SICKLE CELL DISEASE- MANAGEMENT OF PAIN IN CHILDREN

A
Mild – Moderate Pain
Paracetamol (Pain score 1-2)

Is pain relieved after 30 minutes?

Yes
Discharge home

No
Add Ibuprofen or Diclofenac
Move to pathway B

B
Moderate pain
(Pain score 3-4)
Paracetamol
Ibuprofen/Diclofenac

Is pain relieved after 30 minutes?

Yes
Discharge home

No
Add Dihydrocodeine or Codeine Phosphate if over 12 y
Morphine if under 12
Move to pathway C

C
Moderate severe pain
(Pain score 5-6)
Paracetamol
Ibuprofen/Diclofenac
Dihydrocodeine
Codeine Phosphate if over 12 y
Morphine if under 12

Is pain relieved after 60 minutes?

Yes
Observe for 4 hours
If pain control maintained
Discharge home

No
Change Codeine if used to Oral Morphine solution
Move to pathway D

D
Severe pain
(Pain score 7+)
Oral Morphine solution
Paracetamol,
Ibuprofen/Diclofenac

Is pain relieved after 60 minutes?

Yes
Continue with regular oral Morphine, Ibuprofen/Diclofenac and Paracetamol

No
Commence PCA/NCA
Administer bolus of Morphine if PCA delayed

NB: Please let Dr Bhatti’s secretary (ext 2538) know about children discharged home.
**Sickle Cell Disorders**

The sickle cell disorders are a heterogeneous group of disorders affecting patient in whom haemoglobin S is the major haemoglobin. They include haemoglobin SS, SC, and S beta thalassaemia.

It is important to make the diagnosis early to prevent and treat common complications effectively; some of them can be life threatening.

- Infection
- Painful Vaso-Occulsive Crisis
- Splenic Sequestration
- “Aplastic” Crisis
- Stroke
- Chest Syndrome

Early vaccination and Penicillin prophylaxis significantly reduces the infection-related morbidity and mortality. Daily folic acid supplements help to minimise anaemia. Recently introduced Hydroxurea therapy in older children minimised the frequency and severity of crises and the need for hospital admission.

The mainstay management of sickle cell crisis is:

1. Fluid replacement
2. Pain relief
3. Antibiotics

*Sickle cell disorder patients are shared care with Tertiary centre (SGH). It is important to liaise with Dr Bhatti (named consultant for Haemoglobinopathy) and Tertiary centre for advice

**Fluid Replacement:**

**Rationale:** Many patients with sickle cell disorders have reduced tubular concentrating ability. Continued fluid loss without adequate replacement causes a reduction in plasma volume with an increased blood viscosity and aggravation of sickling.

**Minimum Requirements:**

100 ml/Kg for the first 10 Kg body weight
50 ml/Kg for the next 10kg body weight
20ml/kg thereafter.

Fluids may be given orally or intravenously. Use standard
(5% dextrose 0.9% saline) re-hydration solution. Review the need for added potassium.

**NB:**

- Children with sickle cell disease need individualised fluid regimes. They are often dry and will need additional fluids; conversely over zealous fluid replacement may make the situation worse by precipitating cardiac failure.
- The oral route should be used whenever possible but children with severe pain who are not settling, or who have abdominal symptoms should receive intravenous re-hydration.
- Intravenous therapy should be stopped once the patient is stable and pain is controlled.
- Adequate oral intake should be documented.

**SICKLE CELL CRISIS – PAIN MANAGEMENT REGIME**

- Parents often estimate their child’s level of pain quite accurately using knowledge of their child’s normal behaviour and responses. Parent’s estimation of their child’s pain is an important factor to be considered when managing the pain and planning the next stages.
- Healthcare Professionals can underestimate pain levels therefore assessment should be completed using a validated pain assessment tool taking into consideration the child’s age and cognitive abilities.
- This guideline is designed to guide practice for children and young people experiencing all levels of pain from mild to severe and also considers whether the child is treated at home or admitted to hospital. Individual assessment is therefore essential if quality care is to be provided.

The Alder Hey Triage Pain Score; reference scoring chart

<table>
<thead>
<tr>
<th>Response Score</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cry/Voice</td>
<td>No Complaint/Cry/Normal Conversation</td>
<td>Consolable/No negative talk</td>
<td>Inconsolable/Complaining of pain</td>
</tr>
<tr>
<td>Facial Expression</td>
<td>Normal</td>
<td>Short Grimace &lt;50% of time of observation</td>
<td>Long grimace &gt;50% of time of observation</td>
</tr>
<tr>
<td>Posture</td>
<td>Normal</td>
<td>Touching/rubbing/sparing</td>
<td>Defensive/Tense</td>
</tr>
</tbody>
</table>
Movement | Normal | Reduced or restless | Immobile/Thrashing
--- | --- | --- | ---
Colour | Normal | Pale | Very pale/“Green”

**ADMISSION TO ACCIDENT AND EMERGENCY (A&E):** Analgesia should be administered within 30 minutes of admission and aim for pain control within 60 minutes. Administration of oxygen will help to control pain and maintain oxygen saturation.

Patients may have tried oral analgesia at home. A full assessment is needed to ascertain what has already been given and when.

**STAGE 1: MILD PAIN (Pain Score 1-2)**

a) **Paracetamol**

b) Non-drug methods (see Box 1) can help a child or young person to relax and place the focus of their attention on something other than their pain. (NB. these methods should complement, NOT replace pain medicines). Methods where the child/young person plays an active rather than passive role can be more effective, e.g. the child reads the story not the nurse or parent.

c) Reassess pain after 30 minutes - if not improved move onto next stage.

d) If assessed as clinically well with no other symptoms and tolerating adequate amount of oral fluids, the child can be discharged home on regular Paracetamol

e) Fluids – ensure full maintenance fluids are taken and tolerated.

**Box 1: Non-drug pain management methods**

**NON-DRUG PAIN MANAGEMENT METHODS**

**Physical** - stretching, application of heat pads (do not use cold packs as this can exacerbate sickling), massage, stroking

**Behavioural** - distraction (including play, blowing bubbles, and reading, music, and computer games), guided imagery often combined with relaxation

**Information** - Talking to children (think about their age, cognitive level and “What needs to be explained and talked about”?)

**STAGE 2: MODERATE PAIN - PARACETAMOL ADMINISTERED REGULARLY WITH LITTLE EFFECT**

(Pain Score 3-4)

a) **Paracetamol**
b) **Ibuprofen.**  
   **OR**  
   **Diclofenac**

c) Non-drug methods as in stage 1.

d) Reassess pain after 30 minutes - if not improved move onto next stage.

d) If assessed as clinically well with no other symptoms evident, pain is under control and tolerating oral maintenance fluids then the child can be discharged home on regular Paracetamol and Ibuprofen (or Diclofenac)

e) When one of the NSAID agents is in use, the child’s hydration status **must** be checked to ensure that they are well hydrated to avoid Acute Renal Failure.

**STAGE 3: MODERATE TO SEVERE PAIN - STAGE 2 INTERVENTIONS NOT EFFECTIVE**  
**(Pain Score 5-6)**

a. **Paracetamol**

b. **Ibuprofen**  
   **OR**  
   **Diclofenac**

c. **Dihydrocodeine**  
   **OR**  
   **Codeine** (only use in children over 12 y. of age)  
   There is evidence that giving Dihydrocodeine/Codeine and Paracetamol together is more effective. Only use Dihydrocodeine/Codeine in children over 12 y. In younger children use Morphine.

d. Non-drug methods as in stage 1.

e. Reassess pain after 45 minutes - if not improved then move onto next stage.

f. If no other symptoms evident, pain is under control and tolerating oral maintenance fluids then the child can be discharged home on regular Paracetamol, Ibuprofen (or Diclofenac) and Dihydrocodeine / Codeine (in children over 12 y.). If younger then 12 y. use Morphine

g. When one of the NSAID agents is in use, the child’s hydration status **must** be checked to ensure that they are well hydrated to avoid Acute Renal Failure.
**STAGE 4: SEVERE PAIN (Pain Score 7 or more)**

All of these children should be admitted as soon as possible. The Consultant on call **must** be contacted and Sickle Cell Crisis plan implemented, which incorporates pain management. Such patients should be admitted to HDU

a. Check analgesia administered regularly over last 24 hours. If not – please continue at the stage identified (i.e. stage 1, 2 or 3) and assess pain regularly. If pain persists with pain score of 7 or more, for a minimum of 1 hour (using validated pain assessment tool) or more:

b. **Oral Morphine solution**

c. To be given 1 hour after Dihydrocodeine or Codeine dose (only use Dihydrocodeine or Codeine in over 12 y. old)

d. If not effective:

d. **Commence PCA/NCA Morphine**
e. If PCA/NCA commencement is **delayed** – administer IV **boluses of Morphine**

e. If intravenous access is not possible – administer subcutaneous Morphine - see PCA/NCA – Morphine (Opioid) Infusions via the Intravenous or Subcutaneous Route

f. **Multi-modal analgesia** – Paracetamol and Ibuprofen should be continued regularly to increase efficacy of pain management plan.

g. Applying heat directly to the joint/area affected can be very soothing.

i. Non-drug methods as in stage 1.

**Patient controlled Analgesia**

**Contact Pain management team to help to set up PCA/NCA**

Sharon Kitcatt,
Consultant Nurse –Acute pain service,
Direct line 01932722281 Pager 8-270

IV Morphine: Loading dose immediately of 0.1 mg / kg IV stat.
If not relieved in 15 minutes then second loading dose of 0.05 mg / kg. (May have up to 4 doses)
Once pain is controlled set up PCA / NCA*

*patient controlled or nurse controlled analgesia
If under six years the child needs NCA. 
Prescribe on a NCA / PCA form.

Prescribe 1 mg / kg Morphine in 50 mls 0.9% Normal Saline (= 20 mcgs / kg / ml).
For children over 50kg: Maximum dose 50 mg morphine in 50mls of 0.9% Normal Saline.

Initial standard rates: 0.5ml / hr background (10mcg/kg)
                        1 ml / hr bolus (20mcg/kg)

5 minutes lock out if PCA
15 minutes lock out if NCA
Adjust rates as required. (Aim to increase the size or number of boluses first rather than the background)

Write initial PCA instructions on prescription chart; don’t forget to write up a “rescue” dose of naloxone.

**Antibiotics**

Sickle cell patients are particularly susceptible to severe overwhelming blood borne infections.

The commonest organisms are Streptococcus Pneumonia, Haemophilus Influenza, and Salmonella. The use of prophylactic Penicillin has decreased the incidence of pneumococcal infections.

Always look for a focus of infection when the patient is febrile (blood, lungs, urine, bone etc.) and treat appropriately. Collect samples including blood cultures, mycoplasma titres, urine and swabs for bacteriological studies, prior to starting antibiotics as below:

1. Any child with a sequestration syndrome, chest syndrome, or toxic, must receive IV antibiotics:

   >6 months: IV Ceftriaxone 80 mg / kg once daily to be given over ½ hr (if shocked consider Cefotaxime 50mg/kg/dose QDS. Consider dose reduction after 24 hours or when clinically stable)

   < 6 months IV Cefotaxime 200 mg / kg / day in 4 divided doses, after 3 days reduce to 150 mg / kg / day.

2. Any child with two temperatures of 38.5°C and one at 39°C, but who appears mild to moderately ill should receive IV antibiotics:

   > 6 months: IV Ceftriaxone 50 mg / kg/ once daily.

   < 6 months: IV Cefotaxime 150 mg / kg / day in 3 divided doses.
If signs of chest infection as well as the above, add in oral Azithromycin (*to cover mycoplasma*). Also do mycoplasma titres, if it is positive a 10 day course is required, otherwise stop.

Patients who are clinically well and are afebrile or have only a low-grade temperature should have their prophylactic penicillin increased from BD to QDS. If the child then enters either category 1 or 2 (see above), start on IV antibiotics.

Bacteriologically confirmed salmonella osteomyelitis should be treated with high dose IV Ciprofloxacin after discussion with microbiologist, IV first, and then oral.

**EMERGENCY MANAGEMENT - Potentially life threatening conditions**

1. **Sequestration**
   
   a) **Acute Splenic Sequestration** (*More common in young children*).

   Characterised by sudden onset of tachypnoea, pallor, abdominal pain, and splenic enlargement. May be precipitated by fever, dehydration, and hypoxia. Rapid sequestration of red cells can lead to sudden fall of the haemoglobin and death from hypoxic cardiac failure with pulmonary oedema. May have a more insidious onset.

   **Investigation:** Hb, reticulocytes, cross-match, blood-culture, WBC, U&E, store serum for virology.

   **Management:**

   Red cell transfusion without delay (*if in extremis uncross matched O negative*).

   Assess the need for volume expansion and site a cannula. Crystalloid should be used with caution as this may exacerbate heart failure.

   Broad-spectrum antibiotics to cover Pneumococcus and Haemophilus

   b) **Hepatic Sequestration**

   Less common than splenic sequestration in children, but treated in the same way as acute splenic sequestration.

   c) **Chest Syndrome - Sequestration within the lungs.**

   This is a common cause of death, and maybe a postoperative complication in older children. Characterized by “T-shirt” distribution of pain, signs of lung consolidation (often bilateral), high fever, tachycardia, and tachypnoea. Severe pain leads to limited respiration and O2 intake. Adequate analgesia increases O2
intake. Coughing is a late symptom; physical signs may precede X-ray changes by up to 12 hours. However chest X-ray changes can also precede signs. Falling Hb without evidence of splenic or hepatic sequestration is an indication for chest X-ray. A rapid deterioration requires urgent treatment.

It is sometimes difficult to tell the difference between a chest syndrome and a chest infection, early transfusion is often appropriate and frequently life saving. It is important to liaise with tertiary care hospital if child looks unwell for early advice / early transfer to tertiary hospital.

**Investigations:**
- FBC, Reticulocytes, and sickle  %
- Biochemical profile
- Chest X-ray
- Sputum and blood cultures
- Serum for atypical serology

**Management:**
- Most important is prompt recognition of acute chest syndrome
- IV fluids as in painful crisis- but watch carefully for fluid overload → continue with pain management, avoiding hypoventilation from over sedation.
- Maintain adequate oxygenation: monitor with pulse oximeter, regular bronchodilators by nebuliser, chest physiotherapy.
- Treat underlying infection: Ceftriaxone at the higher dose plus Azithromycin.
- Transfusion, as discussed below.

**Transfusion:**

Decisions regarding transfusion are best guided by patient’s clinical condition. **Please liaise with tertiary care hospital regarding transfusion. If exchange transfusion needed, the patient needs to be transferred to tertiary care hospital.** The purpose of transfusion is to enhance oxygen-carrying capacity, improve tissue oxygen delivery, and reduce HbS concentration to reduce sickling and prevent progression to acute respiratory failure. Transfusion commonly results in impressive improvement within hours.

Simple transfusion is indicated for patients with mild or moderate chest syndrome, particularly with falling Hb levels, aiming for a Hb level of no more than 10g/dL

**2. Pneumococcal and Haemophilus Septicaemia/Meningitis**

A septic child is predisposed to Pneumococcal, Haemophilus septicemia and meningitis. Consider sepsis in a child with temperature of 38.5°C or more and treat with IV antibiotics without waiting for culture results.
3. **Malaria**

Needs urgent anti-malarial therapy appropriate to the zone of infection, Enquire about travel history. Transfusion is often necessary as haemoglobin might fall significantly due to increased haemolysis.

4. **Aplastic Crisis**

Onset of profound anaemia over 1 – 3 days without sequestration, due to transient parvovirus – induced marrow hypoplasia. Check Hb, retics, parvovirus DNA and antibody titres. If there is no retic response, transfuse. Immunity appears to be lifelong.

5 **Neurological Complications-Cerebral Infarction**

Sickling within the cerebral vessels- may present with severe headache, fits, TIA and neurological symptoms, onset may be insidious, organise an urgent CT scan. It is an indication for an immediate exchange transfusion. Early liaison with Tertiary care hospital is essential.
PATIENT PRESENTS WITH SEVERE HEADACHE

CONSIDER:
BACTERIAL MENINGITS
INTRACRANIAL BLEED

URGENT CT SCAN

CNS Bleed

These pt often need Exchange transfusion

Meningitis likely

If associated symptoms of fever, neck stiffness and photophobia
IV AB
CONSIDER TRANSFUSION
PATIENT PRESENTS WITH ACUTE NEURO DEFICIT

IS PATIENT IN PAINFUL CRISIS, PALE, SEPTIC?

No

Analgesia, hydration, oxygen
Consider antibiotics
Consider transfusion

Yes

CT SCAN or MRI / MRA
Liaise with Tertiary care for advice / Transfer
**Transfusion in Sickle Cell Disorder**

Anaemia alone in an otherwise well child is not an indication for transfusion unless Hb falls to 5 g/dl or lower, in which case discuss with on call Consultant with details of previous results. Check reticulocyte counts. Use Kell compatible, rhesus compatible blood matched for antibody status.

**Simple or ‘top-up’ transfusion**

Indicated for acute anaemia e.g. aplastic, sequestration crisis or acute bleeding. Calculate volume of packed cells required to reach desired haemoglobin: Do not transfuse to above 11g/dl

**Packed red blood cells cc = wt in kg x 3 x desired rise in Hb in g/dl.**

**Untoward Effects:**

Hypertension convulsion syndrome if Hb is too high, especially in the presence of high Hb S.
Transfusion reactions.

**Hypertonfusion**

(The decision for hypertransfusion is made by consultant in charge of patient after discussion with tertiary care Hospital)

**Definition:** Repeated transfusions to keep Hb S < 30% over a period of time.

**To Hypertransfuse:** Start with simple transfusion. Then transfuse at 3 to 4 week interval to suppress erythropoiesis and keep Hb S <30%. Aim for Hb 11-g/dl initially rising to 13g/dl as HbS falls, and not > 14 g/dl. Patients vary in the frequency and amount of blood required to suppress Hb S production. In children with SC disease it is usually necessary to start with an exchange transfusion, in other children with HbSS (particularly those with a high initial haemoglobin level) exchange may be necessary at times.

**NB** Particular care in children with CNS disease.