	Paediatrics	Y

5.2 Consultation History

Stakeholders Name/Board	Area of Expertise	Date Sent	Date Received	Comments	Endorsed Yes/No
	Spec Trans Practitioner	17/8/2020	17/8/2020	e-learning for nursing staff	yes
	Spec Trans Practitioner	13/9/20	14/9/20	Activating major haemorrhage paeds	yes
	Consultant Paediatrician			Updated	Yes
	Spec Trans Practitioner	26/1/2021	26/1/2021	BSH 2016 recommend transfusion FFP 15-20ml per Kg .	However, on consultation with onc at OUH, they recommend 10-20ml. This is reflected in 3.9-3.10
	Spec Trans Practitioner	26/1/2021	26/1/2021		
	Consultant Paediatrician	28/1/2021	28/1/2021	Comments addressed	Yes
	Library and e-Learning Services Manager	12/2020	26/1/2021	Reviewed and references incorporated	Yes
	Spec Trans Practitioner	28/1/2021	29/1/2021	Reviewed by Dr Aye, Caroline's comments addressed	Await final copy

5.3 Audit and monitoring

Audit / Monitoring Criteria	Tool	Audit Lead	Frequency of Audit	Responsible Committee / Board
The blood transfusion process, as	a) Traceability documentation completed in clinical area and returned to blood bank after every blood/blood product transfused.	Blood Transfusion Team, including	a) Hospital Transfusion Committee quarterly	Hospital Transfusion Committee and

outlined in the Guideline	b) Report to hospital Transfusion Committee (HTC). c) National, Regional and Trust blood transfusion audit when appropriate. d) 2 yearly transfusion training for all staff involved in the transfusion process. e) In cases of near miss or incident a report is sent to Serious Hazards of Transfusion (SHOT) and MHRA. f) NBTC competency testing.	Specialist Practitioner of Transfusion and Consultant Haematologist and Blood Bank Manager		Care Standards Committee (CSC)

5.4 Equality Impact Assessment

As part of its development, this Guideline and its impact on equality has been reviewed. The purpose of the assessment is to minimise and if possible remove any disproportionate impact on the grounds of race, gender, disability, age, sexual orientation, religion or belief, pregnancy and maternity, gender reassignment or marriage and civil partnership. No detriment was identified. Equality Impact assessments will show any future actions required to overcome any identified barriers or discriminatory practice.

Equality Impact Assessment			
Division	Women and Children	Department	Paediatric
Person completing the EqIA		Contact No.	
Others involved:	Nil	Date of assessment:	17/08/2020
Existing policy/service	Yes	New policy/service	No

Will patients, carers, the public or staff be affected by the policy/service?	Yes
If staff, how many/which groups will be affected?	Medical and Nursing staff

Protected characteristic	Any impact?	Comments
Age	NO	Positive impact as the policy aims to recognise diversity, promote inclusion and fair treatment for patients and staff
Disability	NO	
Gender reassignment	NO	
Marriage and civil partnership	NO	
Pregnancy and maternity	NO	
Race	NO	
Religion or belief	NO	
Sex	NO	
Sexual orientation	NO	

What consultation method(s) have you carried out?
Face to Face, via e-mail, meetings
How are the changes/amendments to the policies/services communicated?
Face to Face, via e-mail, meetings

What future actions need to be taken to overcome any barriers or discrimination?			
What?	Who will lead this?	Date of completion	Resources needed
N/A	N/A	N/A	N/A
Review date of EqIA			

Appendix 1: Blood Transfusion Prescription and Administration Record

The blood transfusion prescription and administration form is available in ward 4 and ward 5.

Appendix 2: Oxford University Hospitals NHS Foundation Trust, Paediatric Haematology / Oncology Guidelines. 2020

Please refer to:

Oxford University Hospitals NHS Foundation Trust (2020) *Paediatric haematology/oncology guidelines*. [Online]. Available from: http://ouh.oxnet.nhs.uk/PaedHaemOnc/Pages/HaematologyOncologyGuidelines.aspx [Accessed 18 January 2021]

Appendix 3: Guidelines for the Use of Special Blood Components in Paediatric Haematology / Oncology

Please refer to:

Oxford University Hospitals Guideline

Oxford University Hospitals NHS Foundation Trust (2017) *Blood transfusion guidelines for the use of special blood components in paediatric haematology/oncology*. Version 5.0, July 2017. [Online]. Available from: http://ouh.oxnet.nhs.uk/BloodTransfusion/Document%20Library/Local%20Guidelines/Blood%20Transfusion%20Guidelines%20for%20the%20use%20of%20special%20bloodblood%20components%20in%20paediatric%20haematology%20oncology.pdf [Accessed 18 January 2021]

The 'Red Book'

Joint United Kingdom (UK) Blood Transfusion and Tissue Transplantation Services Professional Advisory Committee (2013) *Guidelines for the Blood Transfusion Services in the UK*. 8th ed. Last updated January 2021 – Change Notification No.3 -2021. [Online]. Available from: https://www.transfusionguidelines.org/red-book [Accessed 18 January 2021]

"The 'Red Book' (as the printed version of these guidelines are known) aims to define guidelines for all materials produced by the United Kingdom Blood Transfusion Services for both therapeutic and diagnostic use. The guidelines reflect an expert view of current best practice, provide specifications of products, and describe technical details of processes. Every effort has been made to ensure that the guidelines reflect the legally binding requirements of the Blood Safety (and Quality) and Regulations, UK Statutory Instrument 2005 No. 50."

CMV seronegativity

Safety of Blood, Tissues and Organs Expert Advisory Committee (SaBTO) (2012) *Report of the Cytomegalovirus Steering Group*. [Online]. Available from: https://www.gov.uk/government/publications/sabto-report-of-the-cytomegalovirus-steering-group [Accessed 18 January 2021]

Irradiated Blood

Foukaneli, T., et al., on behalf of the British Society for Haematology Guidelines Transfusion Task Force (2020) *Guidelines on the use of irradiated blood components*. [Online]. Available from: https://b-s-h.org.uk/guidelines/guidelines/guidelines-on-the-use-of-irradiated-blood-components/ [Accessed 19 January 2021]

Appendix 4: Massive Blood Loss Transfusion Management for Children (<50kg)

If >50kg, follow Milton Keynes University Hospital NHS Foundation Trust. Haematological management of major haemorrhage in adults.

↓

Clinical picture compatible with **massive blood loss**

↓

Trigger **local major haemorrhage protocol** (including necessary clinical and transfusion teams)

↓

Secure **intravenous access** and take **blood samples** for:
- Full blood count
- Group and save (with subsequent second sample)
- Clotting screen to include fibrinogen
- Near patient testing (blood gas, electrolytes)

↓

Give **tranexamic acid** (in trauma) if < 3 h post-injury (use timing and dosage recommended by RCPCH)

↓

Initiate **emergency transfusion**:
- 20ml/kg red cells (O D-negative or ABO and D-specific)

↓

If bleeding continues

↓

Until laboratory results available

↓

Give:
- RBCs in 20ml/kg aliquots
- FFP in 20ml/kg aliquots

To achieve FFP:RBC ratio 1:2 (for trauma give FFP: RBCs in a 1:1 ratio)

↓

If > 40ml/kg RBCs given, consider:
- Platelets 15-20ml/kg
- Cryoprecipitate 10ml/kg

If laboratory results available

↓

Continue transfusion to achieve:
- Hb > 80g/l
- Platelet count > 75 x 10^9/l
- Fibrinogen > 1.5g/l
- APTT/PT < 1.5x midpoint of normal

↓

Continue to monitor and give appropriate blood components until **bleeding is controlled**

Activate 2222
State major haemorrhage, location, male/female child

Ring **Blood Bank (ext. 85774)** or bleep 1412 giving further information

Additional aims:
- **Control bleeding**
- Normothermia (or >35°C)
- Ionized Ca++ >1mmol/l
- pH > 7.2
- Lactate < 1mmol/l

Adapted from: New, H.V. et al, on behalf of the British Committee for Standards in Haematology (2016) Guidelines on transfusion for fetuses, neonates and older children. [Online], Appendix 4, p.825. Available from: https://b-s-h.org.uk/guidelines/guidelines/transfusion-for-fetuses-neonates-and-older-children/ [Accessed 18 January 2021]

Appendix 5: Anaphylaxis Algorithm

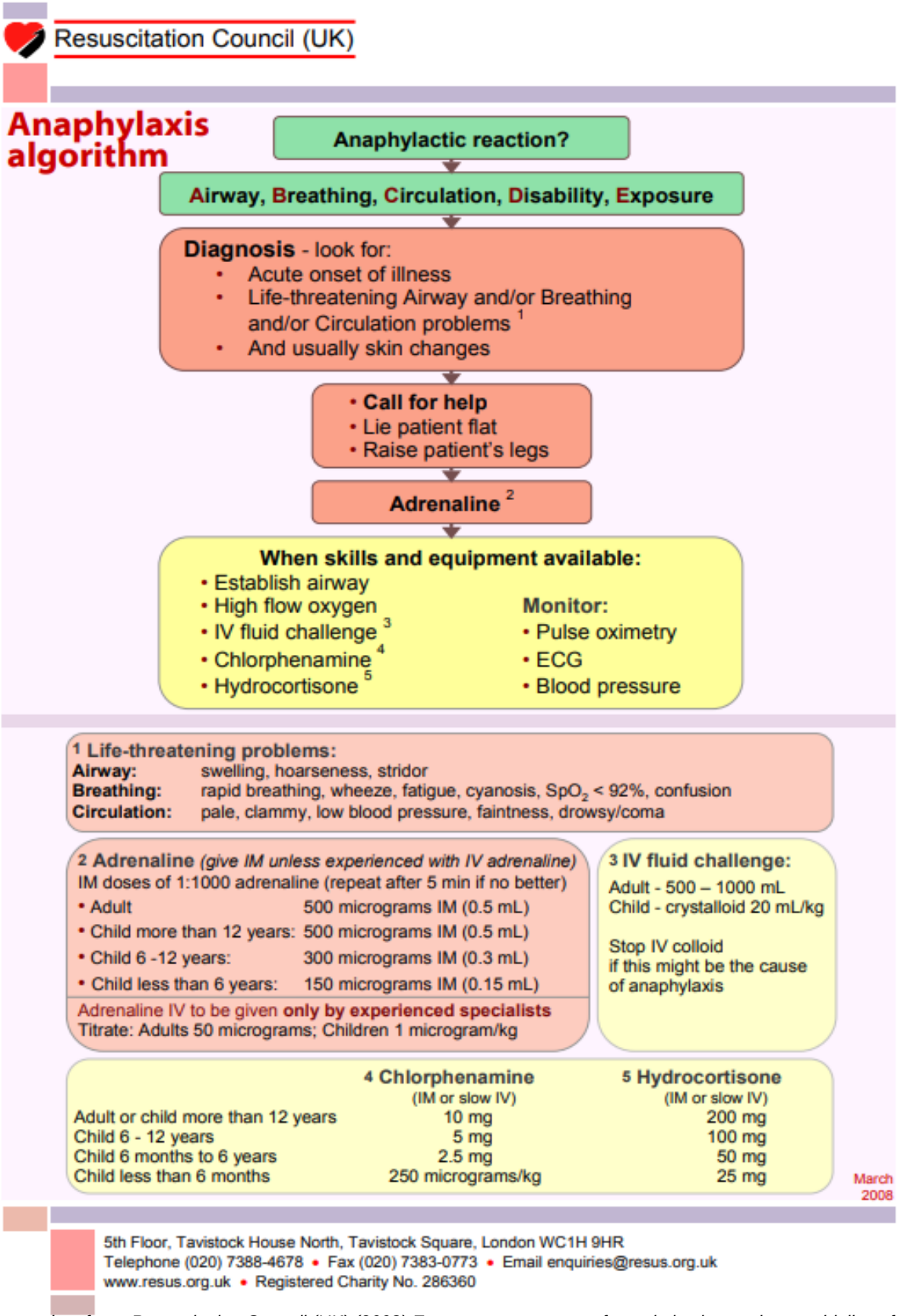
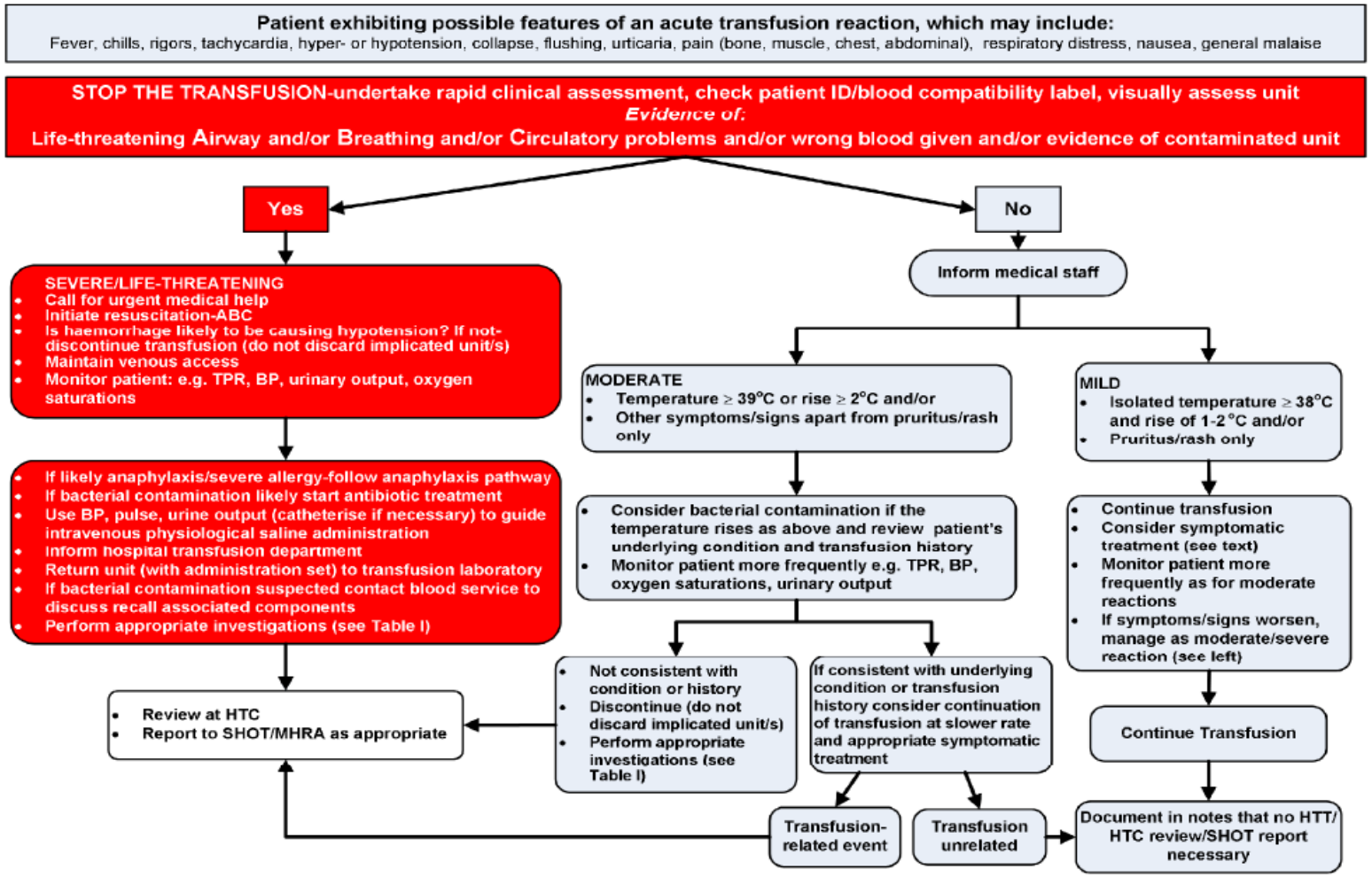


Image taken from: Resuscitation Council (UK) (2008) Emergency treatment of anaphylactic reactions: guidelines for healthcare providers, Figure 3, p.20. Available from: https://www.resus.org.uk/sites/default/files/2020-06/EmergencyTreatmentOfAnaphylacticReactions%20%281%29.pdf [Accessed 19 January 2021]

Appendix 6: Management of Transfusion Reaction Flowchart

Figure 1 Flow Diagram for recognition, initial management and subsequent management and investigations.



(British Committee for Standards in Haematology, 2012a, p.145 Guideline on the investigation and management of acute transfusion reactions: prepared by the BCSH Blood Transfusion Task Force. https://doi.org/10.1111/bjh.12017