South Thames Sickle Cell & Thalassaemia Network

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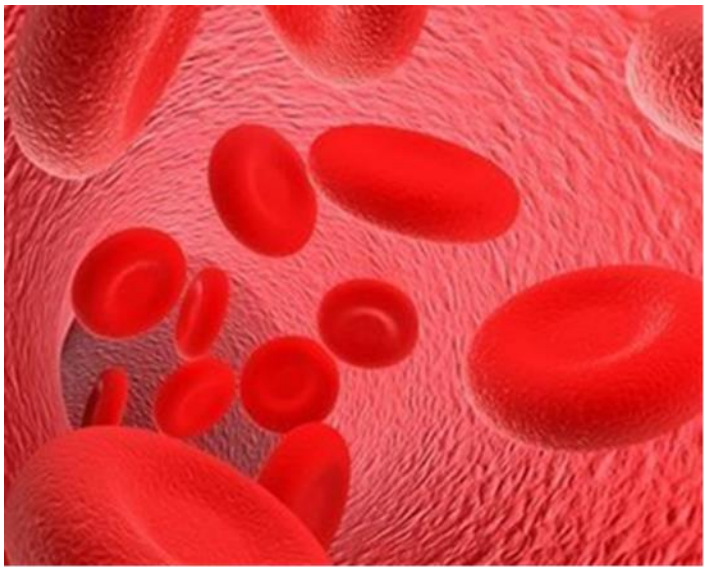
Paediatric and Adolescent Haemoglobinopathy Workbook



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AKNOWLEDGEMENTS
This Paediatric Haemoglobinopathy Workbook has been produced collaboratively with input from both Paediatric and Adult Haemoglobinopathy teams. It is intended for the training of nurses and allied healthcare professionals involved in the care of Haemoglobinopathy patients, and is based on published documents including the National Standards of Care and the Royal College of nursing (RCN) competencies 'Caring for people with Sickle Cell Disease and Thalassaemia syndromes', as well as relevant published guidelines and research.

We are grateful to all members of the Kings College Hospital Haemoglobinopathy teams, South Thames Sickle and Thalassaemia Network (STSTN) and members of the multi-disciplinary teams and the wider specialist teams including nephrologists, orthopaedic surgeons, cardiologists, hepatologists and obstetricians with whom we collaborate.

We also thank our training day sponsors ROALD DAHL and NOVARTIS.

We thank attendees for raising awareness, improving knowledge and skills and being part of working towards offering haemogloboinopathy patients the optimal care.

INTRODUCTION TO WORKBOOK
The Haemoglobinopathy Workbook is intended to illustrate key clinical issues and management strategies in the care of haemoglobinopathy patients. It is hoped that this will enable the widespread use of effective preventative and therapeutic interventions for adult haemoglobinopathy patients. Completion of the workbook and attendance at the study day is required for the successful completion of this haemoglobinopathy training event. You can contact your area Practice Development Educator to notify them of your successful completion so that they can update your training record

AIMS and OBJECTIVES
This workbook is designed for registered nurses, junior doctors and allied health professionals (AHP) who have some basic experience in caring for haemoglobinopathy patients (including Sickle Cell disease and Thalassaemia). We aim to promote high consistent standards of nursing and medical care. This workbook should be studied in combination with attendance at the training day.

The training day aims to update and build on your specialist knowledge of haemoglobinopathies. There will be an opportunity to discuss specific issues and queries with specialist haemoglobinopathy consultants, nursing staff and psychologists.

ACCREDITATION

This programme has been accredited by the RCN Centre for Professional Accreditation until September 4th 2018

Accreditation applies only to the educational content of the programme and does not apply to any product

RESOURCES, REFERENCES AND FURTHER READING

1. Identification and management of stroke risk in children with sickle cell disease 2004. http://www.nhlbi.nih.gov/health/prof/bloods/sickle/sc-mngt.pdf in the UK 2008 (Sickle Cell Society)

2. Local central venous access device policy.

3. NHS Sickle Cell and Thalassaemia Screening Programme Standard for the linked Antenatal and Newborn Screening Programme 2nd edition. 2011.

4. Piel FB, Steinberg MH, Rees DC. Sickle Cell Disease. New England Journal of Medicine 2017 April 20;375 (16):1561-1573.

5. RCN Competencies: Caring for People with Sickle Cell Disease and Thalassaemia Syndromes. A Framework for Nursing. NHS Screening programmes. 2011.

6. Russell E Ware, Mariane de Montalembert, Léon Tshilolo, Miguel R Abboud. Sickle Cell Disease. Lancet 2017 S0140-6736(17)30193-9.

7. Sickle Cell Disease in Childhood 'Standards and Guidelines for Clinical Care'. 2nd edition. October 2010 (NHS Screening Programmes).

8. Sickle cell disease: acute painful episode overview. Nice Guidelines (2016/2017).

9. Standards for the Clinical Care of Adults with Sickle Cell Disease. 2008.

10. Standards for the Clinical Care of Children and Adults with Thalassaemia in the UK 3rd Edition, 2016. UK Thalassaemia Society.

11. STSTN South Thames Sickle and Thalassaemia network. Guidelines, policies, and leaflets created by Network. website http://www.ststn.co.uk/

12. The NHS Sickle Cell and Thalassaemia Screening Programme. https://www.gov.uk/topic/populatoipn-screening-programmes/sickle-cell-thalassaemia

13. Thalassaemia International Federation (TIF) Guidelines http://www.thalassaemia.org.cy

14. Transcranial Doppler Scanning for Children with Sickle Cell Disease - Standards and Guidance, second edition. September 2016.

15. Guidelines on red cell transfusion in sickle cell disease. Part I: principles and laboratory aspects. Bernard A. Davis, Shubha Allard, Kate Ryan et al on behalf of the British Committee for Standards in Haematology. 7 November 2016.

16. Guidelines on red cell transfusion in sickle cell disease Part II: indications for transfusion. Bernard A. Davis, Kate Ryan et al, on behalf of the British Society for Haematology. 18 November 2016

17. Vichinsky E. Consensus document for transfusion-related iron overload. Semin Hematol 2001;38:2-4

    http://www.b-s-h.org.uk/media/2640/transfusion_scd_01178_part_ii-1.pdf.

18. Learning Outcomes and Competencies in conjunction with the RCN Competencies, NHS Screening Programmes for Sickle Cell and Thalassaemia. Streetly, Tangayi and Anionwu. 2011

Sickle Cell Patients who present to Paediatric Accident and Emergency Department

1. Where can you find all Sickle cell policies?

Trust Intranet guidelines and http://www.ststn.co.uk

2. Where are individualised Adolescent Sickle care plans found?

On Electronic Patient Record EPR, in the patients document list, (may need to extend visit period)

3. What observations should be carried out on arrival?

Temperature, Pulse, Respiratory Rate, Oxygen saturation in room air and Blood Pressure

4. What blood tests should be taken on presentation?

Full Blood Count, Renal Function, Bone Function, Liver Function, Group & Screen, retics, HbS%, LDH and crossmatch at least 2 units in case required

5. What is the time frame that a Sickle Cell Patient should receive pain relief after presenting to A & E, and what history should be taken before giving the pain relief?
By 30 minutes after arriving history should include:
Analgesia already taken
Allergies
Previous opiate toxicity

6. What condition should be considered with a sickle cell patient who presents with oxygen saturations of less than 94%, ⇧ Work of Breathing , Shortness of Breath, temp and history of Coryzal Symptoms**?**

Acute chest syndrome (ACS)

7. What condition should be considered when a Sickle Cell Patient presents with a distended abdomen, pallor, lethargy Shortness of Breath, ⇧ Work of Breathing and lethargy?

Sequestration, constipation, girdle syndrome and also acute abdomen

8. What is a vaso-occlusive episode?

The most common clinical manifestation of Sickle Cell Disease is vaso-occlusion. A vaso-occlusive episode can occur when the microcirculation is obstructed by sickled RBCs, causing ischemic injury to the organ supplied and resultant pain. Pain constitutes the most distinguishing clinical feature of sickle cell disease and is the leading cause of emergency department visits and hospitalizations for affected patients, this can occur from birth onwards but children usually protected by raised fetal haemoglobin levels in first year of life. Dactylitis can occur from about 9 months of age Other complications of sickle cell disease may also be accompanied by pain

9. List some of the types of vaso-occlusive episodes?

Painful vaso-occlusive episode ~(also known as 'painful crisis')

Dactylitis

Acute sickle abdomen

Girdle syndrome (rare)

Chest syndrome

Priapism

10.What other complications may occur in children/ adolescents with sickle cell disease?

Stroke

Thromboembolism (rare)

Avascular necrosis of hips and shoulders

Gall bladder disease

Aplasia

Osteomyelitis

Invasive pneumococcal disease

Admission of Paediatric and Adolescent Patients with Sickle Cell to the Ward

1. On admission of a Sickle Cell paediatric patient to the ward how often vital signs should be taken and what are the observations?
Every 30 mins until pain relieved, continuously if acutely unwell, then 4 hourly if stable, TPR, Sats on Room Air, BP (Pain score is measured on a visual analogue scale, with 0 being no pain and 10 being the worst pain).

2. Which of the following would prompt you to escalate a deteriorating patient to the Sickle Cell Team?
a) Decreased level of consciousness

b) A drop in oxygen saturations of more than 2% from the patient's baseline

c) A drop in oxygen saturations of more than 4% from the patient's baseline +/- saturation of less than 94%

d) If triggering PEWS (Paediatric Early Warning Score)

a, c & d

3. When monitoring oxygen Saturations this should always be recorded and monitored in……..?

Room air

4. What are the key aspects of treatment for a patient admitted with painful crisis?

Hyperhydration used to be thought to reduce the length of a painful episode but this is now not thought to be the case and is not recommended as it can precipitate respiratory failure in ACS due to fluid overload. Adequate pain relief.Maintaining adequate hydration. Regular observations of vital signs , regular penicillin v if other antibiotics not prescribed

5. How often should pain score and observation be carried out for a patient admitted with a painful vaso-occlusive episode?

Every 30 mins until patient is comfortable/settled

6. What are the key aspects of treatment for a patient admitted with headache untouched by pain relief, blurry vision, slurred speech and unilateral weakness?

Clinical assessment: for neurological signs and symptoms

Radiology: Urgent CT scan of brain to exclude bleed, followed by MRI/MRA of brain as soon as possible but transfusion should not be delayed

Blood tests including Full Blood Count, Retics, LDH, CRP Renal, Bone Profile, Group and Crossmatch, secure venous access

Strict neuro-observations, nurse in HDU

Urgent red cell exchange transfusion (automated where possible), To reduce S% to <30 and increase the Hb concentraton to 100-110g/l. If exchange is likely to be delayed by 6 hours, provide a small top up transfusion to bring Hb up to 100g/l.

Pain relief and hydration to continue. Aspirin, anticoagulation or thrombolysis not indicated in acute infarction in SCD, due to risk of bleeding due to underlying vasculopathy.

7. What should you do if a patient appears over narcosed?
Seek medical review urgently
Give any prescribed reversal medication
Withhold further opiates until confident the patient is stable

8. When can the monitoring of the patients vital signs be extended?
When pain controlled and patient is stable

9. What is girdle syndrome and how is it treated? Most likely to be seen in older children
Severe abdominal pain that affects the whole abdomen circumferentially is described as 'Girdle Syndrome' and is possibly due to bowel ischaemia as a result of vaso-occlusion, often causing abdominal distension and ileus. A more common presentation in children of all ages is abdominal sickling associated with constipation but no ileus. See guideline
Treatment
1. **Secure IV access**
2. **Abdominal X-ray**
3. **Surgical review**
4. **Optimum pain management with intravenous opiates**
5. **Nil by mouth, intravenous fluids, strict monitoring of fluid balance**
6. **Nasogastric tube on free drainage**
7. **Monitor blood gases to treat acidosis or abnormal electrolytes**
8. **Red cell transfusion (top up or exchange)**
9. **Intravenous broad spectrum antibiotics**

Management of Sickle Complications Acute Chest Syndrome (ACS) in Paediatric and Adolescent Sickle Cell Patients

1. What methods can you administer to try and prevent a patient admitted with a painful vaso-occlusive episode (painful crisis) from developing ACS?

a. Adequate pain relief
b. Incentive Spirometry
c. Continuous monitoring of vital signs
d. Antibiotics
e. Respiratory physiotherapy
f. All of the above

2. What methods of treatment can you provide for a patient who has confirmed ACS?

a. Review by Sickle Cell Team/Senior Nurses
b. Chest X-ray
c. Continuous monitoring of vital signs
d. Top up transfusion if steady state Hb has dropped by 20g/l or more
e. Exchange Transfusion (Apheresis) with direction from Sickle Cell consultant and registrar
f. Antibiotics
g. All of the above

Management of Sickle Complications Sequestration in Paediatric and Adolescent Sickle Cell Patients

1. What is sequestration and what are the symptoms?

   Pooling of large volumes of blood mainly in the spleen (usually in children under eight) but may occur in liver at any age resulting in rapid enlargement of the liver or spleen

   Resulting hypotension and hypovolaemic shock, as blood is in the spleen/liver rather than circulating

   May result in death if not recognized and treated with blood/ fluid support

2. What are the organs affected by sequestration?

   Spleen and Liver

3. What treatment can you administer for sequestration?

   Top up transfusion/ fluid support adequate pain relief.

4. Some major indications that a Sickle Cell patient may require a splenectomy are?

Oversized spleen and causing discomfort.

Transfusion requirement over 200-220mL/Kg/yr.

   Other signs of an overactive spleen, such as low white blood cell count and low platelet count.

   Recurrent episodes of splenic sequestration (greater than 2 episodes)

5. Name two complications that can occur post splenectomy?

   Overwhelming post-splenectomy sepsis (OPSI)- usually worse in the first year post –splenectomy)

   Increased platelet count

Management of Sickle Complications Management of Sickle Complications Cerebrovascular accidents /Stroke in Paediatric and Adolescent Sickle Cell Patients

1. Name types of stroke or cerebrovascular accident (CVA) that a Sickle cell patient can present with?

Ischemic stroke can be divided into two main types: thrombotic and embolic.

Intracerebral haemorrhage occurs when a diseased blood vessel within the brain bursts, allowing blood to leak inside the brain.

Subarachnoid haemorrhage occurs when a blood vessel just outside the brain ruptures.

Transient ischemic attack (TIA)- this is where the symptoms of stroke are short-lived and usually no abnormalities are found on imaging

Silent cerebral infarcts (SCI)- in this case there are imaging evidence of strokes, but no physical signs on clinical examination

2. What are the signs of an overt stroke?

Sensory and motor movements maybe impaired, unable to smile, unable to move one side of the body, drooping/facial palsy, slurred speech.

3. What treatment should be administered for a patient with suspected stroke immediately?

Initial investigations: Full blood count, electrolytes, blood gas analysis, liver function test, coagulation screen, fibrinogen levels, Blood group and crossmatch, serum lactate, urgent CT scan of head followed by MRI/MRA of brain

Observations: Strict neuro-observations, may need nursing in a HDU environment

Involve neurologists early

Urgent exchange transfusion (preferably automated) in an ITU setting. Top up transfusion to be given if exchange transfusion is likely to be delayed by >6 hours. For centres with no facility for monitoring, urgent transfer after patient has been stabilised.

4. What treatment should be provided for Sickle Cell Disease patient post Stroke?

Over 90% of patients with one overt stroke will have subsequent strokes, Hence secondary stroke prevention strategy is vital in preventing further neurological damage. This is done by initiating a transfusion regime (tp up or exchange) whereby pre-transfusion sickle percentage is maintained <30. Children with strokes need regular monitoring of their cerebral vasculopathy with neurology follow up, annual MRI/MRA scans and monitoring of the effects of iron overload. This is best done in a multi-disciplinary setting.

5. What are some of the stroke prevention methods that a comprehensive centre must provide for sickle cell patients?
Transcranial Doppler in children (identification), transfusion (top up transfusion and red cell exchange transfusions, hydroxycarbamide therapy initiation and monitoring, family education and support for patient and family.

6. What is the age range that children with Sickle Cell Disease should have Transcranial Doppler Scans?

2-16 years of age (often facilitated better if a play specialist it available for younger children)

Management of Sickle Complications Renal function in Paediatric and Adolescent Sickle Cell Patients

1.List some renal complications that a sickle patient may experience?

Nocturnal enuresis

Distal renal tubular damage and renal tubular acidosis

Renal papillary necrosis

Glomerular sclerosis

Proteinuria may predate chronic renal failure (responds well to angiotensin converting enzyme (ACE) inhibitors)

6.5% of patients develop chronic renal failure

Increased incidence of renal medullary carcinoma in sickle trait and sickle cell disease

2. How would you monitor renal function in a sickle patient?

Regular measurement of serum urea and creatinine

Urine albumin creatinine ratio

Urine protein creatinine ratio

Serum cystatin

Management of Sickle Complications Priapism in Paediatric and Adolescent Sickle Cell Patients

1. What is priapism?

Painful persistent erection due to vaso-occlusive obstruction of the venous drainage of the penis

2. How should priapism be treated?

General measures:
Adequate pain relief
Hydration
Warm bath/exercise
Seek medical help if priapism persists for >2 hours

Specific treatment in hospital setting:
Optimising pain relief
Involve urologists early; they may undertake penile aspiration/irrigation. May need a shunt insertion under GA
Initiate alpha-adrenegic drugs such as etilefrine
Blood transfusion is often done urgently but no evidence to support its use in the acute setting and should not delay urological intervention

3. What is the end result for a patient who has suffered with untreated priapism?

Prolonged episodes of priapism may cause impotence

4. What advice would you provide to a patient experiencing stuttering priapism (short-lived painful erections of up to 30 minutes)?

Try light exercise (jogging on the spot, jogging up and down the step, empty bladder before going to sleep) seek advice if it continues with no change for a maximum of 1 hour .May require long term etilephrine.

No evidence if transfusions or hydroxycarbamide helps, but is often considered.

Management of Sickle Complications Aplastic Crisis in Paediatric and Adolescent Sickle Cell Patients

1.Define briefly what an Aplastic crisis is ?

Bone marrow stops making blood cells for a period of time after being infected with parvovirus B19. This will continue until the infected host's immunity clears the virus from the bone marrow. During the infection, the haemoglobin levels (and sometime the white cell and platelet counts) drop. For healthy individuals with normal haemoglobin levels and normal red cell lifespan, this does not cause any clinical problem. However, as red cells from sickle patients have a very short lifespan in the circulation, these individuals present with anaemia and low reticulocyte counts (occasionally other blood cell counts may also drop).

Reticulocytes are young red cells. During haemolysis, one would expect the reticulocyte count to be high as the body is trying to correct the anaemia by making extra cells. However, this is not the case in aplastic crisis where the production of red cells in the bone marrow id halted by the viral infection.

2. How will someone with aplastic crisis present?

Presents with a sudden fall in haemoglobin due to parvovirus B19 infection resulting in a transient inhibition of erythropoiesis.May or may not have a concurrent painful vaso-occlusive episode. On occasion, the patient may suffer from neurological sequelae of severe anaemia, and may present with seizures, loss of consciousness or strokes, + nephrotic syndrome
Self-limiting recovery usual within 1 to 2 weeks.

3. What treatment can you administer for a patient presenting with Aplastic crisis?

Top up transfusions are often required if the anaemia is profound.
Need to isolate and screen relatives with sickle and pregnancy

Management of Sickle Complications Pain Management in Paediatric and Adolescent Sickle Cell Patients

1. How would you monitor paediatric patients pain scores Babies, Toddlers and Adolescents?

   Paediatric Pain Assessment tool with smiley faces (visual analogue scale, VAS) normally out of 10.

   Parent's description,

   Patient description, observation e.g elevated heart rate elevated BP, Pews Score.

2. What type of pain relief can a paediatric patient receive when admitted with a painful crisis?
   Oral analgesia, opiates, Non-steriods anti-inflamatory drugs, Patient Controlled Analgesia or Nursing Controlled Analgesia if no change to initial pain score/obs

3. How often should pain score be carried out for patients admitted with painful crisis?

   Every 30 mins until patient improves

4. Where can you find the current guidelines for patients on a PCA /NCA?

Trust guidelines, policies and Protocols,

5. What additional medications should be written on the 'PRN' side of the drug chart for Sickle Cell patients receiving PCA/NCA/Opioids?
   Antiemetic
   Laxatives
   Antipyretics

6. What opiate **SHOULD NOT** be given to patients who present with Sickle Cell Disease? And for what reason?

   Pethidine

   Short half life , neurological effects if increase dose

7. What non-pharmacological treatments could be offered to an individual during a sickle cell crisis?

Complementarytherapies
Psychological support
Pain management techniques (distraction,...)
Patient and family education

Management of Sickle Complications Blood Transfusion Management in Paediatric and Adolescent Sickle Cell Patients

1. Name some roles of blood in the human body?

Transport of oxygen: Blood collects oxygen from the lungs, and distributes this essential element around the body.

Removal of waste products: Blood carries carbon dioxide, a gas formed by cells, to the lungs to be released from the body.

Waste products such as urea and uric acid are carried to the kidneys and liver, to be removed from the body in urine and stools.

Transport of hormones: Blood carries substances that regulate the function of important systems of the body, such as the endocrine, sexual and reproductive systems.

Carries nutrients. Blood delivers to the body the proteins, fats and carbohydrates produced from food broken down by the digestive system.

Fights infection. Blood helps the body fight infection and disease through cells that form part of its defence system, the immune system

2. Name the main blood groups?

The ABO blood group system has four major subtypes; A, B, AB and O, identified by the type of protein (also known as the marker or antigen) carried on the surface of the red blood cells. Each person's blood falls into one of these four main categories-i.e. each person has red blood cells of just one of these groups.

Blood group A - red blood cells carry a marker A on their surface.

Blood group B - red blood cells carry a marker B on their surface.

Blood group AB - red blood cells carry both A and B markers on their surface.

Blood group O - red blood cells carry neither A nor B markers on their surface.

Another important blood group system is the Rh system, which has five common subgroups:

C, D, E, c and e. RhD is important in pregnant women and can cause jaundice and haemolysis in the new born.

3. What blood tests should patients undergo when they are on a regular top up transfusion programme?

   Before first transfusion, Initial group and screen should also have extended red cell phenotyping (and if feasible genotyping) to identify rarer blood groups on their red cells.

Serial haemoglobin measurements

Pre- transfusion sickle percentage

Liver function test and ferritin levels

Hepatitis B surface antigen or other serological markers if vaccinated (anti-HBs)

Hepatitis C antibody (and HCV-RNA if positive)

HIV antibody (and HIV Ag and/or HIV-RNA if positive)

4. What actions should you take if you suspect a delayed transfusion reaction could occur 10 to 14 days after transfusion.

Stop blood
Call for review/ help
Record vital signs
Give medications(steroid/ Epo) as directed by medical team
Return blood unit back to blood bank for analysis
documentation incident form /risk management
Avoid giving another transfusion

5. Give two reasons why a Sickle Cell patient requires regular transfusions/exchange?

Stoke

Other chronic complications of sickle cell disease, such as chronic renal failure, recurrent leg ulcers – both rare in children; recurrent acute chest syndrome not responding to hydroxycarbamide

Patients who are unable to tolerate hydroxycarbamide but have recurrent painful episodes or other acute complications.

6.What blood tests should patients undergo pre-red-cell exchange?

Retics, Hb Sickle Percentage %, Renal, Liver and Bone Profile, Virlogy, Full Blood Count, co-ag,Crossmatch Group and Save

7.What blood tests should patients undergo post red-cell exchange?

Retics, Renal, Liver, Bone Profile, Hb Sickle Percentage% and Full Blood Count

8. Where can the proforma for manual Sickle Cell exchange be found?

STSTN website http://www.ststn.co.uk/ Respective intranet e.g GSTT

9. What are the national requirements for filtering blood for a Sickle cell patient?

All blood units are leucodepleted in the NBS, Nurses should use the reccomended blood giving sets, which has a 200 micron filter for large clots and cellular aggregates Blood should be filtered prior to storage to avoid white blood cell interaction

b) Blood should be as fresh as possible preferably < 14 days old storage for top up and <7 days for exchange, temperature should be 4 degrees Celsius and monitored

closely

10. How many days before a top/up or exchange can a sickle patient undergo a blood test?

72 hours max

11. What information is needed prior to an automated exchange?

a)Height
b)Weight
c)Pre- transfusion Haemoglobin level
d)Pre- transfusion Sickle percentage
e)Pre- transfusion Haematocrit level
f) Peripheral access/double lumen port
g) All of the above

12. What are the current national and trust requirements regarding monitoring of vital signs when receiving blood products?
a) Pre each unit of blood
b) 15 minutes in to each unit of blood
c) Post each unit of blood

13. What are the trust guidelines for checking patient blood unit before administration?
Must now have a second checker

14. If a patient has a transfusion reaction when the unit of blood is started what would you do?
Stop blood
Call for review/ help
Record vital signs
Give medications as directed by medical team (antihistamine)
Return blood unit back to blood bank for analysis
Documentation: incident form

15. What are some of the complications of transfusions a SCD patient can experience?
Development of alloantibodies
Iron overload
Haematuria
Transfusion-transmitted infections
Acute or delayed haemolytic transfusion reactions
Post-transfusion purpura
Transfusion-associated allergic reactions such as chills, rigor, hives

16. What Urine test should be collected when patients are being regularly transfused?
Protein Creatinine Ratio, Albumin Creatinine Ratio

17. What must you look for on a unit of blood for a sickle cell patient?

HbSneg, date within in 7-14 days of being donated, type matched for the patient, date, hospital number date of birth, patient name

Blood provided for SCD patients should be:

HbS negative and, where possible, should be <7 days old for exchange transfusion (<10 days old for simple transfusion), but older blood may be given if the presence of red cell antibodies makes the provision of blood difficult

Blood should also be ABO-compatible, extended Rh- and Kell-matched units. If there are clinically significant red cell antibodies (current or historical) then the red cells selected should be negative for the corresponding antigens.

Transfusion to HbS <30% will prevent or reverse most acute sickle complications and significantly reduce long-term complications in chronically transfused patients. Baseline Hb and % HbS should be taken into consideration in setting target post-transfusion Hb in order to avoid **hyperviscosity**. In SCD patients with baseline Hb <90 g/l and not on regular transfusions, the **post-transfusion Hb should not exceed 100 g/l, particularly if %HbS is greater than 30%**. The post-transfusion Hb can be set at a higher target in chronically transfused patients or if %HbS is low, but should be individualised to each patient. Patients with high baseline Hb (>100 g/l) should not be transfused above their steady state Hb

18. When a patient on regular transfusions gets to a serum ferritin level of 1000 what medication should be started?

Iron chelation example deferasiroxdeferroxamine or deferiprone

Blood transfusion in Sickle Cell Disease:
Consideration of sickle cell patients for transfusion, particularly long-term regimens, should weigh up the potential benefits against potential risks.

Cerebrovascular disease
Regular transfusion to maintain HbS <30% should be offered as initial treatment to children with SS or S/β^o thalassaemia aged 2–16 years judged to be at high risk for a first stroke on the basis of Transcranial Doppler ultrasonography (TCD).

Hydroxycarbamide treatment should be considered for the primary prevention of stroke in children with sickle cell anaemia and high TCD velocities but not severe Magnetic Resonance Angiography (MRA)-defined cerebral vasculopathy after an initial period of transfusions. The duration of the initial period of transfusion should be tailored to the individual patient but should be for a minimum of 1year; the transition to hydroxycarbamide should be done gradually and transfusion should be withdrawn after the hydroxycarbamide has been escalated to the maximum tolerated dose.

Regular transfusion to maintain HbS <30% effectively reduces the incidence of recurrence of cerebral infarction (defined as a stroke or a new or enlarged silent cerebral infarct) in children with sickle cell anaemia and S/β^o thalassaemia aged 5–15years. Treatment options including transfusion should be discussed with families of children who are found to have silent cerebral infarcts. Transfusion should be offered to children who are identified to be at greatest risk for recurrence of infarction after discussion of its benefits and risks.

Long-term transfusion to maintain HbS <30% is recommended for the prevention of recurrent ischaemic stroke due to sickle cell disease in both children and adults.
Adults or children who present with signs or symptoms suggestive of acute ischaemic stroke should be transfused without any delay to maintain HbS <30% pending further investigation. Those with confirmed stroke due to sickle cell disease should continue regular transfusions long-term.

Surgery
Preoperative transfusion is recommended for sickle cell disease (HbSS and HbSC) patients undergoing medium-risk surgery (e.g. abdominal, tonsillectomy, orthopaedic).
Transfusion is recommended for sickle cell patients of all genotypes requiring high-risk surgery (e.g. cardiovascular, brain).
All sickle cell patients with other genotypes undergoing surgery should be individually assessed, taking into account previous history and complexity of surgery, and a management plan should be formulated to include the need for transfusion.
Particular care should be taken to ensure that all aspects of perioperative care, including oxygenation, hydration, warmth and anaesthetic and surgical technique, are optimised in all sickle cell patients undergoing surgery.
For patients requiring emergency surgery, the urgency and complexity of the procedure should be taken into account in the timing of perioperative transfusion. Simple transfusion should be given preoperatively if Hb <90g/l provided this will not result in undue delay to surgery. If transfusion is likely to cause an unacceptable delay to surgery, it is reasonable to proceed to surgery while arranging to transfuse the patient intra- or post-operatively if necessary.

Acutely ill patients
Transfusion is recommended and may be life-saving in acute sickle complications such as splenic sequestration, hepatic sequestration, aplastic crisis and severe acute chest syndrome.
Transfusion should be considered in the unwell patient with acute multi-organ failure, mesenteric syndrome and patients with severe sepsis. Such cases should be discussed with the specialist haemoglobinopathy team (SHT).
Transfusion for other causes of acute anaemia requires individual assessment and should be discussed with the SHT. Transfusion may be given by simple transfusion (top up) or exchange depending on clinical severity under the guidance of the SHT.

Pregnancy
Prophylactic transfusion is not routinely required for sickle pregnancy, but should be considered for women with:

- previous or current medical, obstetric or fetal problems related to SCD
- women previously on hydroxycarbamide because of severe disease
- multiple pregnancy.

Women on long-term transfusions for stroke prevention or for amelioration of severe sickle complications should continue with regular transfusions throughout pregnancy.
Transfusion should be considered in women with worsening anaemia or those with acute SCD complications (acute chest syndrome, stroke etc.).

Amelioration of severe disease
In selected patients with severe disease, blood transfusion can be effective in ameliorating disease, resulting in reduction in hospital bed days. Hydroxycarbamide is recommended as first line treatment for prevention of recurrent acute chest syndrome or repeated painful episodes associated with chest syndrome. Regular transfusion should be considered for patients failing this treatment or for whom hydroxycarbamide is contraindicated or not acceptable.

Other indications
Transfusion is not recommended to treat steady state anaemia provided that Hb has not fallen over a period of time to symptomatic levels (e.g. with developing chronic kidney disease).
There is no evidence that transfusion shortens the duration of a painful crisis.

Transfusion is not recommended in uncomplicated painful crises but should be considered if there is a substantial drop in Hb from baseline (e.g. >20 g/l or to Hb <50 g/l), haemodynamic compromise or concern about impending critical organ complications.
The benefit of transfusion to relieve established acute priapism has not been shown in randomised controlled trials. Many patients require a shunt or drainage procedure under general anaesthesia, which may require a transfusion. Such cases should be discussed with the SHT.
Transfusion has been shown to reduce the incidence of symptomatic avascular necrosis in children receiving regular transfusions to maintain HbS <30% for prevention of recurrence of cerebral infarction. However, there is no consensus on the use of transfusion for the sole purpose of preventing this complication in routine practice.
Where transfusion is considered for indications where there is insufficient evidence for its benefit (e.g. leg ulcers, pulmonary hypertension, end stage renal or liver disease, progressive sickle cell retinopathy), a full risk-benefit assessment should be carried out in liaison with the SHT and each case should be considered on its own merits.

Investigation of a haemolytic transfusion reaction:

1) Document evidence of haemolysis.
Check haemoglobin concentration and review blood film

Check bilirubin, lactate dehydrogenase and reticulocyte count

Check urine for haemoglobinuria and if positive and hyperhaemolysis suspected, consider serial high performance liquid chromatography analysis of the urine

(2) Serological testing on pre-transfusion and post-transfusion blood samples.
Repeat ABO/Rh D typing

Check antibody screen on both samples

Red cell units transfused within 12–24 h should be crossmatched against both the pre- and post-reaction samples

Check the direct antiglobulin test (DAT). A positive DAT may be encountered as part of an investigation

(3) If antibody screen positive
Determine the specificity of the antibody (ies) – (antibody investigations may demonstrate a new alloantibody or antibodies in a patient with a delayed haemolytic transfusion reaction)

If the specificity of the red cell antibody is not clearly determined the sample should be sent to a red cell reference laboratory

(4) If DAT positive
Prepare an eluate to test for the presence of specific alloantibodies

Even if no new red cell alloantibody is detected in post-transfusion sample as above, but DAT is positive, red cell eluate studies should be undertaken

(5) Selection of red cell units for further transfusion
Carefully consider the need for further transfusion with consultant input and discussion with the National Blood Service if complex transfusion requirements

Select ABO extended Rh and K matched units negative for the relevant antigen(s) to which there are current or historical antibodies

Undertake serological crossmatch to check compatibility; **electronic issue should not be used**
If the identity of the new alloantibody is in doubt despite further specialist testing, consider providing extended antigen matched blood (if serological phenotyping cannot be used because of the presence of transfused donor red blood cells, the sample should be sent to an appropriate reference laboratory for molecular red cell genotyping)

Any adverse events or reactions related to transfusion should be appropriately investigated and reported to local risk management systems and to National Haemovigilance Schemes (e.g. Serious Hazards Of Transfusion – SHOT).

Management of Sickle Complications Central Venous Access in Paediatric and Adolescent Sickle Cell Patients

1. What are the types of ports that a sickle patient may have insitu?

Double lumen vortex port

Simple port-a-cath

2. Who can access ports?
   Trained staff only (apheresis, Sickle Cell CNS, most day care staff, CVC team, staff given specific vortex training)

3. How should ports be accessed?

   Aseptic technique

4. What solution should a double lumen vortex port be locked with?
   Heparin Sodium Flushing Solution 200iu in 2 mls.

5. How often does the port-a-cath need to be flushed and locked?

   4 weekly

6. What are other forms of access for a patient who is in need of top up transfusion or exchange?

Vascath Up to 48 hours unless instructed otherwise by the Sickle Cell team.

Management of Sickle Complications Long Term Management of Paediatric and Adolescent Sickle Cell Patients

1. Which of the following may alleviate long term complications of sickle cell?

a) Hydroxycarbamide
b) Red cell exchange transfusion
c) Bone marrow transplantation
d) All of the above

2. In accordance to the National Standards for Haemoglobinopathies how soon after birth should a patient be seen by a comprehensive centre/ haemoglobinopathy Consultant?
Must be seen by 12 weeks

3. What are the precautionary methods used to assist with stroke prevention for children between ages 2-16 years of age?

a)Transcranial Doppler

b) top up or exchange transfusions if at risk

c) hydroxycarbamide /parent education

4. What is the lifelong prophylaxis treatment that a sickle cell patient should be taking from the age of 6weeks old?

Pencillin V, should have all vaccinations up to date + Pneumovax and Men ACWY Hep B annual flu

National guidelines recommend the following:

- All routine vaccines, including live vaccines such as measles, mumps and rubella (MMR) can be given safely to children or adults with an absent or dysfunctional spleen.
- Asplenia or hyposplenism is not a contra-indication for live vaccinations prior to travel (eg, yellow fever and live oral typhoid vaccine).
- Re-immunisation with Pneumovax of hyposplenic/asplenic patients is currently recommended every five years. Re-immunisation in these patients may be made on the basis of antibody levels.
- Influenza vaccination - annual influenza vaccination is recommended after 6 months of age.

Lifelong prophylactic antibiotics

These are recommended in patients at high risk of pneumococcal infections and the antibiotics of choice are oral phenoxymethylpenicillin or macrolides. Patients developing infection, despite measures, must be given systemic antibiotics and admitted urgently to hospital.

- Risk factors for high risk in hyposplenism include:
    - Age <16 years or >50 years.
    - Poor response to pneumococcal vaccination.
    - Previous invasive pneumococcal illness.

- Use phenoxymethylpenicillin (adult 250-500 mg bd - although 500 mg od may be more realistic if compliance is a particular problem), amoxicillin (adult 250-500 mg daily), erythromycin (adult 250-500 mg daily) orally.
- Consider recommending that the patient take a full therapeutic dose of antibiotics if they develop infective symptoms such as pyrexia, malaise, shivering, etc and that they seek medical advice immediately.
- Allowing patients to have a reserve supply of antibiotics at home or on holiday may also seem appropriate.
- If not deemed to be high-risk then the pros and cons of taking lifelong antibiotic prophylaxis need to be discussed with each individual patient.

The British Committee for Standards in Haematology recommends the following:

- Patients should be given written information and carry a card to alert health professionals to the risk of overwhelming infection. Patients should wear an alert bracelet or pendant.
- Patients should be aware of the potential risks of overseas travel, particularly with regard to malaria and unusual infections - e.g., those resulting from animal bites.
- Patient records should be clearly labelled to indicate the underlying risk of infection. Vaccination and re-vaccination status should be clearly and adequately documented.

Management of Sickle Complications Peri-operative Care Paediatric and Adolescent Sickle Cell Patients

1. Before any planned surgical procedure an individual with sickle cell should have the following pre-requisites:

See a consultant anaesthetist in pre-assessment
Consider pre-operative transfusion (top up or exchange)
Be admitted for pre-hydration (from when nil by mouth)
May need intensive care or high dependency care post op care- ensure it is discussed with sickle clinical team and anaesthetic
See the Sickle Cell team in outpatients for peri-operative planning

2. What is the current national standard guideline and trust recommendation on antibiotics for individuals with sickle cell and those without a functioning spleen?

Treat when infection present
Prophylactic lifelong penicillin (or alternative)
Immunisations including Pneumovax and Men ACWY

3. Where can you find the haemoglobinopathy antibiotic guideline?

Trust intranet, pharmacy guidelines / formulary

Included in trust antimicrobial guidance

Pre-operative outpatient review with a haematology consultant with a specialist interest in haemoglobinopathies for peri-operative planning will include documented decisions about:

- Red cell transfusion (Exchange transfusion or top up to Hb of 10g/l) with blood fully matched for ABO, full-Rhesus phenotype (Cc/D/Ee), and K1 antigen, plus any other red cell allo-antigens present.
- Pain relief
- Hydration/fluid balance
- Oxygenation (including hyperoxygenation at induction of anaesthesia and careful monitoring of peri-operative oxygenation by pulse oximetry), incentive spirometry, chest physiotherapy, and consideration of prophylactic CPAP for 24 hours particularly post major abdominal and thoracic surgery
- Prophylactic antibiotics and infection screening and early management of any post-operative infections (hyposplenism)
- Thromboprophylaxis
- Temperature regulation (including consideration of warm air blankets, warmed IV fluids and adjustment of temperature in theatre)
- Avoidance of tourniquets and red cell salvage (neither suitable in sickle patients)
- Discharge planning and follow up.

Management of Thalassaemia Complications in Paediatric and Adolescent Thalassaemia

Thalassaemia

1. Name some types of thalassaemia

b) β-Thalassaemia Major or transfusion –dependent thalassaemia

c) Thalassaemia intermedia or non-transfusion dependent thalassaemia (may be α or β- thalassaemia)

2. The major clinical consequences of the pathophysiology of thalassaemia are severe, life-threatening anaemia and severe bone marrow hyperactivity. These result in

Severe pallor

Growth failure

Bone deformities, especially of the skull

In the absence of treatment, falling haemoglobin levels lead to heart failure, severe complications involving other vital organs and death in the first decade of life.

3. List some complications of β-Thalassaemia Major and intermedia

Endocrine problems

Delayed puberty, growth retardation

Diabetes mellitus

Hypothyroidism

Hypoparathyroidism

Hypogonadism

Osteoporosis

Cardiac abnormalities- mostly in poorly transfused or inadequately chelated patients

Pericarditis

Arrhythmias

Biventricular failure

Congestive heart failure

Pulmonary hypertension (more common in thalassaemia intermedia)

Hepatic abnormalities

Cirrhosis (especially if HCV and or HBV co-exist with iron overload), Liver failure

Splenic enlargement with possible hypersplenism

4. How can you identify a person's pre-transfusion trough haemoglobin level?

(EPR) Electronic patient Records/clinical Notes and clinic letters

5. Name at least three co-morbidities or conditions associated with Thalassaemia.

Anaemia, hypogonadism, osteoporosis, hypoparathyroidism, iron overload, diabeties, hyperplensism, splenomegaly, heapatomegaly, short stature,

6. Individuals with thalassaemia should have what blood test prior to every transfusion?

Full Blood Count, ferritin, Renal, Bone , Liver Profile Crossmatch

7. How many days in advance of top up transfusion can a patient with Thalassaemia have pre-blood tests?

Maximum 7 days

8. Thalassaemia patients who have special blood requirement where will these details be found where?

EPR Electronic Patient Record, letters/ labs can confirm.

9. Urine should be tested monthly for:

Albumin Creatinine and Protein/ creatinine ratio

10. Thalassaemia patients receiving blood transfusions should have what tests yearly?

Virology
Glucose tolerance test
Hormone profile (FSH, LH, TFT, oestradiol, testosterone)
MRI scan for iron overload monitoring

Management of Transfusion related Iron Overload in Sickle Cell Patients

1. Untreated iron overload can lead to:

liver cirrhosis, hormone deficiency, diabeties, cardiac failure, susceptibility to infection, organ damage

2. Side effects of Iron Chelation

Deferoxamine (Desferal)

Thrombocytopenia

Hearing loss

Deferasirox (EXJADE)

Increased creatinine

Rashes

GI disturbances

Proteinurea

Deferiprone

Neutropenia

Agranulocytosis

3. What is the serum ferritin Level that you start treating with chelators?

a) 800

b) 1000

c) 1200

d) 1020

4. What monitoring tests should be performed yearly to monitor iron overload for patients having regular blood transfusions?

t2* MRI scan of the heart

Ferriscan of the liver

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For a copy of the answer book.

Thank you

Please note: The RCN **cannot confirm competence of any practitioner**.