SPAH
SCOTTISH PAEDIATRIC AND ADULT HAEMOGLOBINOPATHIES NETWORK

Paediatric guidance

Exchange Transfusion

NOTE
This guidance is not intended to be construed or to serve as a standard of care. Standards of care are determined based on all clinical data available for an individual case and are subject to change as scientific knowledge and technology advance and patterns of care evolve. Adherence to guidance recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgement must be made by the appropriate healthcare professional(s) responsible for clinical decisions regarding a particular clinical procedure or treatment plan. This judgement should only be arrived at following discussion of the options with the patient, covering the diagnostic and treatment choices available. It is advised, however, that significant departures from the national guidance or any local guidance derived from it should be fully documented in the patient's case notes at the time the relevant decision is taken.

This document has been prepared by the National Services Directorate (NSD) of Public Services Delivery Scotland (PSD Scotland) on behalf of the Scottish Paediatric & Adult Haemoglobinopathies network (SPAH). Accountable to Scottish Government, PSD Scotland works at the heart of the health service providing national strategic services to the rest of NHS Scotland and other public sector organisations to help them deliver their services more efficiently and effectively. SPAH is a collaboration of stakeholders involved in the care of patients with a haemoglobinopathy, who are supported by a PSD Scotland Programme Team to drive improvement across the care pathway.

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Stakeholders involved **Others consulted**	Consultant Paediatric Haematologists, Consultant Paediatricians, Haematology Nurse Specialists, Consultant Paediatric Radiologist Dr J Laird, Consultant Haematologist, SNBTS, Dr J Easterbrook, Consultant Haematologist, SNBTS,
Methodology used	Evidence-based literature review and engagement with clinical experts within the field of Paediatric Haematology, Transfusion medicine and Adult Haematology.
Rationale	The network was established to support and develop haemoglobinopathy services throughout Scotland in improving standards of clinical care for patients. The network supports the delivery of evidence based, patient centred care through the development and implementation of clinical guidelines, care pathways and information resources utilising a once for Scotland approach.
Scope	Haematology specialists and general paediatricians including hospital staff managing children with sickle cell disease that requires an exchange transfusion in NHS Scotland
Approval process	The guideline was approved by the SPAH Paediatric Guideline and Protocol subgroup on 10 March 2026. This subgroup has the authority to develop, review and endorse guidelines. This has been agreed by the SPAH Steering Group and noted in its Terms of Reference. See appendix for list of Paediatric Guideline and Protocol subgroup members.

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Background

Exchange transfusion is undertaken to rapidly reduce the percentage of sickle cells in the circulation when a patient develops a life-threatening complication of the disease and when a simple 'top up' transfusion is deemed not appropriate in the clinical scenario. The decision to proceed with an exchange transfusion should be taken following discussion with the Paediatric Haematology Consultant on call as the procedure is not without possible complications. Several clinical and logistical factors will determine whether a manual or automated exchange is the preferred method of exchange in any given situation.

Where an automated red cell exchange is required, the Haematology Consultant should discuss the referral with the local SNBTS Apheresis team to set up the arrangements for the procedure, or for out of hours contact the national SNBTS on-call consultant via switchboard.

Contact Details:
Aberdeen Apheresis Centre:

- **Telephone:** 01224 812 436
- **Email:** nss.ab-clinapheresis@nhs.scot

Edinburgh Apheresis Centre:

- **Telephone:** 0131 242 3609
- **Email:** NSS.Edin-Cau@nhs.scot

Glasgow Apheresis Centre:

- **Telephone:** 0141 301 7013
- **Email:** NSS.CAU@nhs.scot

Indications for urgent exchange transfusion in patients with sickle cell disease include:

- severe acute chest syndrome (ACS) – see ACS protocol for indications https://www.nn.nhs.scot/spah/professional-zone/protocolsguidance-group-paediatric/
- girdle syndrome
- acute stroke (or as part of primary/secondary stroke prevention)
- fat Embolism Syndrome (where a subsequent plasma exchange may also be indicated)
- multi-organ failure syndromes

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Additionally, red cell exchange may be indicated electively, for example, in preparation for planned surgical procedures in selected cases and for other clinical situations as per BSH guidelines.

Preliminary investigations

- FBC
- % HbS (or S+C if HbSC disease)
- extended RBC phenotype (if not already known), crossmatch and antibody screen (ensure that the blood transfusion laboratory is aware that the blood requested is for a child with a haemoglobinopathy AND for exchange transfusion so unit specifications can be met)
- urea and electrolytes, creatinine, calcium, magnesium, liver function tests, ferritin and CRP
- capillary or arterial blood gases - in those with symptoms suggestive of chest or girdle syndrome
- baseline Serology for Hepatitis B and C and HIV, if not done recently

Red cell requirements

- Red cells should be ABO compatible and matched for extended Rh (C,c,D,E and e) and K types, antigen-negative for current and historical red cell allo-antibodies of clinical significance and tested negative for HbS.

Automated exchange transfusion

A national SNBTS SOP for automated red cell exchange exists and is available through SNBTS (nss.snbtsnatsops@nhs.scot).
Information required:

- Patient height and weight
- Pre-exchange Hb, Hct and HbS%
- Transfusion fluid Hct (or default 60%)

Target values post red cell exchange will vary depending on the patient's baseline results and the clinical situation.

Adequate venous access is required. For any emergency procedures, or for elective procedure if it is anticipated that adequate access may not be obtained via peripheral access, then insertion of a large bore double lumen catheter with staggered ends (dialysis type line) should be arranged.

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Manual exchange transfusion

Volumes Required
The initial aim is to exchange 1.5 - 2 times the child's blood volume, divided over 2-3 procedures. 28ml/kg is the approximate red cell mass from infancy to teenage years

Volume (ml) of SAG-M blood *for each exchange* should be:

28 x weight (in kg) = volume in mls

Venous Access
Two ports of venous access are required: one for venesection, the other for administering blood and crystalloid.

Procedure
The aim is that this should be an isovolaemic procedure with frequent, monitoring of blood pressure, heart rate and oxygen saturations every 15 minutes, and 1 hourly temperature monitoring. Exchanges are done in 'aliquots' of approximately 1/10 of the total to be exchanged.

- if Hb greater than 60g/L start by giving a bolus of 10ml/kg of 0.9%saline. If Hb less than 60g/l, start by transfusing 5ml/Kg of red cells then proceed to venesection
- venesect an aliquot (i.e. 10% of total volume to be exchanged) over 10-15 minutes
- transfuse an equal first aliquot at a rate of 5-7.5ml/kg/hr
- venesect second aliquot
- transfuse the second aliquot
- venesect third aliquot, and so on
- finish the procedure by giving the last aliquot of blood as a top-up transfusion ie venesect the 9th aliquot then transfuse 9th and 10th aliquots

At end of procedure check FBC, HbS %, urea and electrolytes including calcium. If HbS not less than 20%, then consider continuing with further exchanges, to give a final Hb of 100-110g/l and Hb S ideally between 10% and 20%.

Ensure the child is well hydrated between successive exchanges as the haematocrit of transfused packed cells is higher than that of the venesected blood. Keep PCV/Hct less than 0.4. In larger volume exchanges consider giving a break between 2nd or 3rd unit and giving dextrose/saline to rehydrate.

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Possible immediate complications

Transfusion reactions - ABO incompatibility, acute haemolytic reactions, febrile non-haemolytic reactions, allergic reactions can occur with manual or automated exchanges.

Convulsions are very rare. They are usually a sign of cerebral sludging, often in patients with previous CNS problems. Check that the PCV/Hct has not risen too high (greater than 0.4). Give anti-epileptics; ensure there is a large fluid intake; give oxygen.

Hypertension is occasionally seen in patients with circulatory overload. If diastolic BP increases by more than 20mmHg, slow down exchange, check PCV/Hct not more than 0.4. If diastolic BP is more than 100mmHg stop the exchange, venesect, and consider antihypertensives.

Citrate toxicity is a common complication of automated red cell exchange as a small amount of the citrate contained in the anti-coagulant used on the apheresis machine is returned to the patient with the transfused red cells. This can cause temporary hypocalcaemia, which may manifest as peri-oral paraesthesia, muscle cramps and can progress to cardiac arrhythmia if untreated. Management is with calcium replacement during the procedure.

Complications associated with IV access are also common.

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References

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Appendix - Guidelines and Protocols subgroup membership

Name:		Job Title:	Organisation:
Katrina	Adams	Non-Malignant Haematology Nurse Specialist	NHS GG&C
Ruth	Allen	Consultant Paediatric Radiologist	NHS GG&C
Susan	Baird	Consultant Paediatric Haematologist	NHS Lothian
Nadia	Catherwood	Paediatric Haematology Nurse Specialist	NHS GG&C
Shahzya	Chaudhury	Consultant Paediatric Haematologist	NHS GG&C
Sarah	Clarke	Non-Malignant Paediatric Haematology Consultant	NHS GG&C
Emma	Cockburn	Consultant Paediatrician	NHS Tayside
Cheryl	Hill	Non-Malignant Haematology Nurse Specialist	NHS GG&C
Kirsten	Husselbee	Consultant Paediatrician	NHS Tayside
Jennifer	Milne	Paediatric Haematology Nurse	NHS Tayside
Lucy	Paterson	Clinical Nurse Specialist - Benign Haematology	NHS Lothian
Fernando	Pinto	Consultant Paediatric Haematologist	NHS GG&C
Rosina	Shujaat	Consultant Paediatric Haematologist	NHS Lothian
Gordon	Taylor	Consultant Paediatric Haematologist	NHS Grampian

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