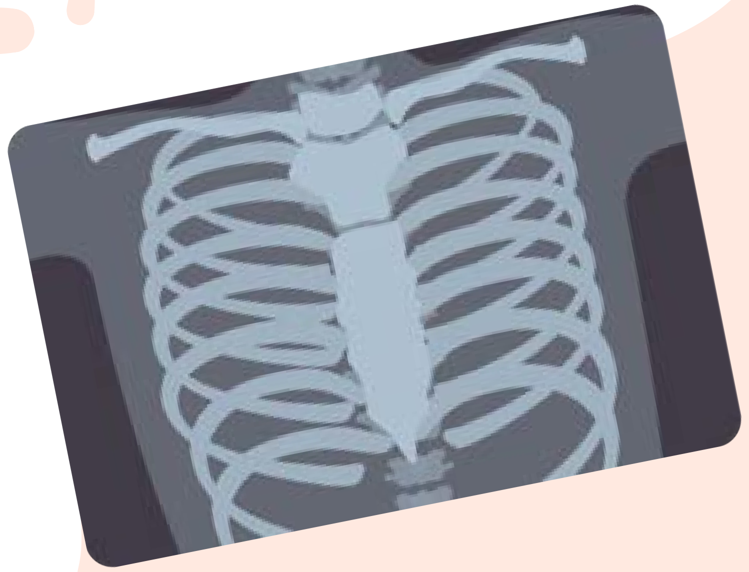
# HAEMOGLOBINOPATHIES IN THE EMERGENCY DEPARTMENT




Dr Amy Cooper
Haemoglobinopathy QI Fellow

## Today we will cover

What are haemoglobinopathies?

- Basic science underlying conditions
- How to apply this knowledge in understanding the management of the conditions

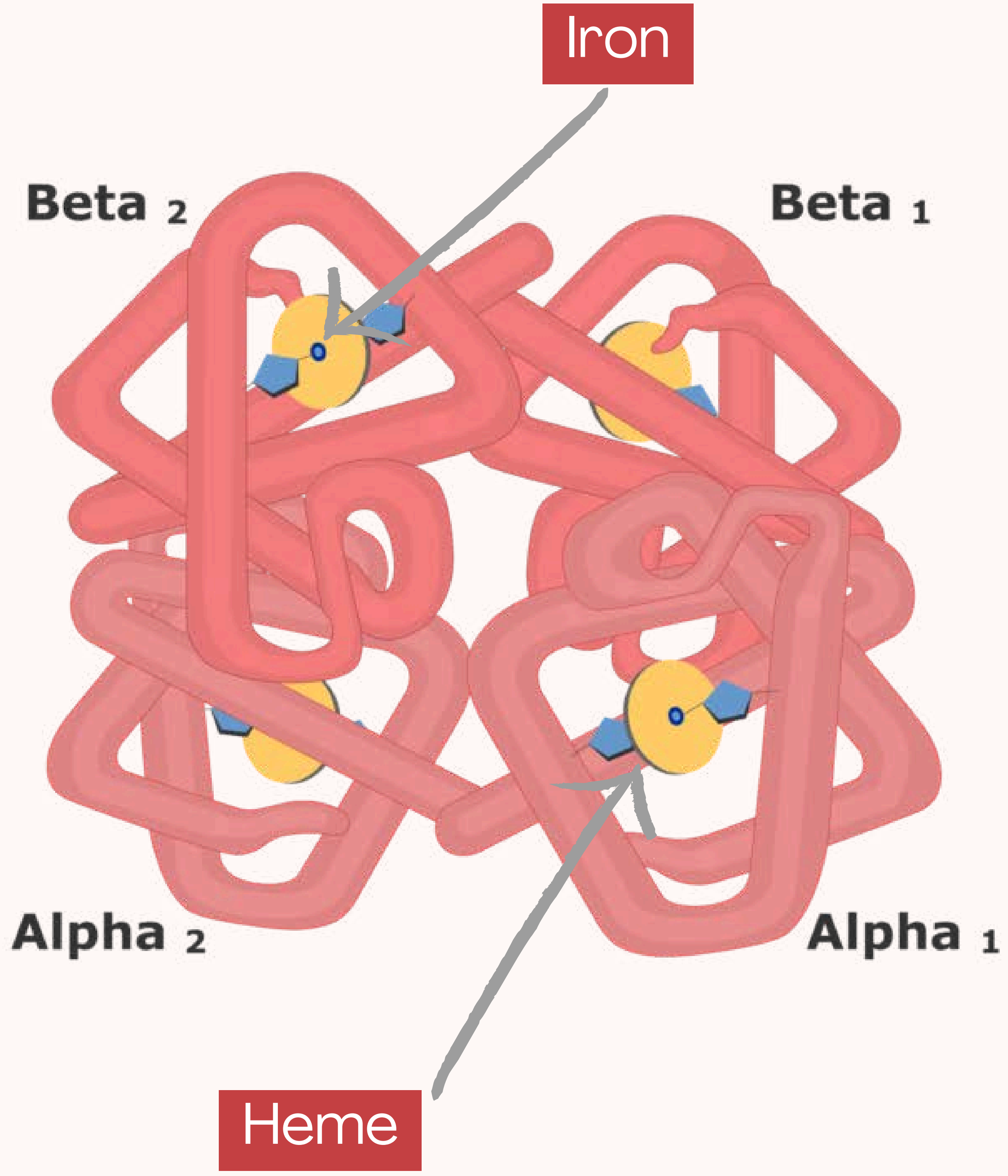
What complications of haemoglobinopathies can you see in the emergency department?

- Sickle cell disease
- Thalassaemia

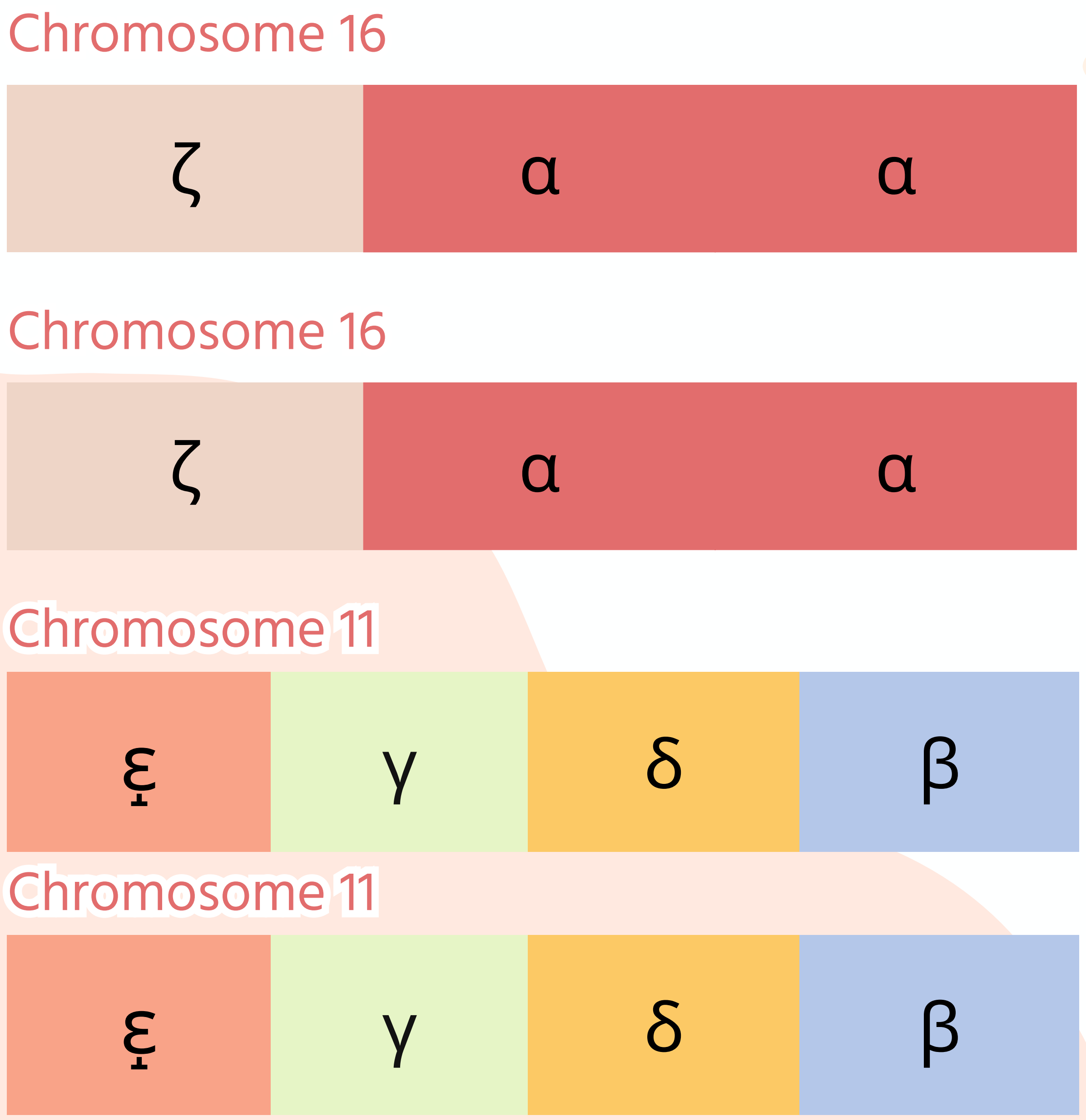
# HAEMOGLOBIN

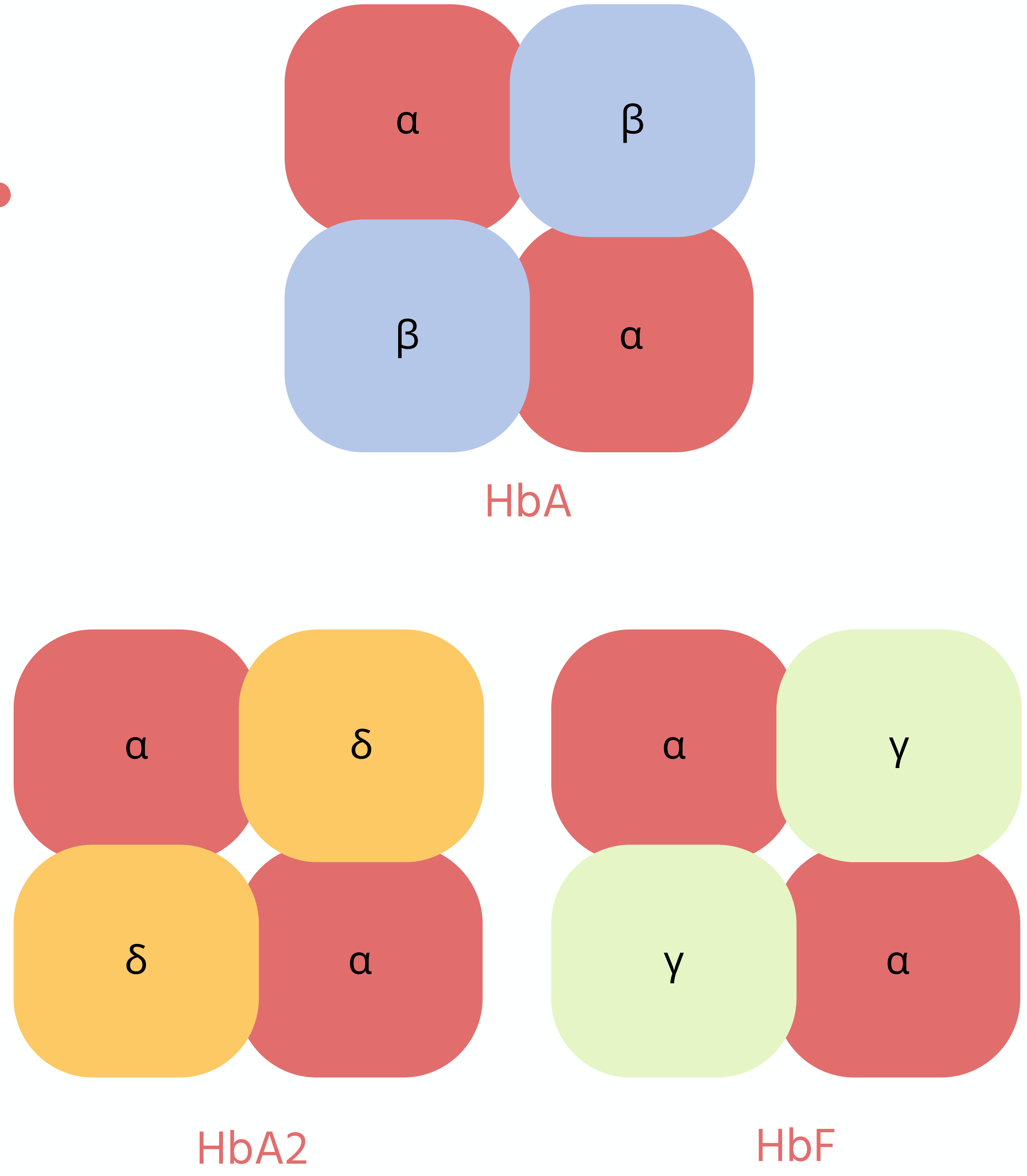
- Consists of two alpha and two beta globin chains
- Heme sits inside the globin chain and holds one iron molecule (4 per haemoglobin)
- The iron molecule reversibly binds oxygen (allowing it to carry and give up the O2 molecule)

**Reminder - this is what Hb measures!**



# NORMAL HAEMOGLOBIN SYNTHESIS



# HOW CAN HAEMOGLOBIN SYNTHESIS GO WRONG

## Structural abnormalities

Haemoglobin is made, but the structure is different to normal haemoglobin due to a genetic mutation (usually affecting the beta gene). Examples include:

- HbS
- HbC

## Abnormalities in haemoglobin production

Mutations in alpha or beta genes reduce the production in alpha or beta chains. This reduces the amount of normal haemoglobin. These conditions are called thalassaemias.

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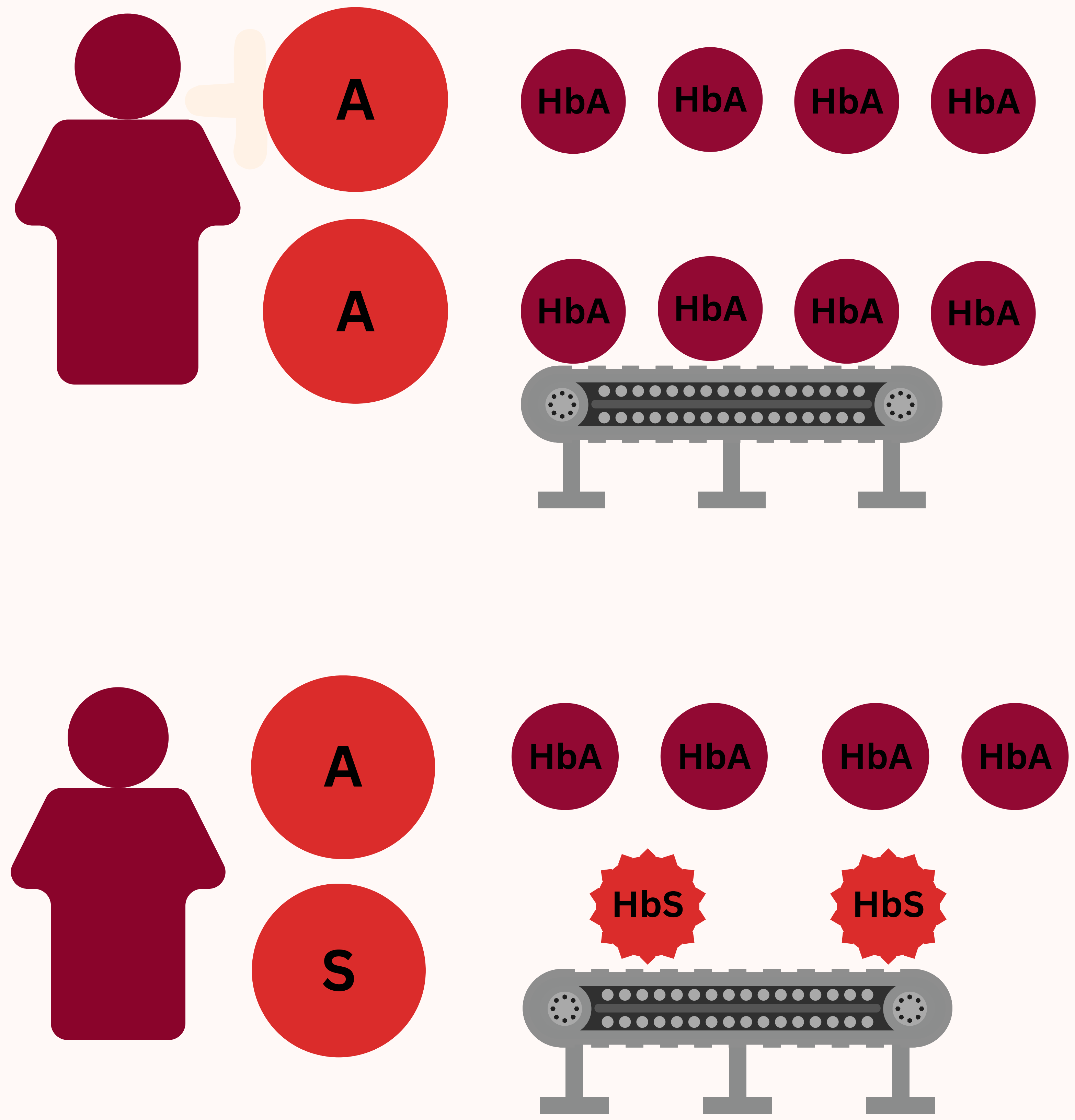
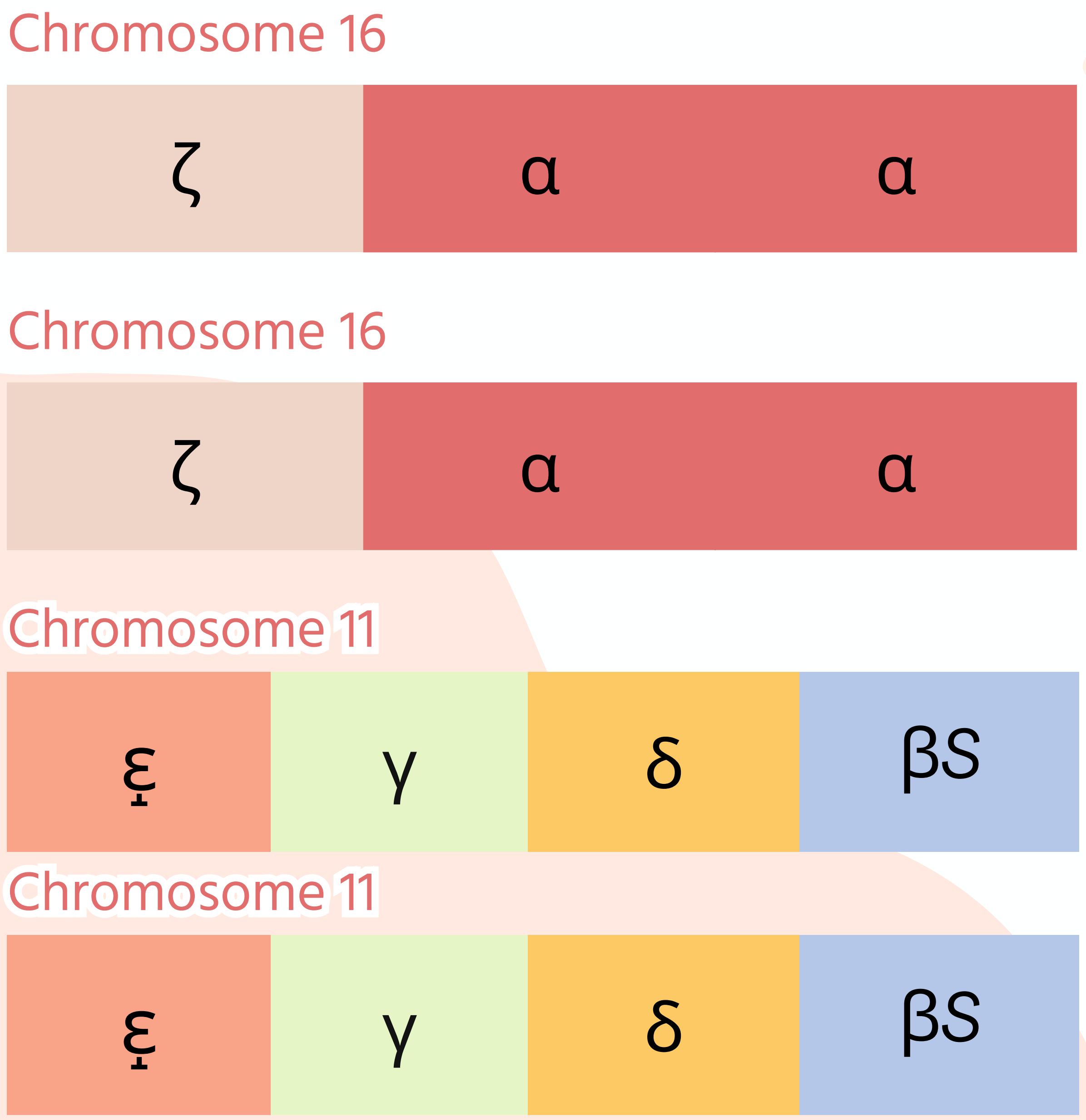
# A NOTE ON HAEMOGLOBIN SYNTHESIS

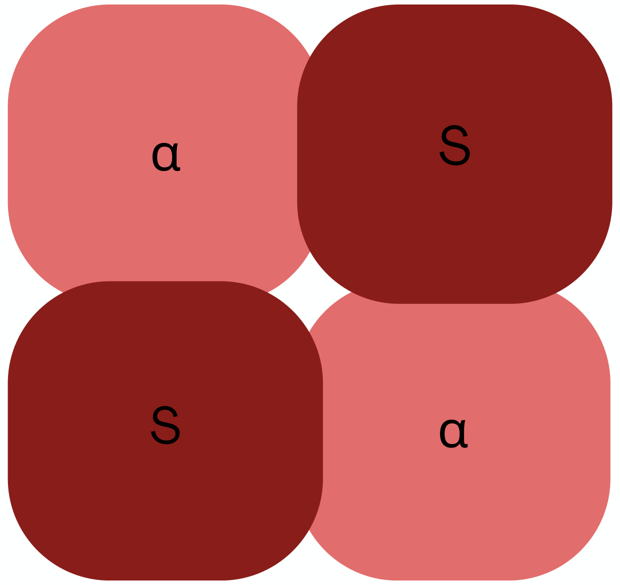
- Inheritance of sickle cell disease is **autosomal recessive**

- Haemoglobin genes are **codominant**
- Both alleles are expressed independently, which means they both create haemoglobin
- HbS is made less efficiently than HbA - this is compensated in trait

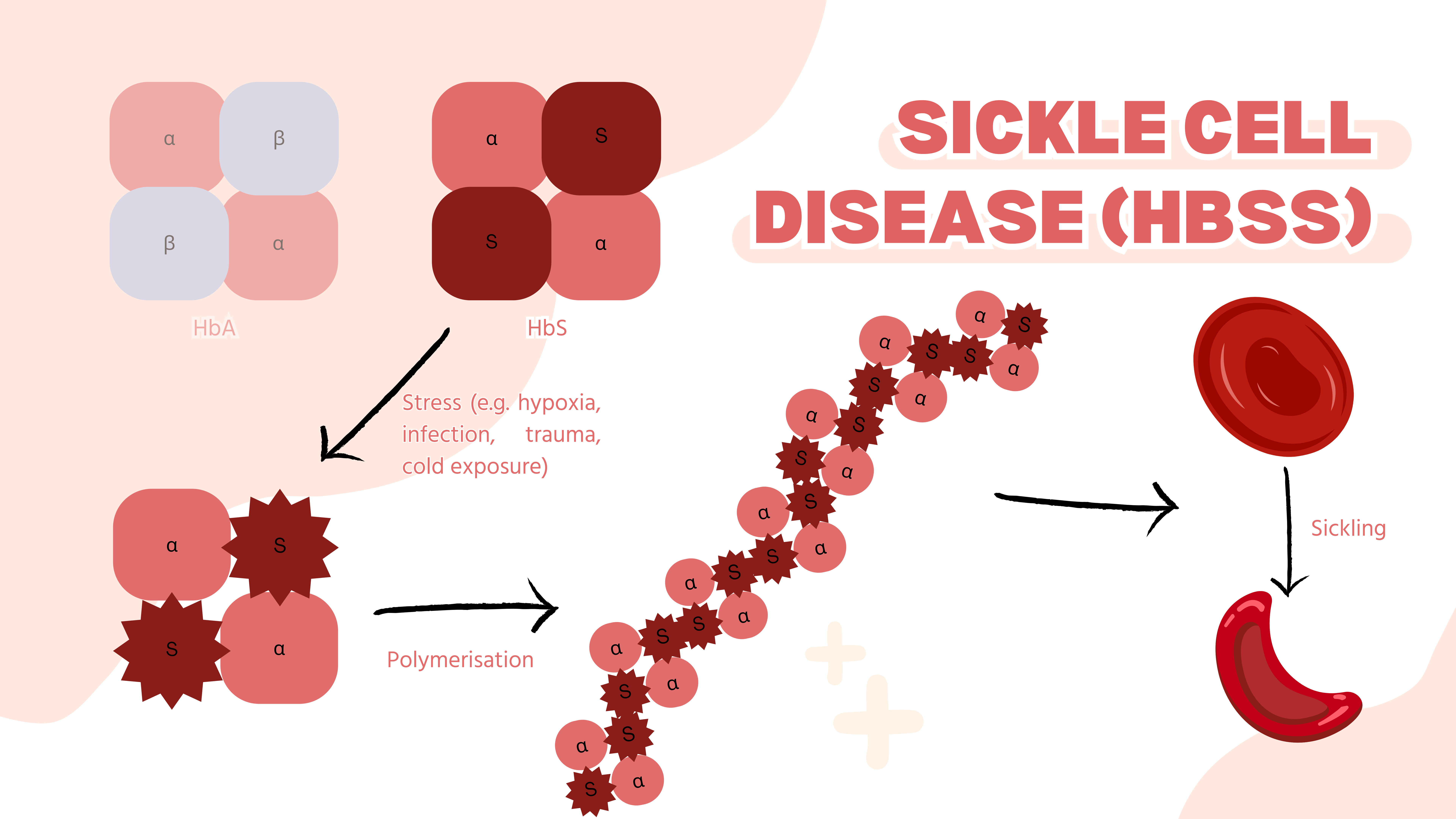


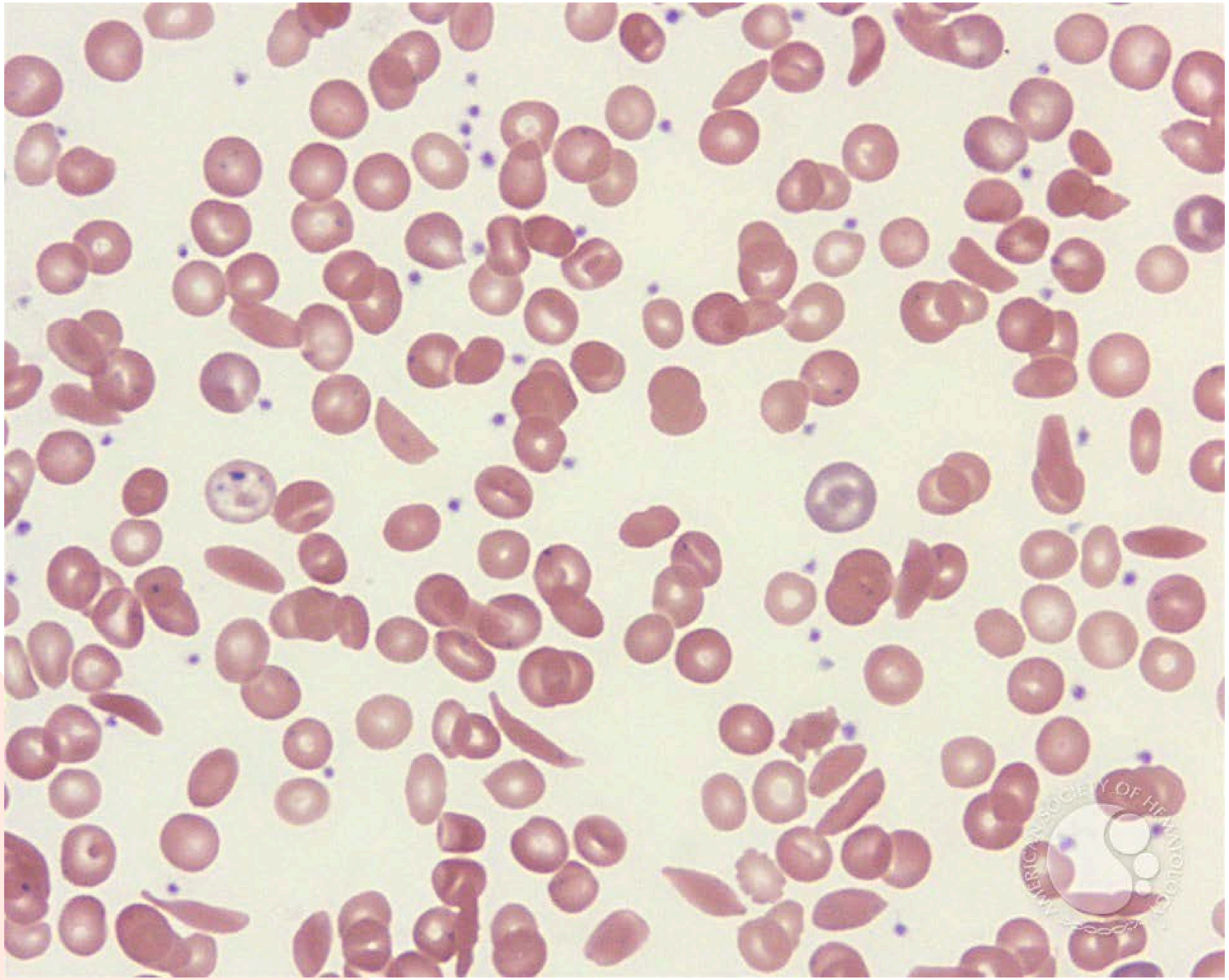
# HBSS SICKLE CELL DISEASE



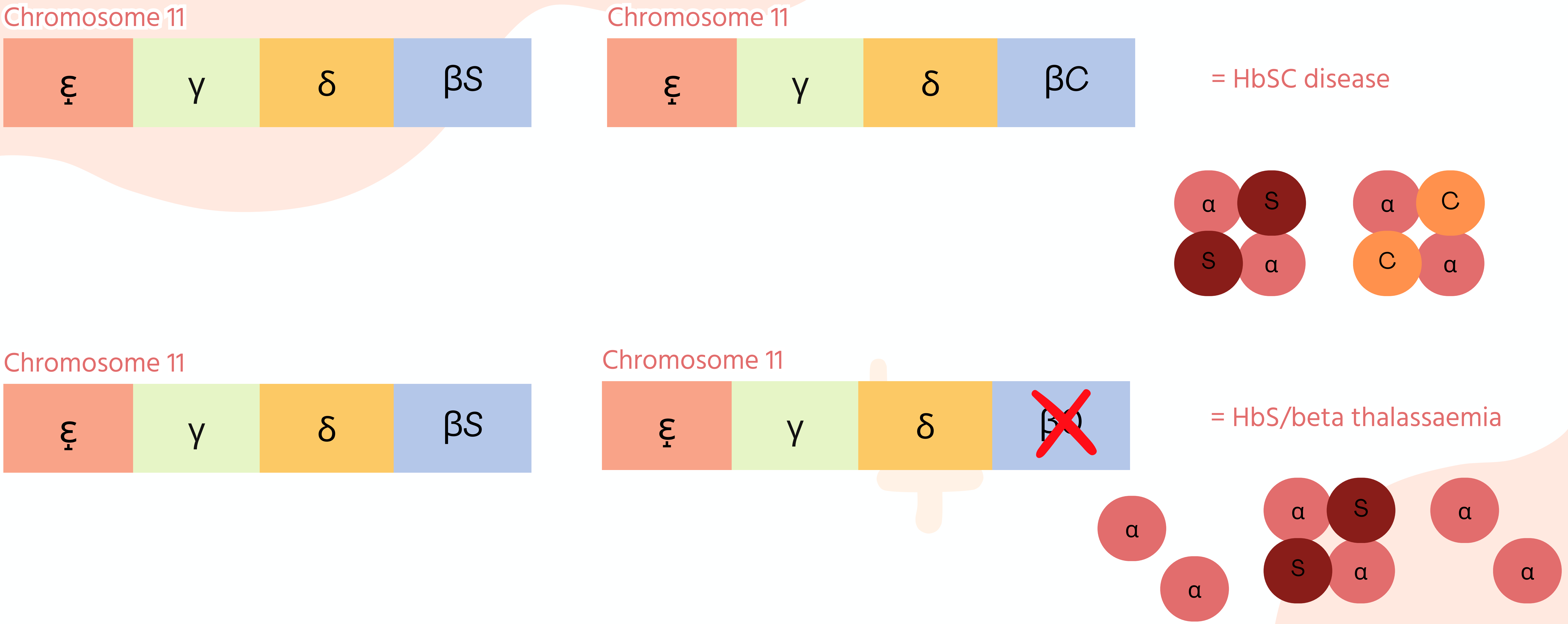




HbS


SICKLE CELL DISEASE (HBSS)
α
β
β
α
HbA
α
S
S
α
HbS
Stress (e.g. hypoxia, infection, trauma, cold exposure)
α
S
S
α
Polymerisation
Sickling



# OTHER TYPES OF SICKLE CELL DISEASE



# WHAT DO SICKLED CELLS DO IN THE BODY?

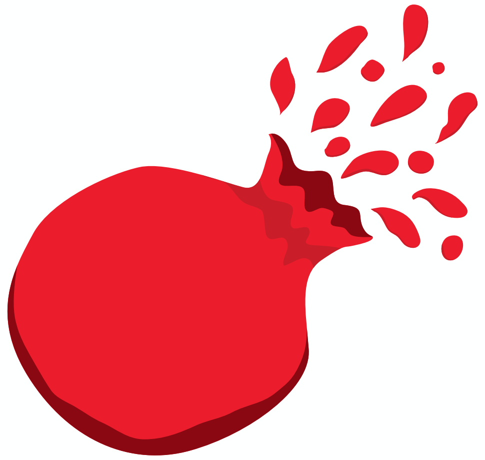
### Vaso-occlusion

Sickled cells are rigid and non-deformable. They can get stuck in small vessels leading to ischaemia, organ damage and pain

### Haemolysis

The abnormal sickled cells are destroyed through intravascular haemolysis. The lifespan of a sickle cell is around 10 days.

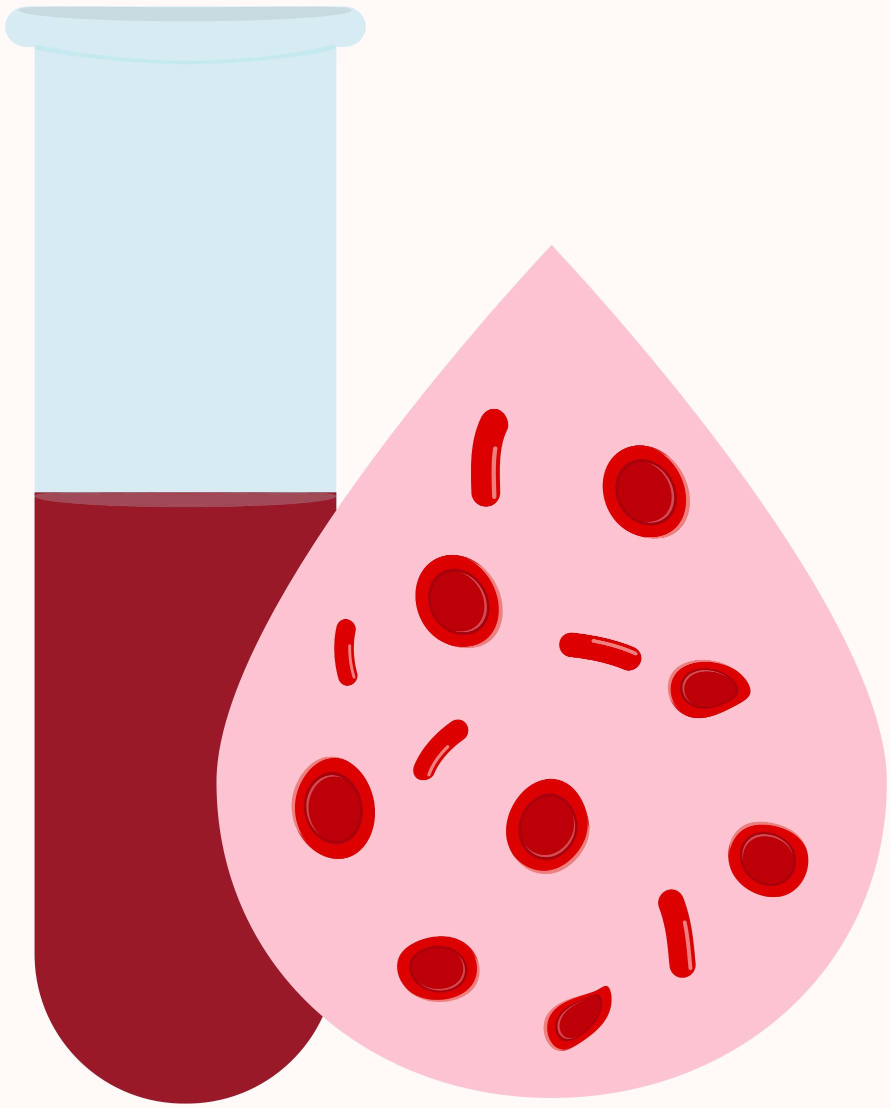
Haemolysis causes local vascular damage and promotes systemic inflammation



# A NOTE ON ANAEMIA

- Patients with sickle cell disease have been anaemic since birth
- Able to tolerate anaemia with minimal side effects
- Usual Hb can range from 50-90 with HbSS, and 90-130 with HbSC

**Anaemia without symptoms does not usually require blood transfusion**



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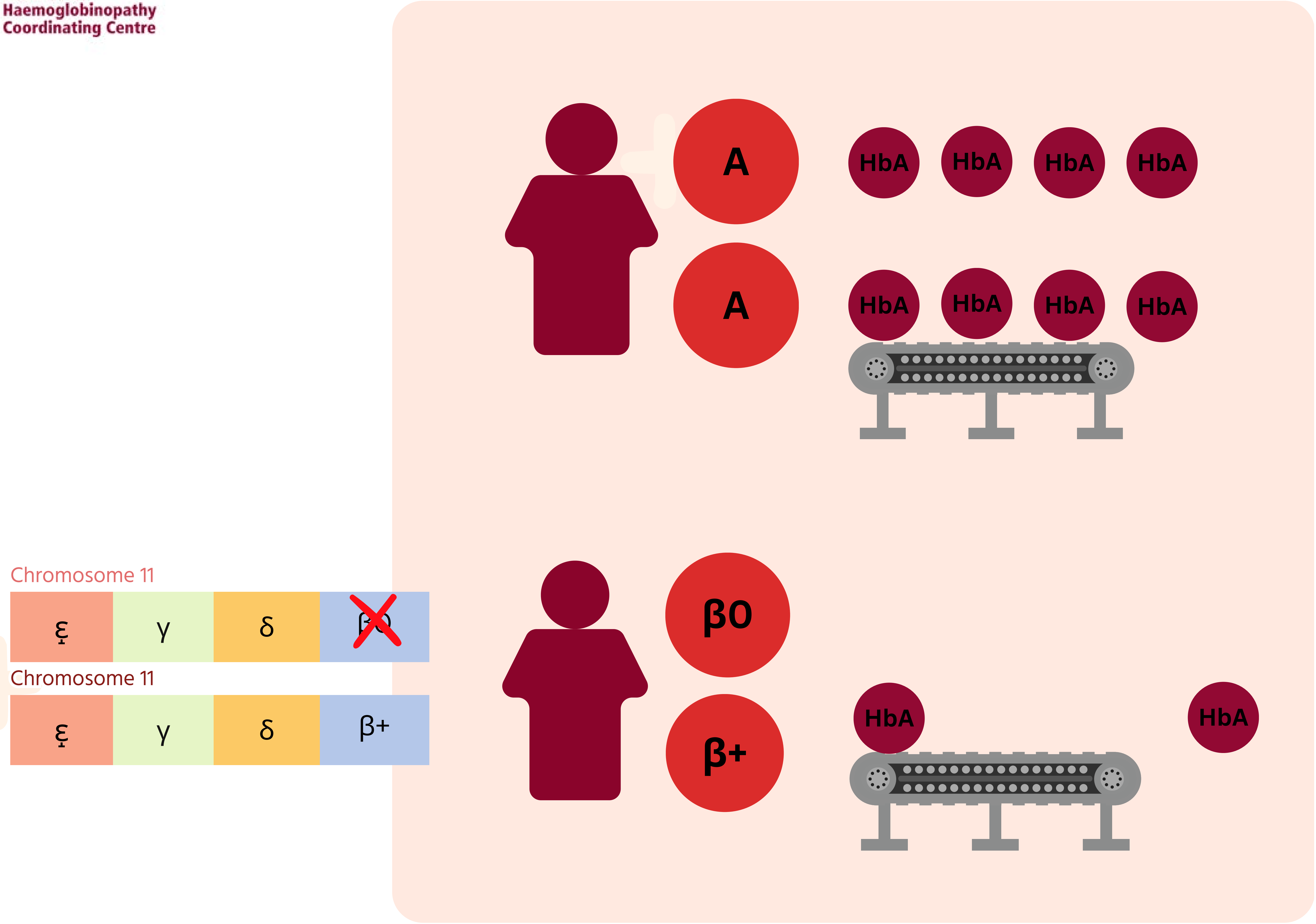
South West
Haemoglobinopathy
Coordinating Centre



# BETA THALASSAEMIA MAJOR

Chromosome 16

| | | |
|---|---|---|
| ζ | α | α |

Chromosome 16

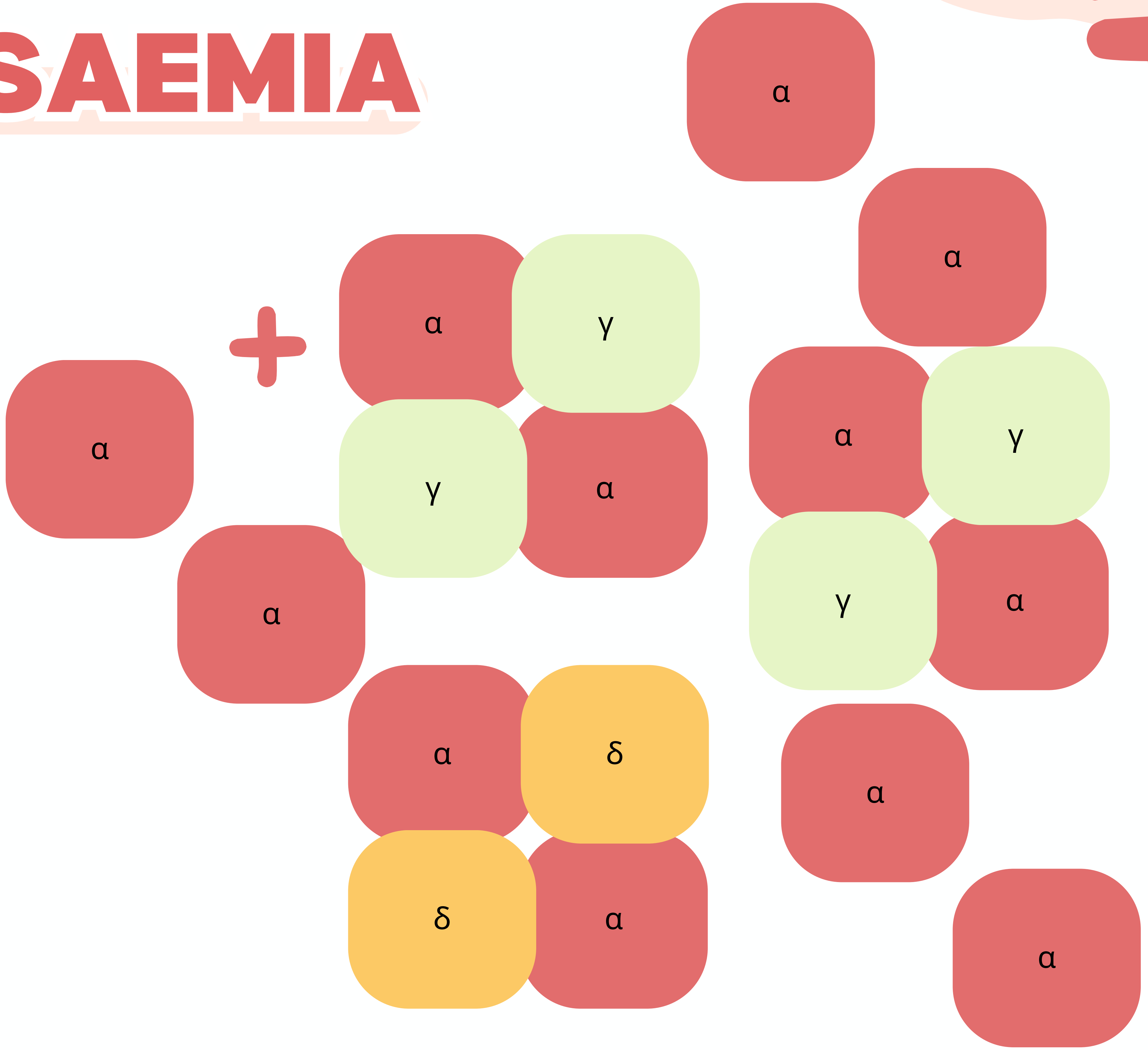
| | | |
|---|---|---|
| ζ | α | α |

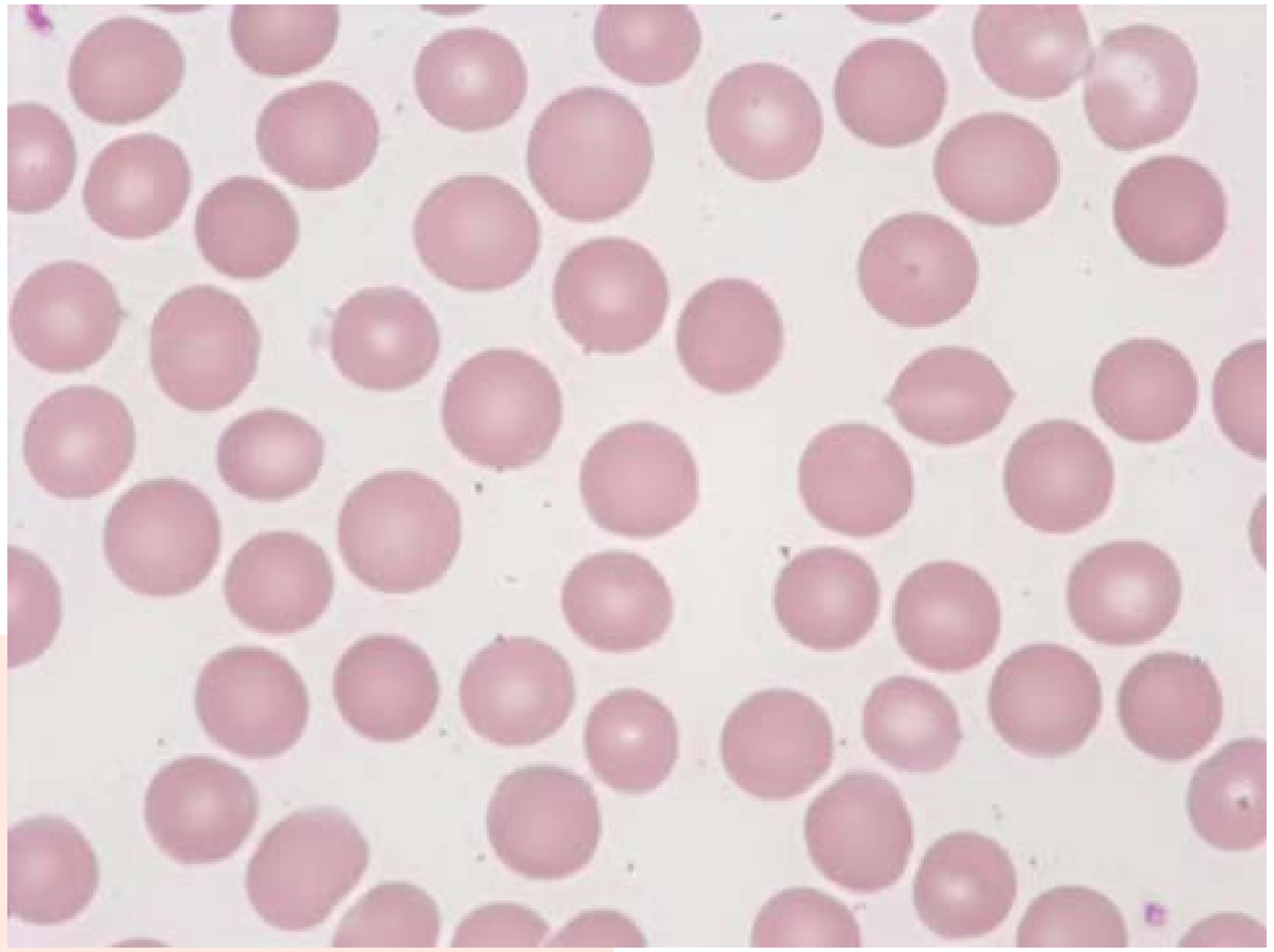
Chromosome 11

| | | | |
|---|---|---|---|
| ξ | γ | δ | ~~β0~~ |

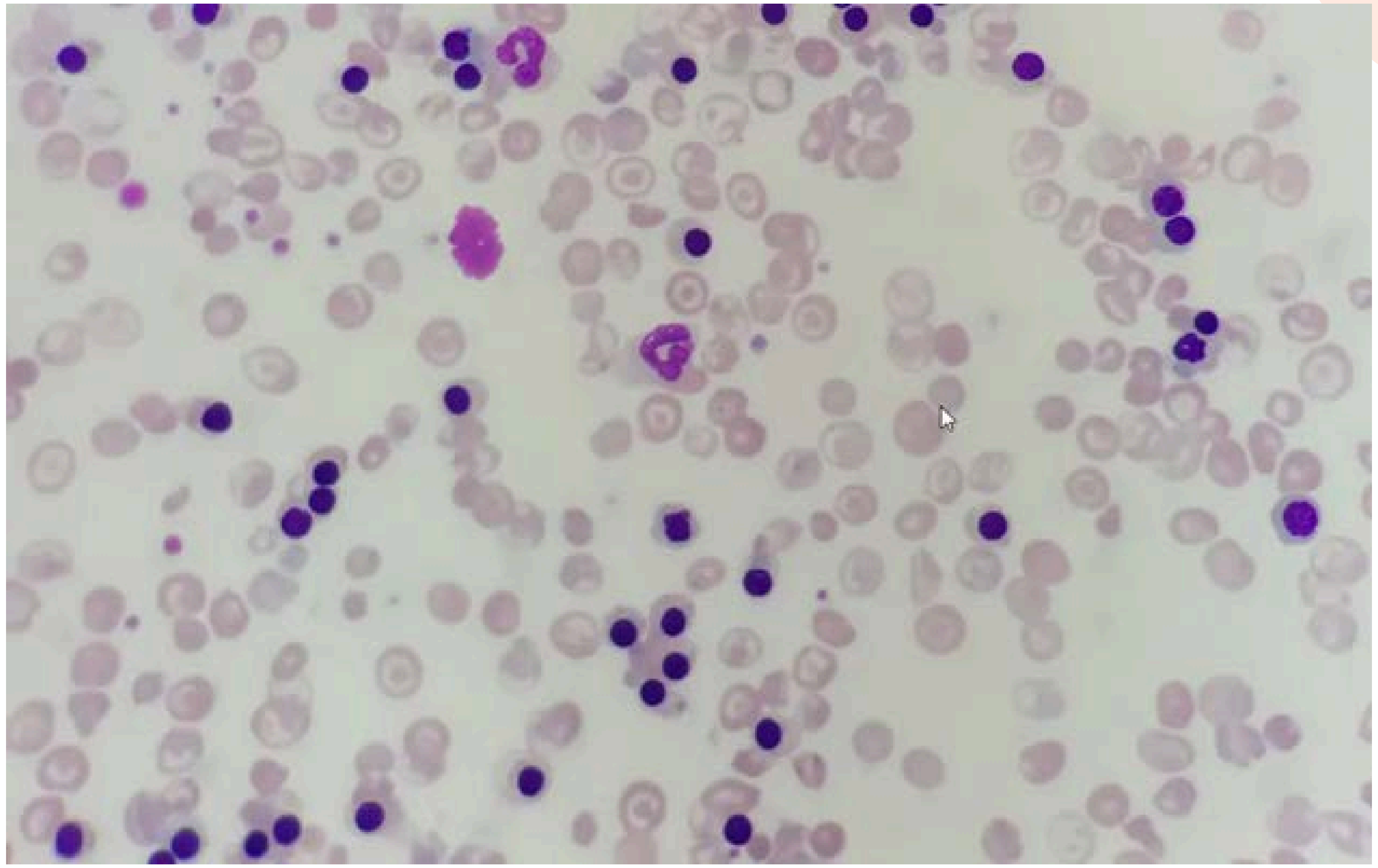
Chromosome 11

| | | | |
|---|---|---|---|
| ξ | γ | δ | ~~β0~~ |



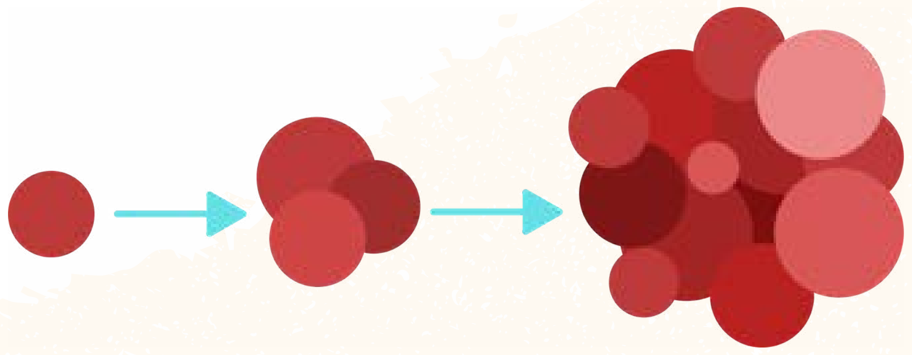


Normal

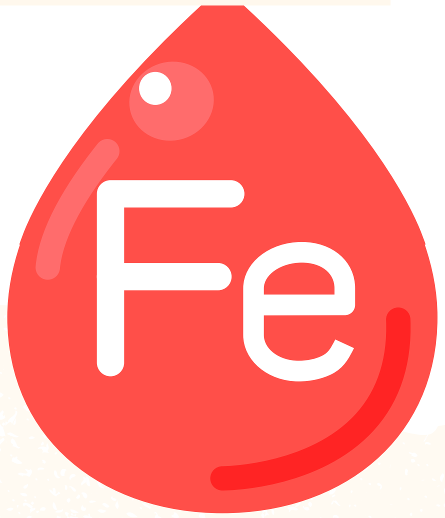


Thalassaemia major

# WHAT HAPPENS IN THALASSAEMIA?



Extramedullary haematopoesis ensues to try to improve anaemia




The body desperately tries to compensate for the anaemia by absorbing more iron, leading to **iron overload.**

**Treatment is with regular blood transfusion and iron chelation**

# HBSS SICKLE CELL DISEASE

Chromosome 16

| | | |
|---|---|---|
| ζ | α | α |

Chromosome 16

| | | |
|---|---|---|
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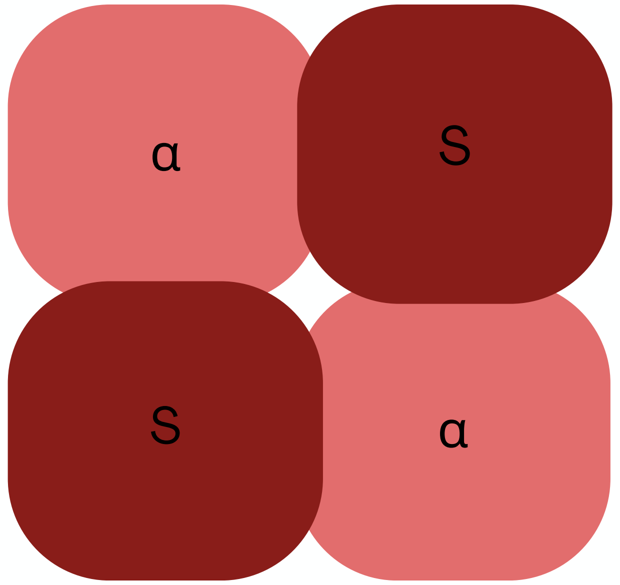



HbS

# NO ONE'S LISTENING

NO ONE'S
**LISTENING:**

AN INQUIRY INTO THE AVOIDABLE DEATHS AND FAILURES OF CARE FOR SICKLE CELL PATIENTS IN SECONDARY CARE


**Variations in care: "It really is like a lottery"**

**Specialist v non-specialist variation: "Clinicians had not got a clue or the care was so poor it was negligent"**

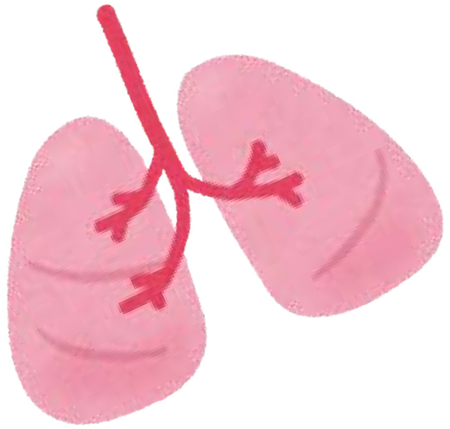
**Lack of compliance with national care standards: "It is life threatening!"**

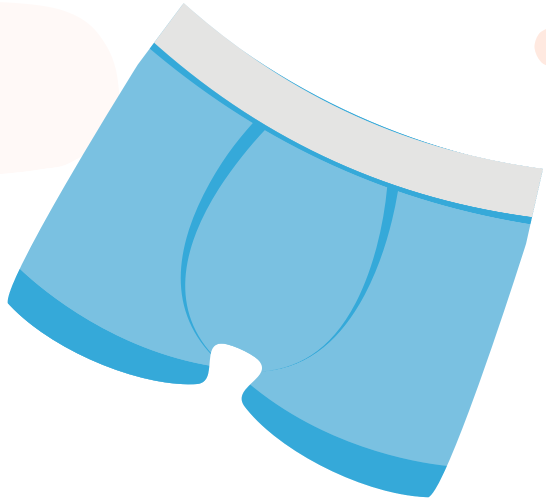
**Fear and avoidance of hospitals: 'I do not trust the people who have sworn to protect us, because many times they have failed'**

A large number of patients told us that their experiences of sub-standard care meant that they feared accessing secondary care, while others told us that they feel compelled to avoid attending hospital altogether.

> "Going into hospital as a sickle cell patient requires you to put on an armour because from the moment you reach A&E it becomes your job to convince everyone you are really in that much pain and are not simply there for medication"
>
> – Sickle cell patient

**Racial inequality as a factor in sickle cell care: "Care is clouded by stereotypical perceptions of black people"**





# ACUTE COMPLICATIONS


This patient with sickle cell disease has arrived to ED saying she has 8/10 pain in her right leg after being at the gym yesterday.

What's going on?

**What would your immediate management be?**

# ACUTE PAINFUL CRISIS

## Mechanism

An acute insult (e.g. cold, infection, hypoxia, trauma) prompts red cells to sickle and cause vaso-occlusion. This leads to ischaemia and acute **severe** pain.

## Most common sites

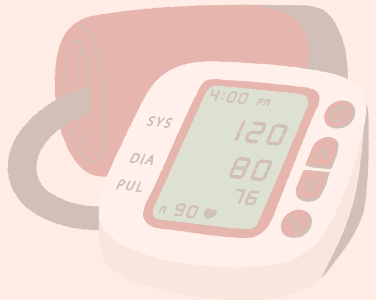
Can happen in any bone, but most common in limbs, back, ribcage/sternum.

## Type of pain

Pain is related to acute ischaemia and is excruciatingly painful. Listen to your patient and treat appropriately. Patients may not show their pain as you would expect.

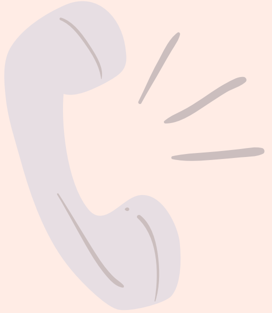


Opioid analgesia **within 15 minutes** of presentation for moderate to severe pain

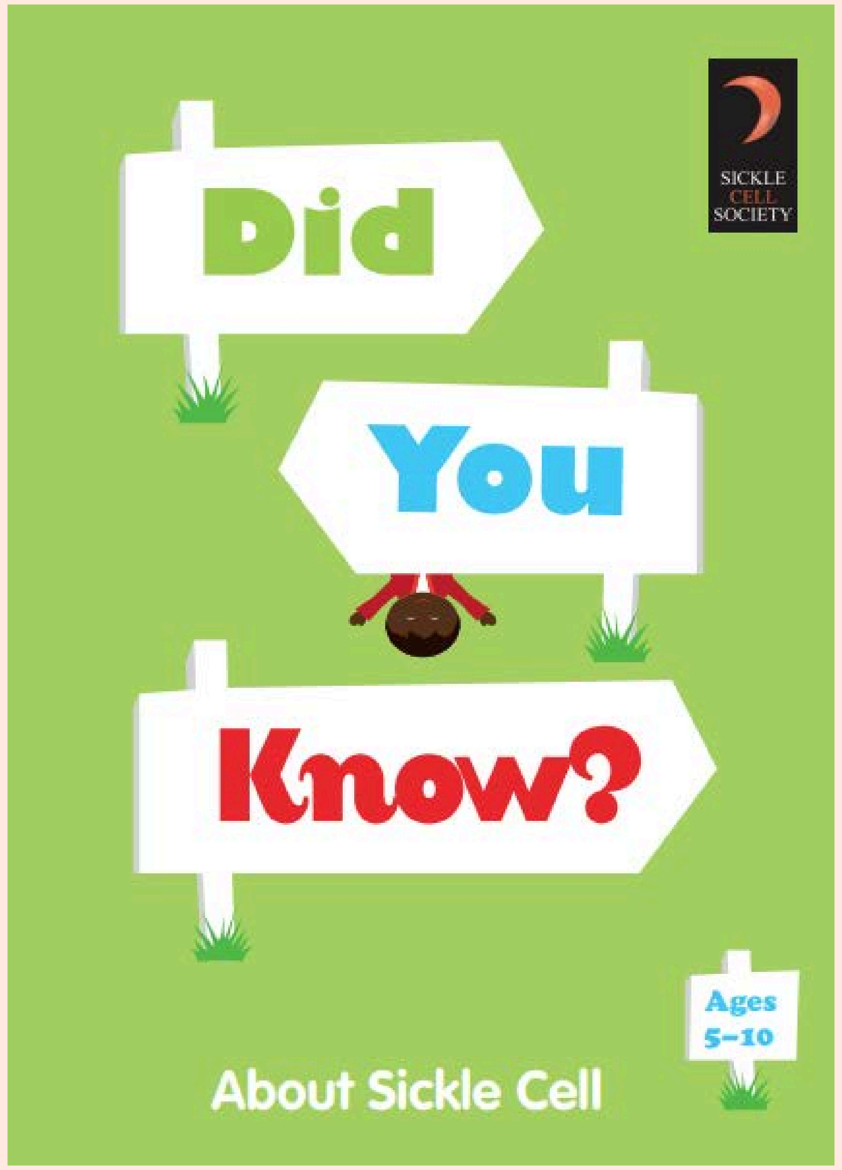



Closely monitor observations, early warning score and pain score

Regular sedation score while using opiates



Early discussion with haematology team



but there are other things you can try too.
You could try:

- Reading
- Listening to music
- Hot water bottle
- Eating food you like
- Phoning a friend
- Watching TV
- Sleeping
- Thinking of a place that makes you feel happy
- Playing computer games

6

# ACUTE PAINFUL CRISIS

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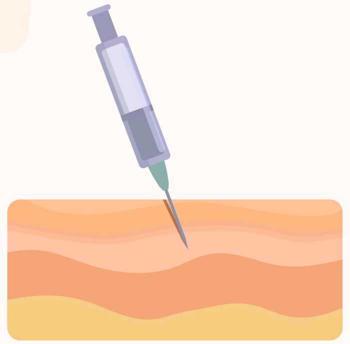

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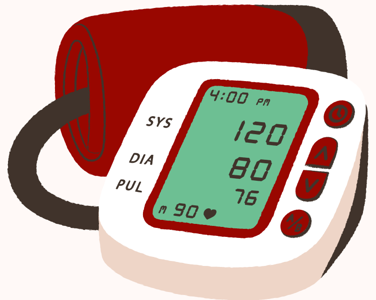



Closely monitor observations, early warning score and pain score

Regular sedation score while using opiates

Early discussion with haematology team

# ANALGESIA CHOICE


NHS
University Hospitals Bristol and Weston
NHS Foundation Trust

Clinical Guideline

**SICKLE CELL ACUTE PAIN (VASO-OCCLUSIVE) CRISIS IN THE EMERGENCY DEPARTMENT**

1. **For all levels of pain, prescribe:**
   - Diclofenac 50mg PO TDS or ibuprofen 400mg PO TDS (adjust in renal impairment), with PPI cover
   - For opioid naïve patients (not on regular opioids at home):
     - Give Co-codamol 30/500mg PO QDS (Dose adjust if weight <50kg or liver impairment)
     - Codeine alternatives include tramadol & dihydrocodeine. Avoid pethidine.
   - For patients on regular opioids at home:
     - Continue usual background slow-release opiates
     - Give Paracetamol 1g PO QDS (Dose adjust if weight <50kg or liver impairment)

2. **a) For mild to moderate pain:** give oral morphine sulphate 10mg/5ml (Oramorph®) 5-10mg

   **b) For severe pain / pain unresponsive to oral analgesia:**
   - For opioid naïve patients (not on regular opioids at home):
     - give 0.15mg/kg SC morphine up to every 30 mins until pain improves.
   - For patients on regular opioids at home:
     - Refer to individualised plan if available
     - If unavailable & background intake <200mg/day oral morphine equivalent, give 0.3mg/kg SC morphine up to every 30 mins until pain improves
     - If unavailable & background intake >200mg/day oral morphine equivalent, give 0.45mg/kg SC morphine up to every 30 mins until pain improves

**Or PCA?**

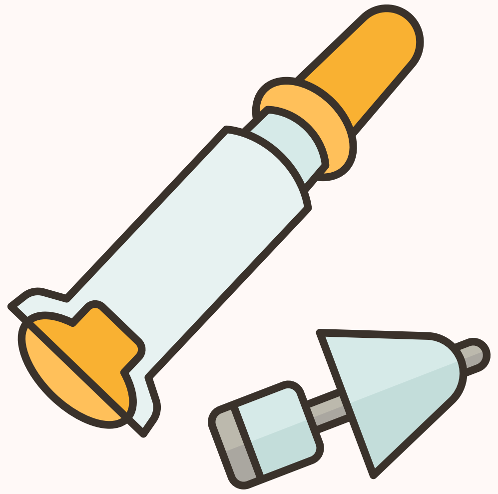
# SUPPORTIVE MEDICATION

Antiemetics

Laxatives

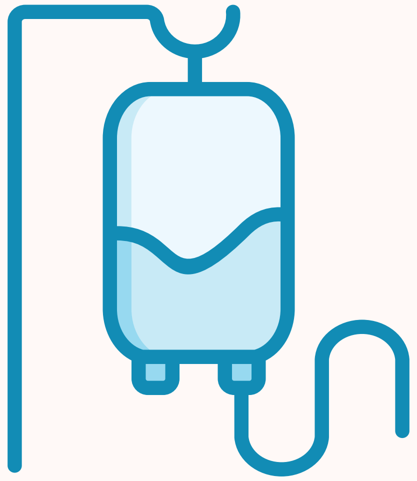
Thromboprophylaxis

Antipruritic



Naloxone

# OTHER CONSIDERATIONS



IV fluids and input/output monitoring



Low threshold for antibiotics to cover encapsulated/atypical organisms and septic screen




Give supplementary oxygen if O2 sats <95%

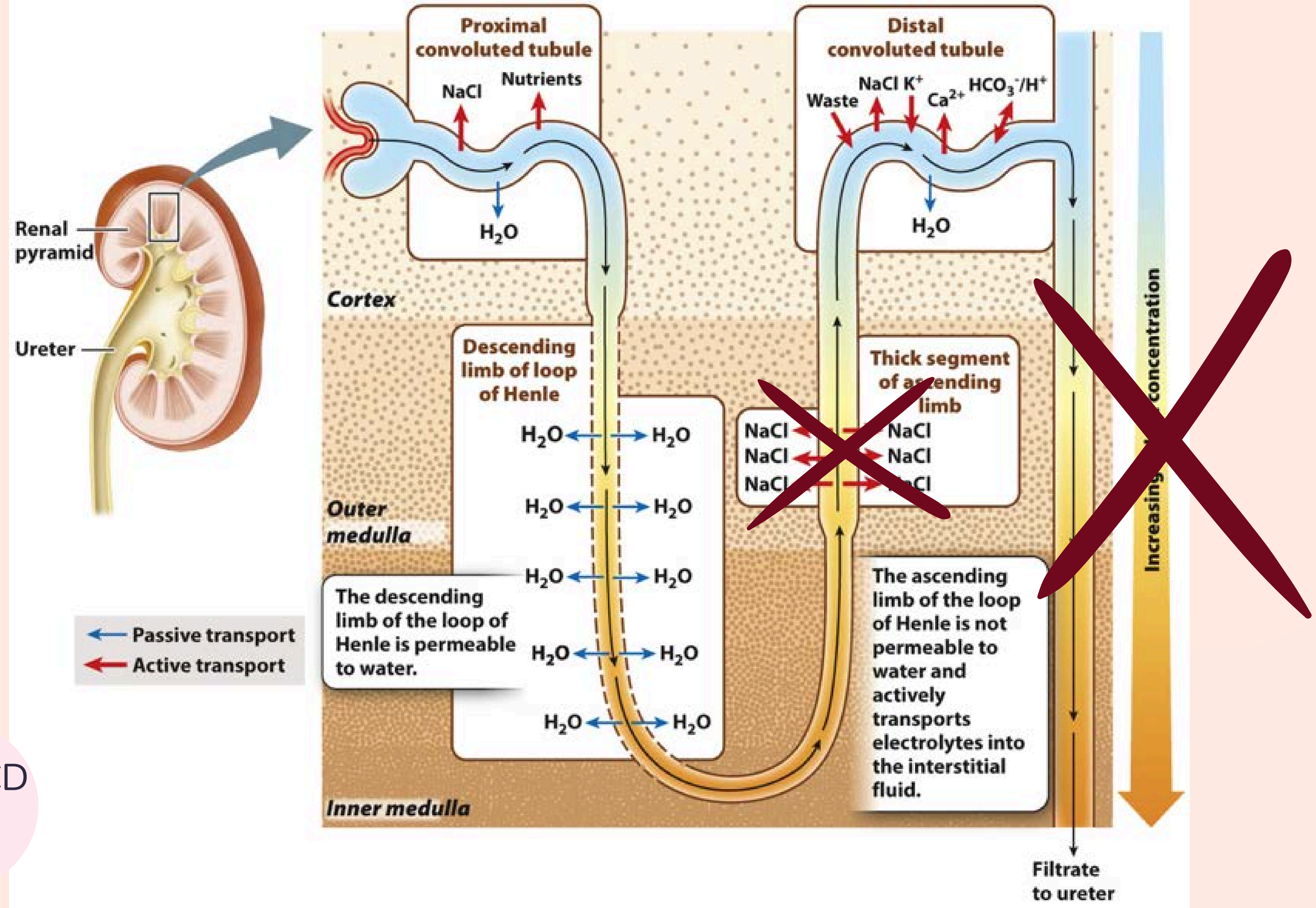


CXR if chest pain or O2 requirement



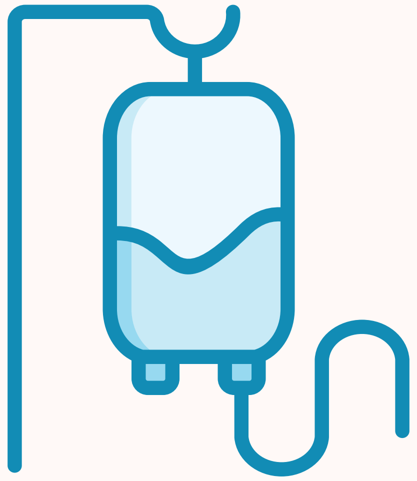
Send bloods including group and screen and haemoglobinopathy screen

# URINE CONCENTRATION DEFECTS (HYPOSTHENURIA)




This is near-universal in all SCD patients.

# OTHER CONSIDERATIONS



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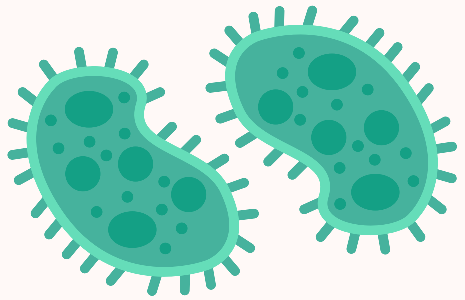

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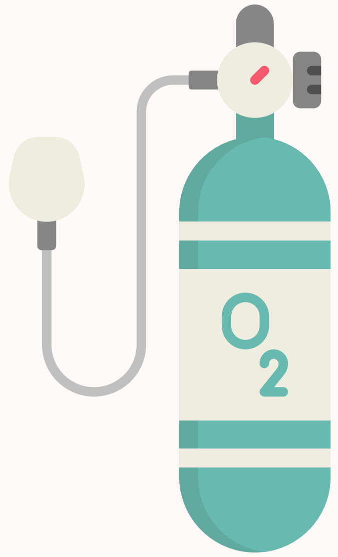


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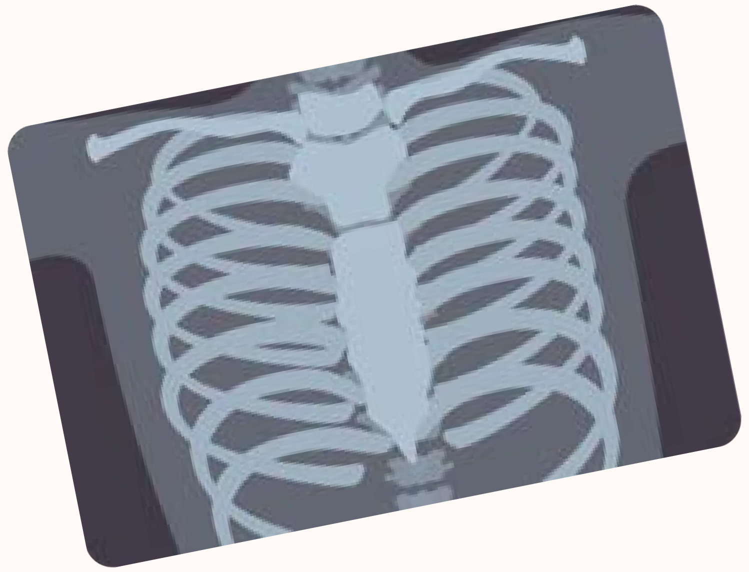
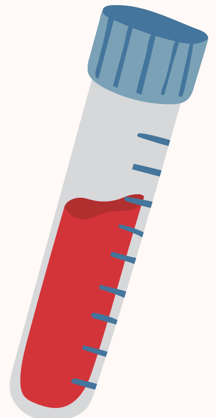


CXR if chest pain or O2 requirement



Send bloods including group and screen and haemoglobinopathy screen

# OTHER CONSIDERATIONS

**"Should I X-ray the painful limb?"**

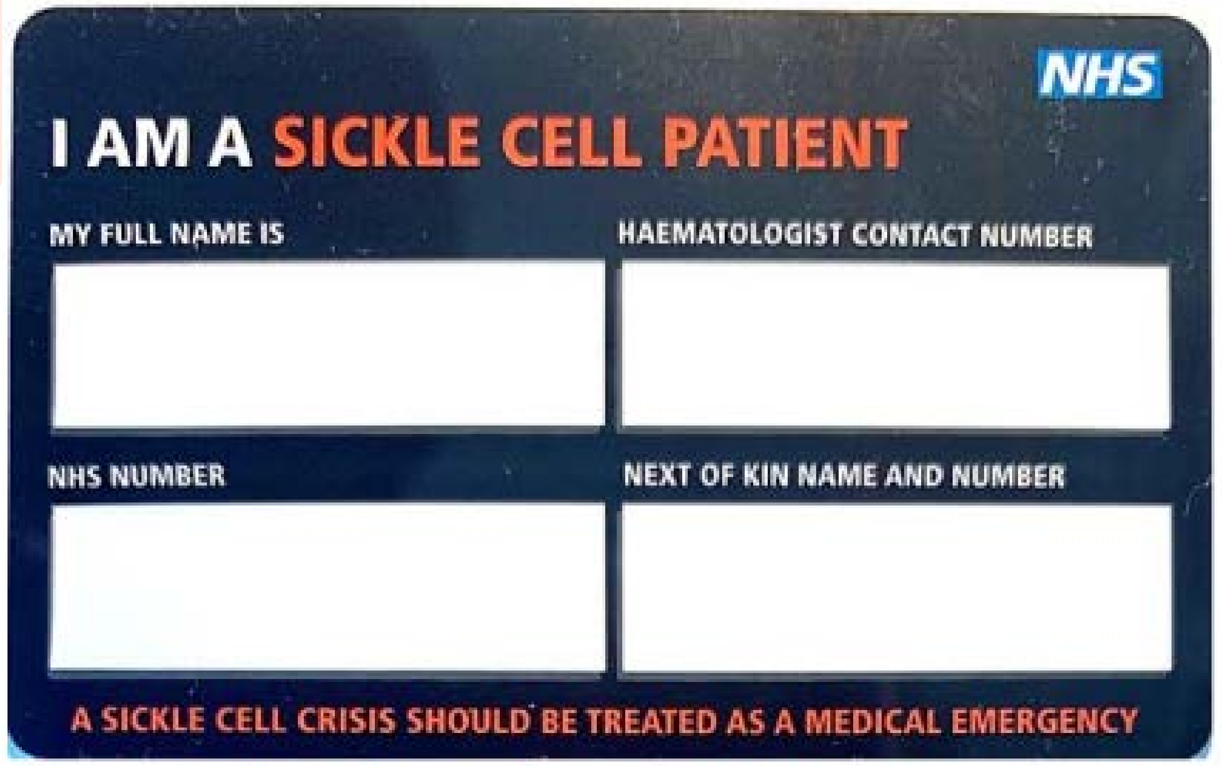
- Not really helpful in diagnosing simple pain crisis
- Consider if clear non-sickle related indication e.g. concern for fracture
- If persistent pain despite analgesia and fever/raised CRP - consider X-ray (but MRI better for osteomyelitis)

# MANAGING ACUTE PAINFUL CRISIS IN SICKLE CELL DISEASE

## Sickle Cell Crisis – every second counts

| | |
|---|---|
| **ANALGESIA** | **Give analgesia within 30 minutes**, in line with NICE guidance. **Regular assessment of pain score** every 30 minutes until controlled and then every 4 hours. Refer to individualised care plan. |
| **COMPASSION** | **Be compassionate**, Kind, Actively listen, Provide reassurance and keep the patient informed |
| **TEST/TRIGGER** | Tests: including transfusion history/previous transfusion reactions. Blood tests (FBC, reticulocyte count, group and save, routine renal, liver & bone biochemistry, CRP), other tests as suggested by history e.g. CXR, MSU.<br>Trigger – what has precipitated the crisis? e.g. infection, dehydration, hypoxia, travel, pregnancy, stress, cold exposure.<br>**Consider IV fluids & antibiotics to treat infection and dehydration.** |
| **NOTIFY** | **Notify Specialist Haematology Team**<br>Notify Next of Kin or advocate (when requested or in individual care plan) |
| **OXYGEN** | **Offer oxygen supplementation if saturations <95% in room air**; regularly monitor oxygen saturations, including on room air, hourly for the first 6 hours and then 4 hourly if stable as per NICE guidance. |
| **WATCH** | **Watch and keep warm** – regular observations of BP, pulse, respiratory rate, SpO2, temperature. Assess pain every 30 minutes until controlled. **Escalate promptly** (use local scoring e.g. NEWS2 for adults). **Encourage fluids.** |

# IDENTIFYING PATIENTS AND THEIR PLAN




| Acute Personalised Pain Plan For Sickle Cell Disease | | | |
|---|---|---|---|
| Patient's Name | | Date of Birth | |
| Address | | Trust number | |
| GP Name/Practice | | NHS number | |
| Sex | | | |
| **Clinical Details** | | | |
| Sickle Cell Genotype | HbSS | | |
| Medical Surgical History | | | |
| Allergies | | | |
| Hb | Wbc | Plts | Neut |
| Medical history | | | |
| Analgesia Pain Plan | ED | Assuming patient has taken sufficient analgesia at home, treat as opioid naive and give initial dose as follows:<br><br>Pain score 4-7/10: morphine 20mg PO<br><br>Pain score: 8-10/10: morphine 10mg SC<br><br>Repeat up to every sixty minutes until pain improves (i.e. any improvement in pain score), then prescribe this dose every 2 hours. See "Urgent management of a sickle cell crisis" guideline for further guidance. Seek senior help if pain not under control in 2 hours. | |
| | Day Unit | As above. | |
| | Inpatient | As above. | |
| | Outpatients | As above. | |
| Other Medication | | | |

# ACUTE MANAGEMENT GUIDELINES

NHS
University Hospitals
Bristol and Weston
NHS Foundation Trust

Clinical Guideline
**SICKLE CELL ACUTE PAIN (VASO-OCCLUSIVE) CRISIS IN THE EMERGENCY DEPARTMENT**

| | |
|---|---|
| **SETTING** | Emergency department |
| **FOR STAFF** | Medical and Nursing staff |
| **PATIENTS** | Adult patients diagnosed with sickle cell disease |

**Guidance**

Sickle Cell Disease (SCD) is an inherited disorder of haemoglobin characterised by chronic haemolysis leading to multisystem complications. This is often punctuated by acute crises of varying frequency and severity, which may be life-threatening, and require additional considerations alongside standard patient assessment. The most common is vaso-occlusive painful crisis, which is a **medical emergency**.

This guideline is intended for emergency department use only. The more detailed '24852 Sickle Cell Disease Management for Adults' guideline can be found on MyStaff App.

**Management of Acute Presentations of Sickle Cell Disease in the Emergency Department**

Royal College *of* Emergency Medicine

NICE National Institute for Health and Care Excellence

**Sickle cell disease: managing acute painful episodes in hospital**

# DO I NEED TO ADMIT PATIENTS WITH PAINFUL CRISIS?

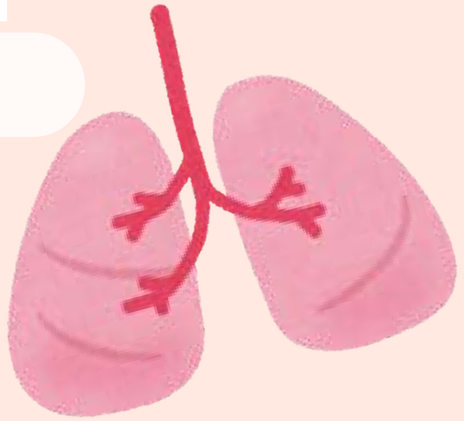

- If requiring parenteral opiates - yes
- If intercurrent illness - yes
- If not responding as you would expect - yes
- If patient concerns - yes

**If in doubt, speak to haematology on call**

My patient with sickle cell disease has presented with a 3 day history of being unwell with fevers and all over body and chest pain. Their sats are 92% on room air and they have a fever.

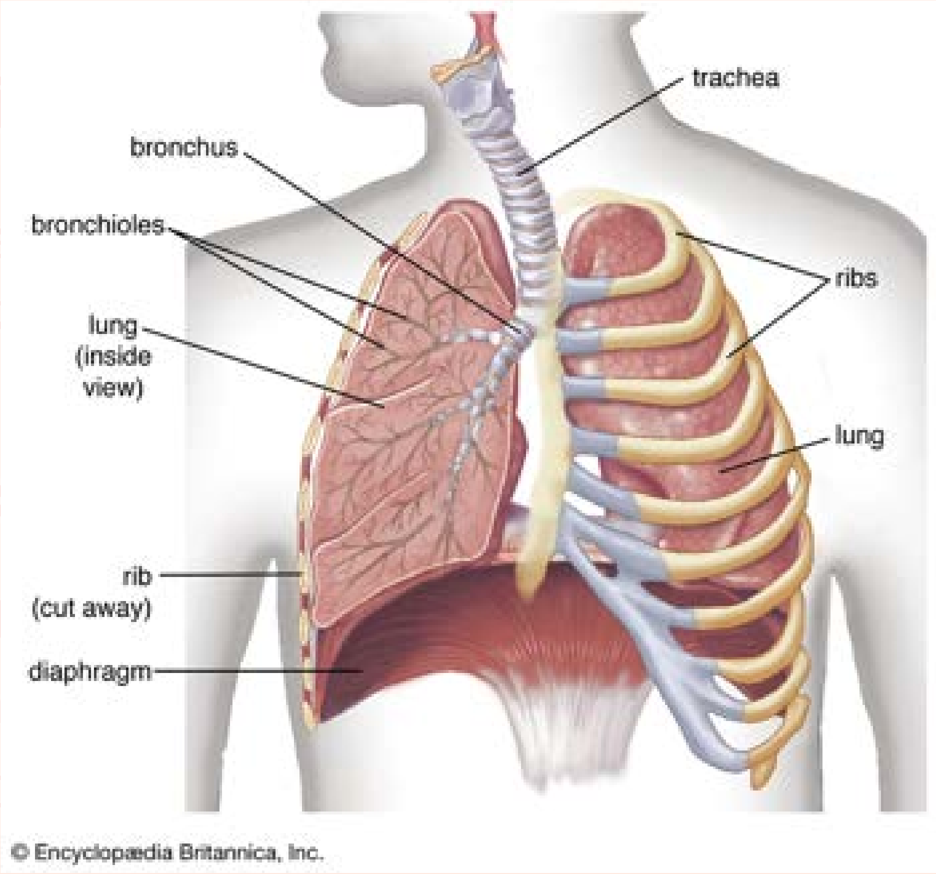
What could this be?

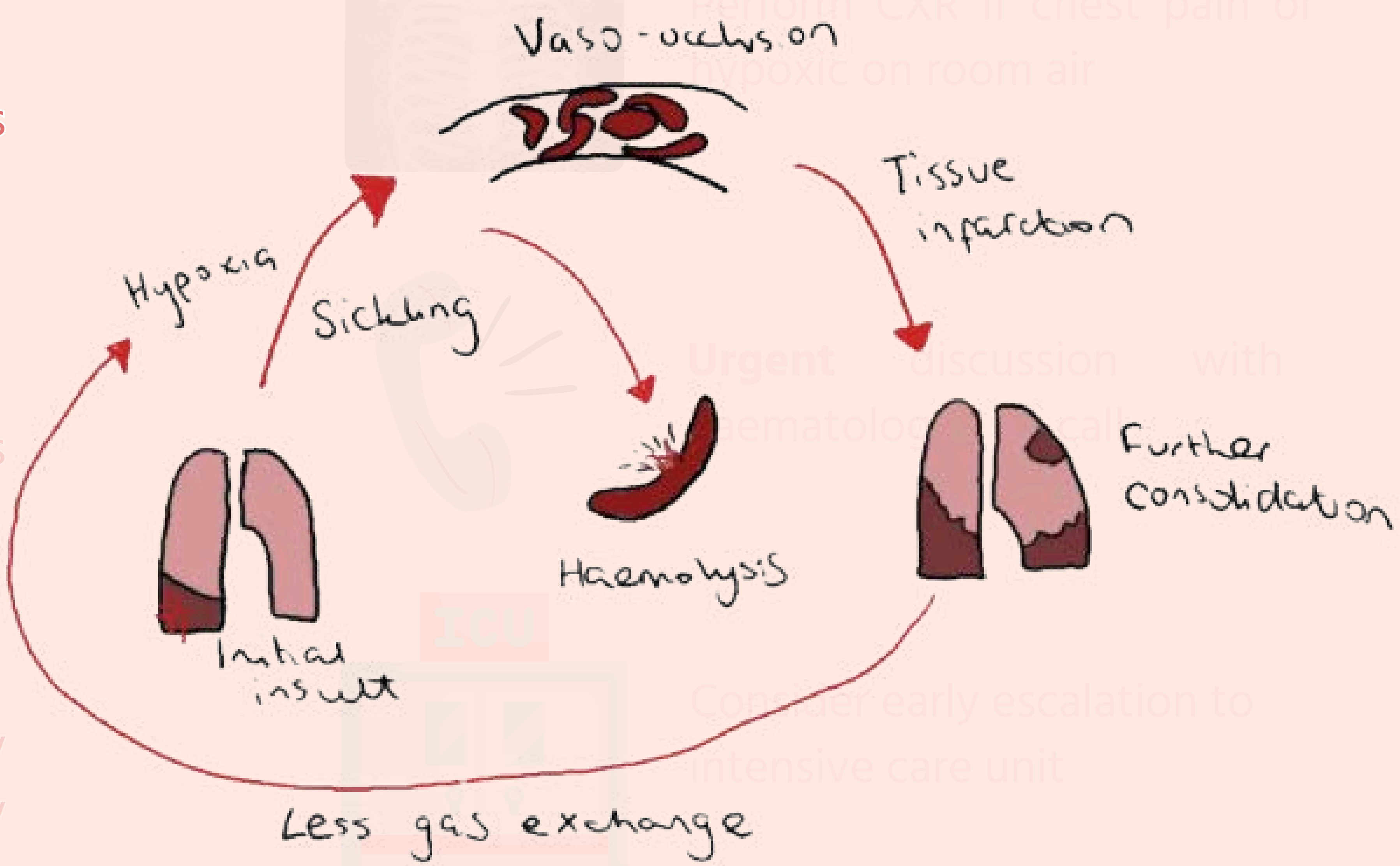
# ACUTE CHEST SYNDROME



## Mechanism

An acute insult on the lung prompts hypoxia, which causes sickling, which leads to more hypoxia, which leads to sickling...



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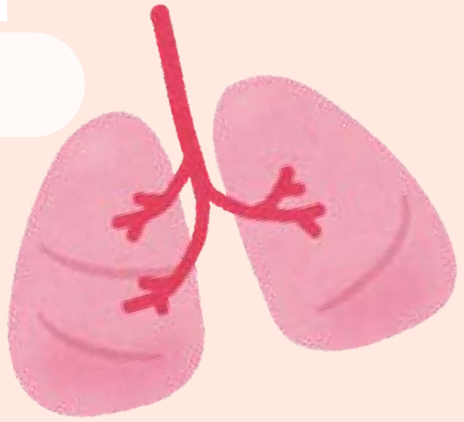

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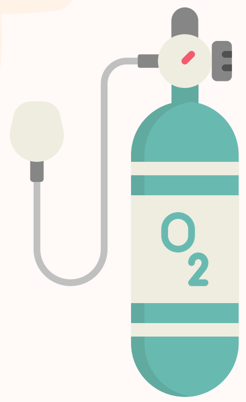
## Definition

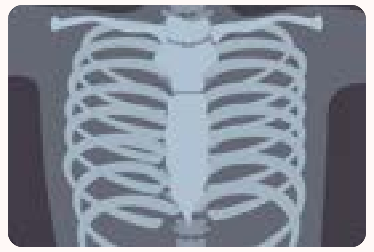
The definition of acute chest syndrome (ACS) is new infiltrates on CXR with fever and/or respiratory symptoms.

## Clinical presentation

Patients may appear well at first but have an escalating early warning score, oxygen requirement or pain. Potential to rapidly deteriorate




Give supplementary oxygen if oxygen saturations are <95% on air



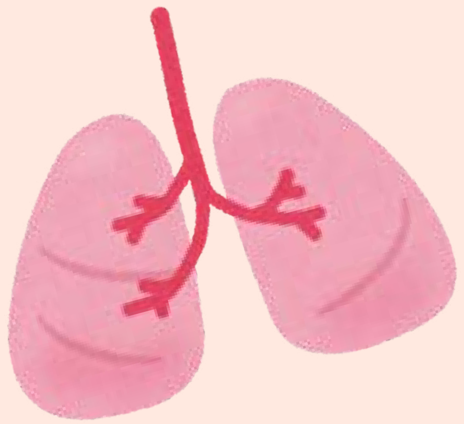
Perform or repeat CXR if chest pain or hypoxic on room air

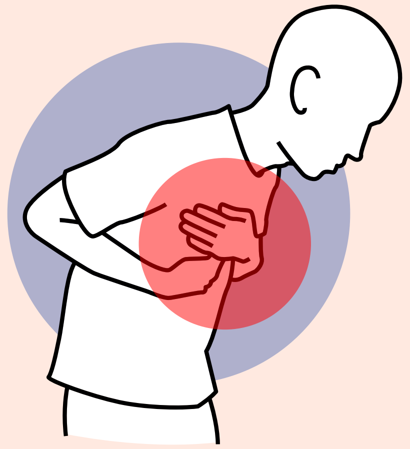
- Consider CTPA if suspicion of PE

**Urgent** discussion with haematologist on call


Consider early escalation to intensive care unit

# ACUTE CHEST SYNDROME - THE USUAL STORY





## Day 1

Attended ED with back, leg and chest pain
Sats 99% on room air
CXR - clear
Looks very well

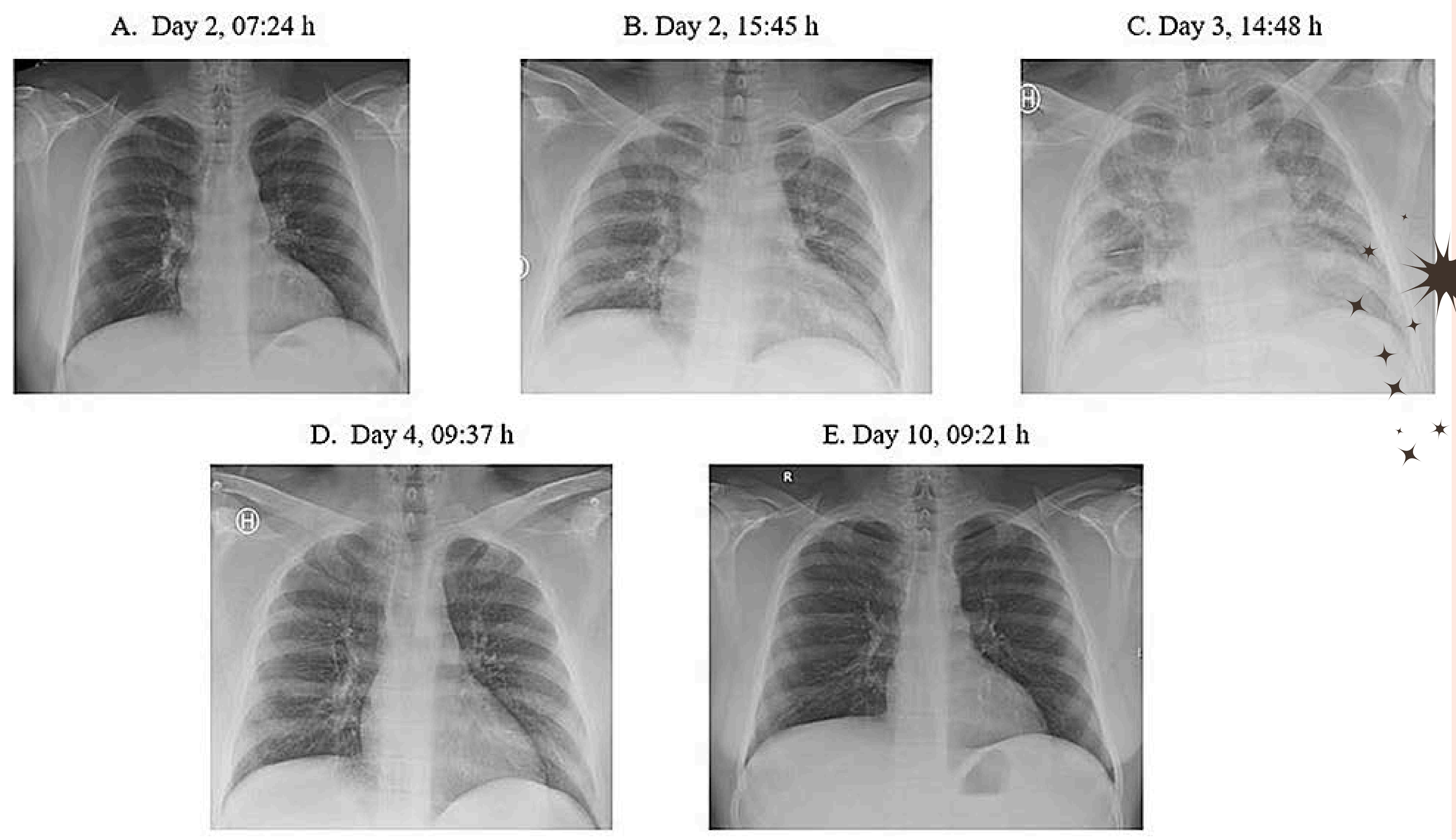
## Day 2

New O2 requirement - 4L nasal cannula
Chest pain settling slightly
New mild cough
Sats 91% on room air, 99% on 4L
CXR - bibasal atelectasis


## Day 3

Found with dropped GCS next morning
Sats 85% on 4L O2 - put on 15L non-rebreathe
Transferred to ITU
CXR - left basal consolidation

# ACUTE CHEST SYNDROME - THE USUAL STORY




10.7759/cureus.20236

# MANAGEMENT OF ACUTE CHEST SYNDROME

**Initially:**

- Supplementary oxygen
- Adequate analgesia but avoiding sedation
- Incentive spirometry
- Treatment of underlying cause (e.g. antibiotics)

**If deteriorating or very unwell:**

- Likely to consider blood transfusion - top up or exchange
    - This is a **HAEMATOLOGY CONSULTANT DECISION**

# PRIAPISM

## Mechanism

The venous drainage from the penis becomes dysfunctional due to nitric oxide depletion and sickling. Trapped blood causes pain like compartment syndrome. This is a very common complication in adolescent and young adult males.

## Types of priapism

**Stuttering priapism:** recurrent episodes last for less than 4 hours and self-resolve. Penis may not be fully erect. Can precede fulminant priapism

**Fulminant priapism:** Fully erect penis with soft glans. Severely painful and lasting >4 hours.

## Aims of treatment

Treatment aims to preserve erectile function. Significant damage can start to occur at around 6 hours.

Patient will have already tried conservative measures - warm bath, exercise, simple analgesia



Urgent discussion with both haematology and **urology** teams



Hyper-hydration can be helpful as a conservative measure



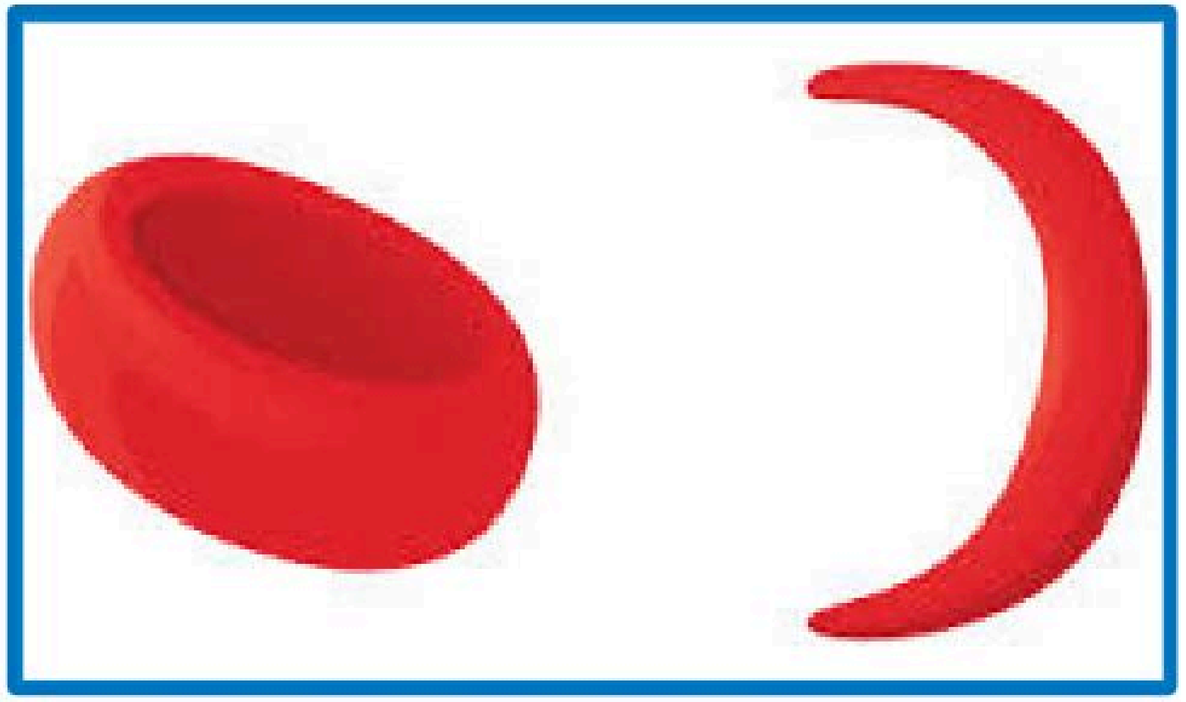
Needle drainage may be required to achieve resolution

NHS

University Hospitals
Bristol and Weston
NHS Foundation Trust

Patient information service
Bristol Haematology and Oncology Centre

# Priapism in adults with sickle cell anaemia



## What can I do if I get a priapism?

Do the following things immediately:

- Drink lots of fluids
- Take simple painkillers such as paracetamol
- Try to pass urine
- Take a warm bath



- Some people also find that jogging, doing squats or other types of exercise help

These should help to stop the episode within an hour. It is important that you report it to the haematology team caring for you in the next few days.

Do NOT:

- Apply ice or cold water to the penis as it may make it worse
- Engage in sexual activity during priapism. Remember priapism will not be resolved by sex or masturbation
- Take lots of painkillers to manage your priapism; find out about other treatment options
- Use alcohol/cannabis/tobacco/Viagra® as these can potentially worsen or trigger priapism

If the priapism does not go away, you must go to the Emergency Department (A&E) immediately. There is a risk of permanent damage if priapism lasts longer than four hours.

# PRIAPISM

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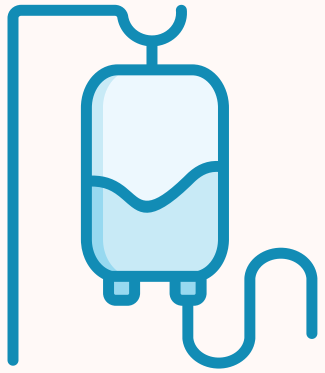

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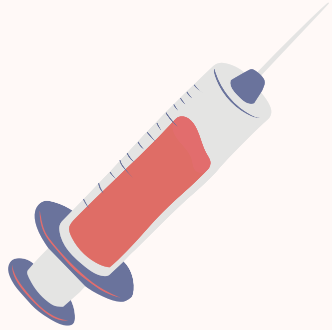
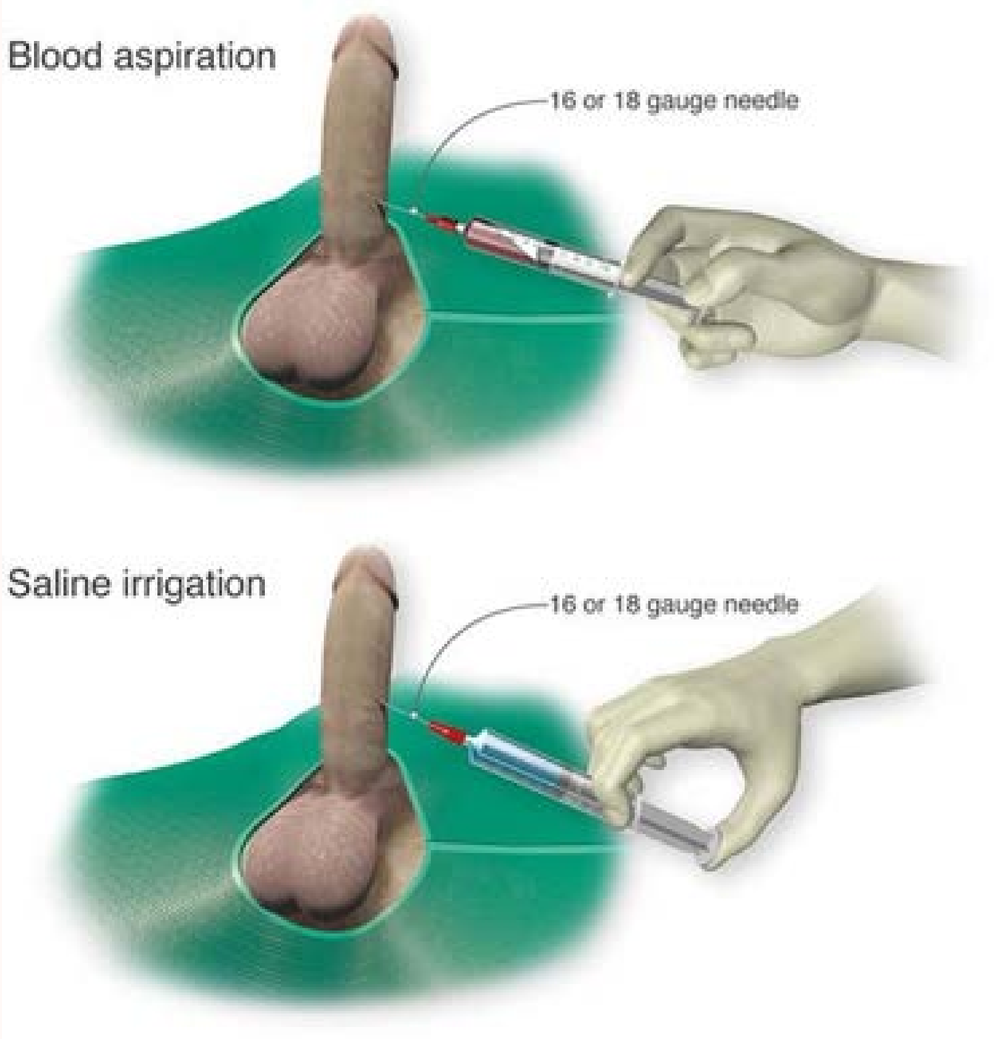


Needle drainage may be required to achieve resolution

# PRIAPISM - MANAGEMENT


Medical management




Needle aspiration +/- irrigation

T shunt procedure

My patient with sickle cell disease has presented with a history of new onset aphasia this morning.

What do I need to do?

**What would your immediate management be?**

# STROKE

## Pathophysiology

Haemolysis causes local inflammation, increased endothelial adhesion, vasoconstriction, hypoxia, sickling and eventually ischaemic stroke

## The odds are high

- 24% of patients with sickle cell disease have a stroke by age 45
- Children with SCD are 333 times more likely to develop a stroke
- Around half of patients with stroke will get a recurrent episode within 1-2 years without appropriate management

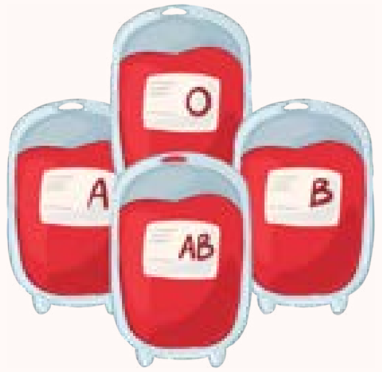
## Ischaemic vs haemorrhagic

- Majority of strokes are ischaemic, but haemorrhagic more prevalent in 20-30s

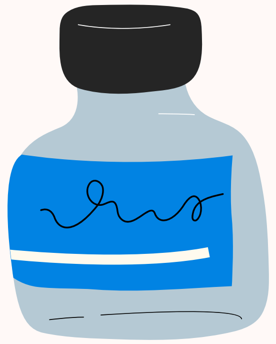
There are many other - less common - neurological complications of sickle cell disease

Urgent discussion with haematologist and stroke/neurology clinician on call


Urgent CT imaging to rule out haemorrhagic stroke




Red cell exchange transfusion can terminate the episode

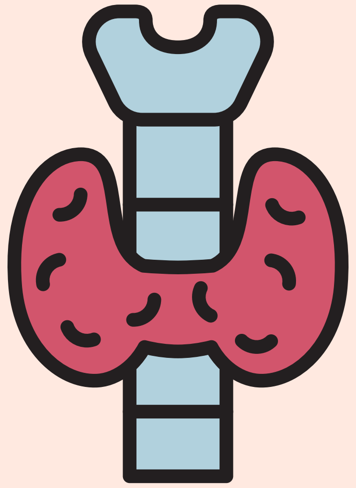


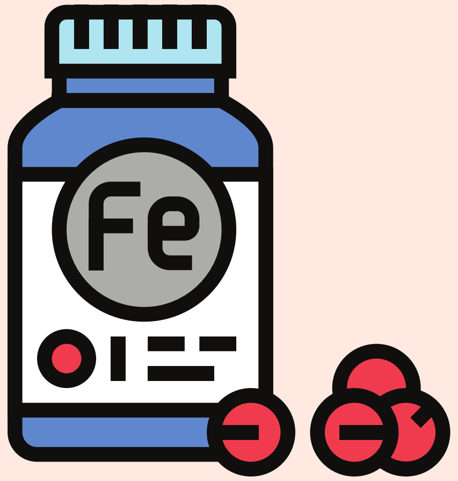
Adult patients with stroke symptoms may be considered for thrombolysis as per stroke pathways (specialist decision)

# ACUTE (ON CHRONIC) ANAEMIA

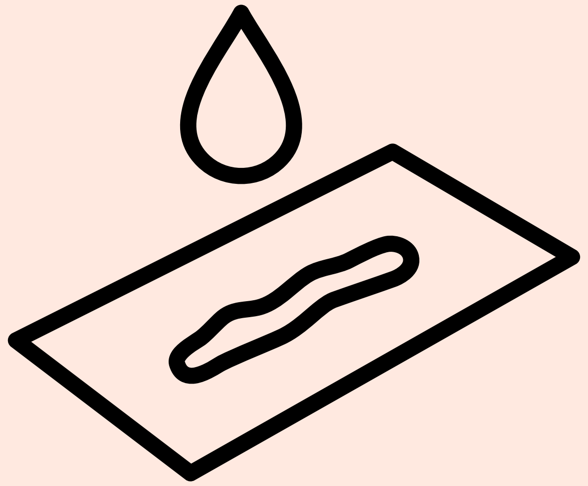

What should we look for?

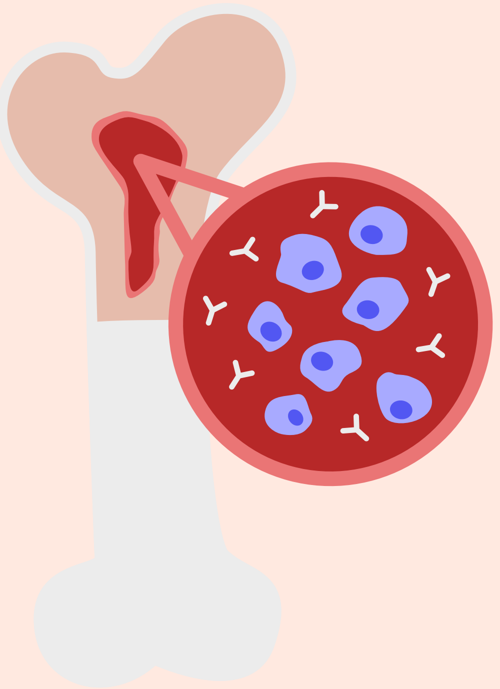
# ACUTE (ON CHRONIC) ANAEMIA




**Shall I think of the usual culprits?**

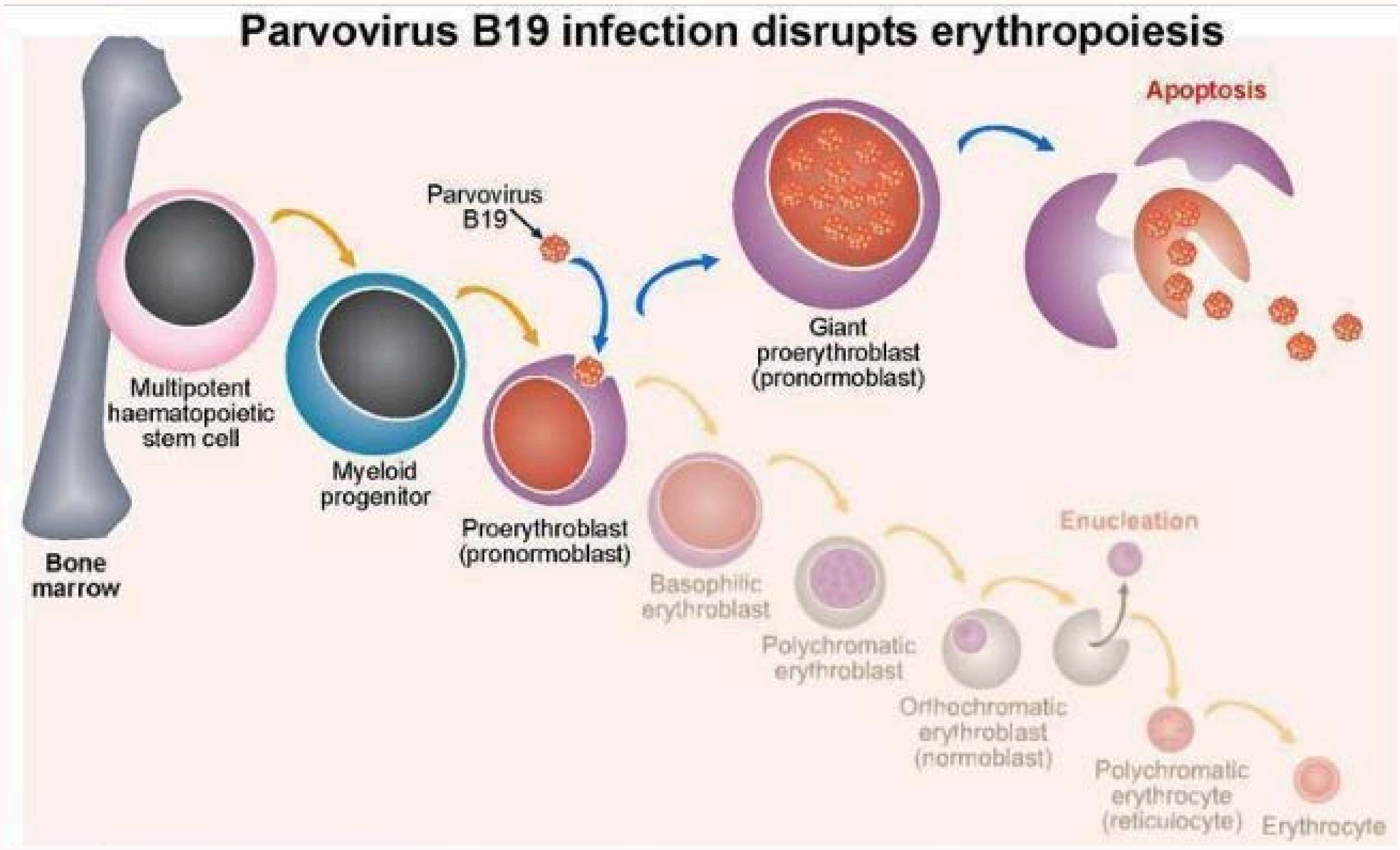




# ACUTE (ON CHRONIC) ANAEMIA

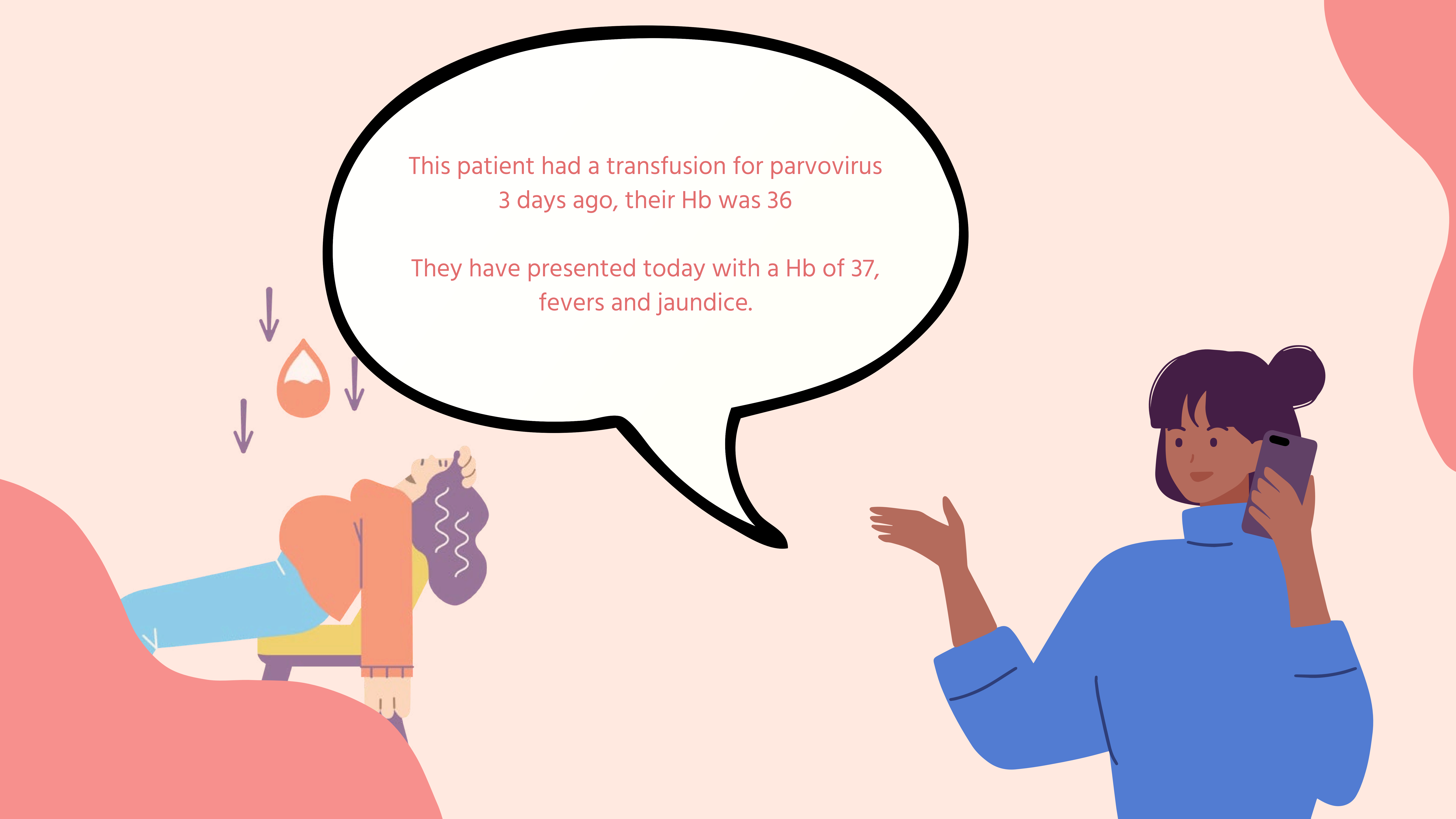
Well yes... but we also need to think outside of the box!

# APLASTIC CRISIS - PARVOVIRUS

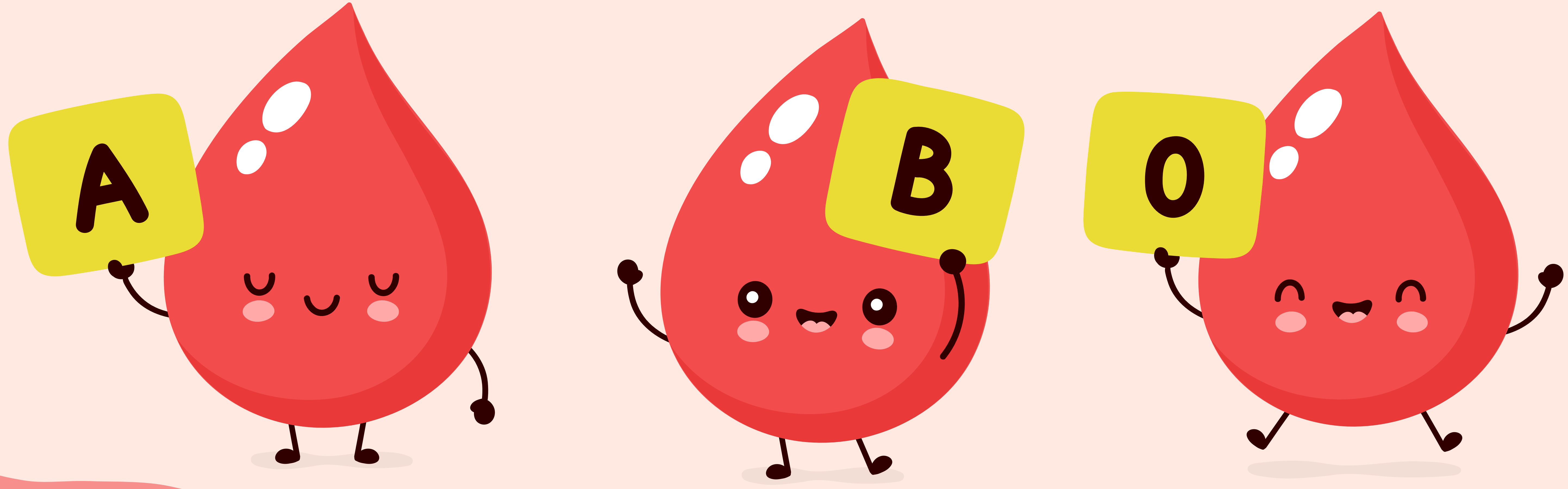



Check the **reticulocyte count**!

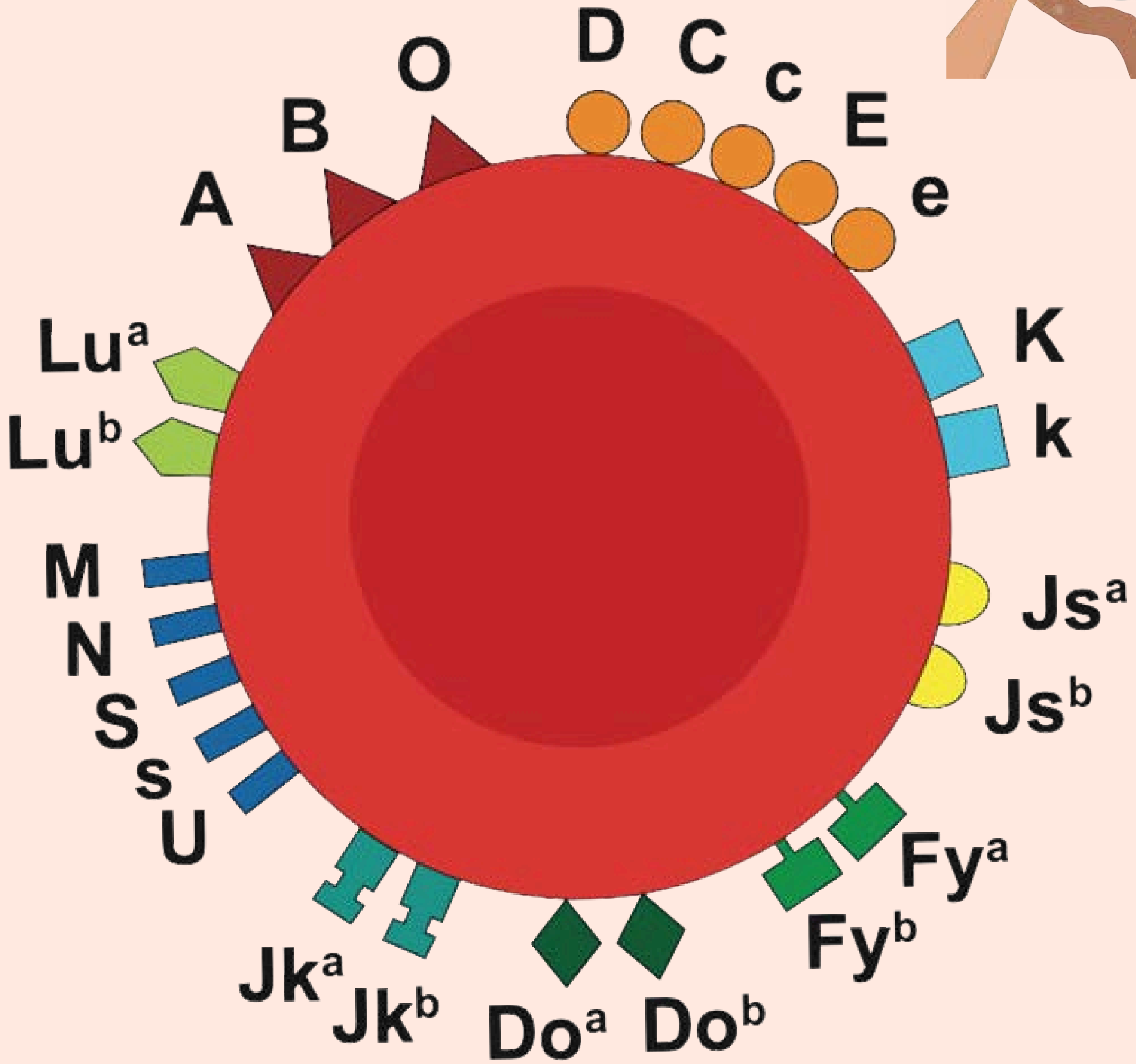
Management - transfusion (on haematology advice)


This patient had a transfusion for parvovirus 3 days ago, their Hb was 36
They have presented today with a Hb of 37, fevers and jaundice.

# DELAYED HAEMOLYTIC TRANSFUSION REACTION

# DELAYED HAEMOLYTIC TRANSFUSION REACTION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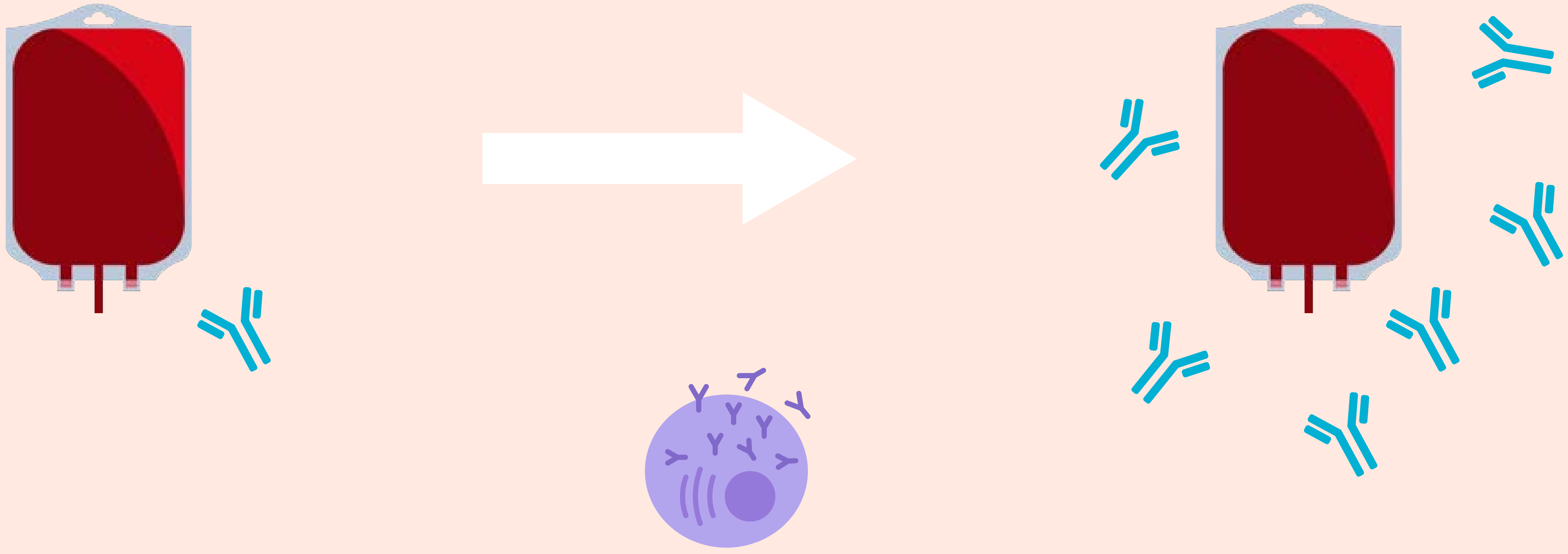

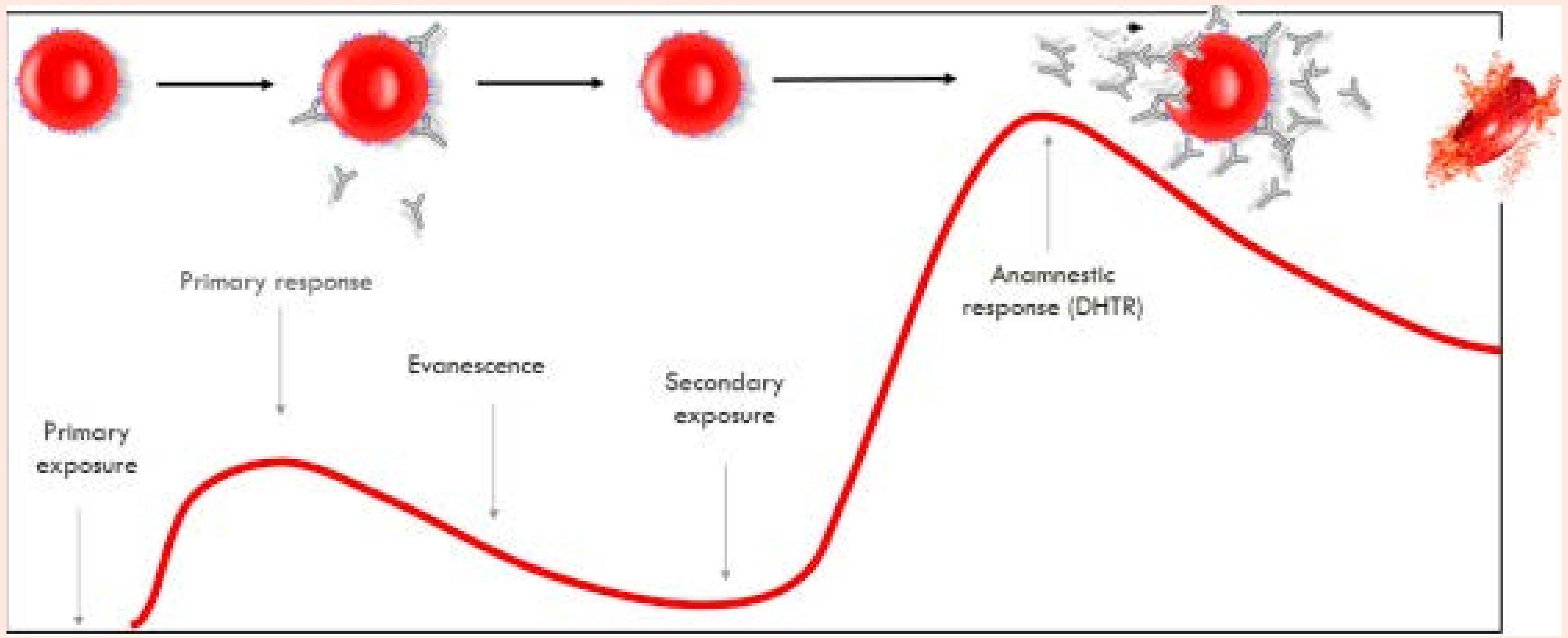

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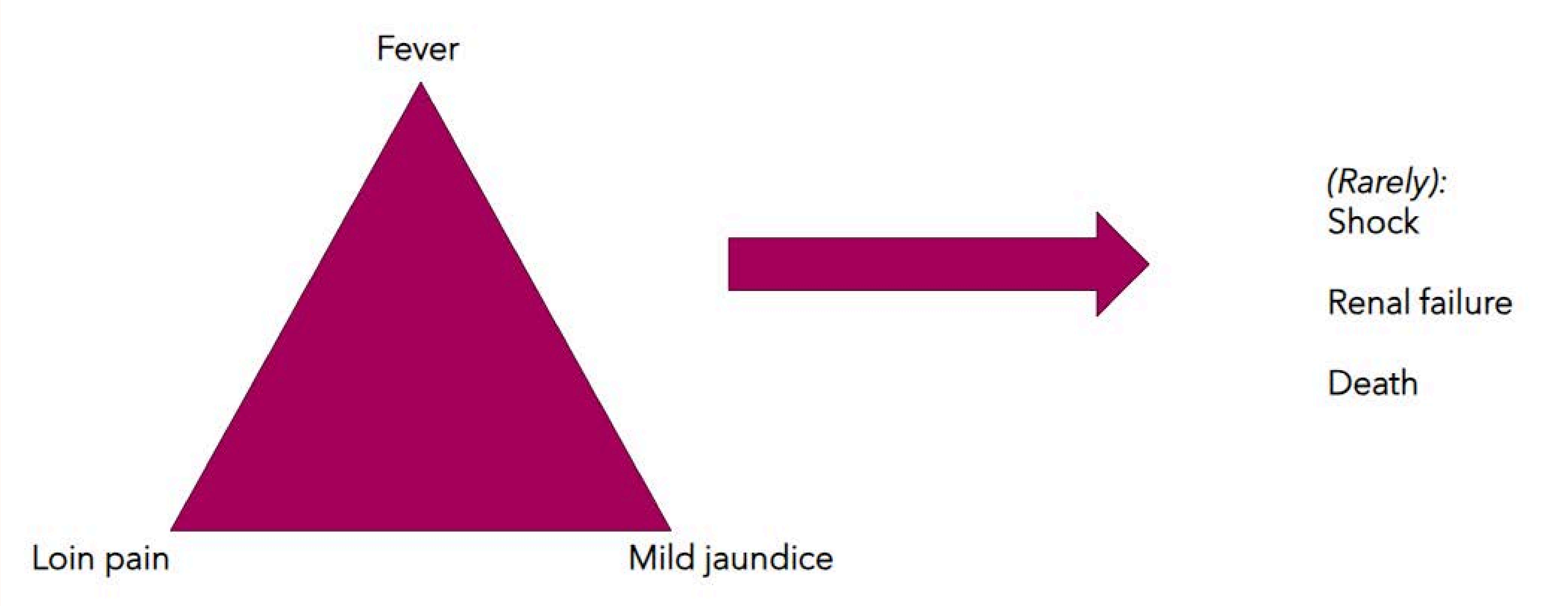


# HOW DO WE TEST FOR HAEMOLYSIS?

### DAT

Measures whether there is an antibody on the outside of the red cells.

### Bilirubin

Released as red cells breakdown.

Specifically indirect/unconjugated bilirubin

### LDH

Released as red cells break down.

A marker of cell turnover

### Blood film

Can tell us whether cells appear abnormal in shape (e.g. spherocytes) or being sheared in the blood vessels (fragments)

### Reticulocytes

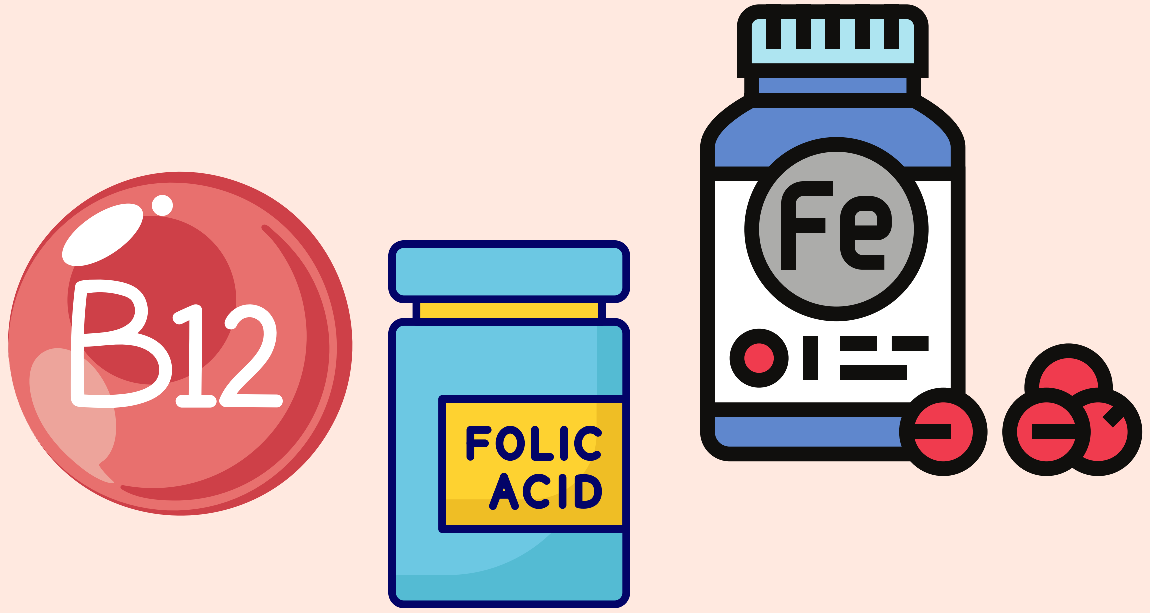
Young red cells released into the circulation to compensate for anaemia

### Haptoglobin

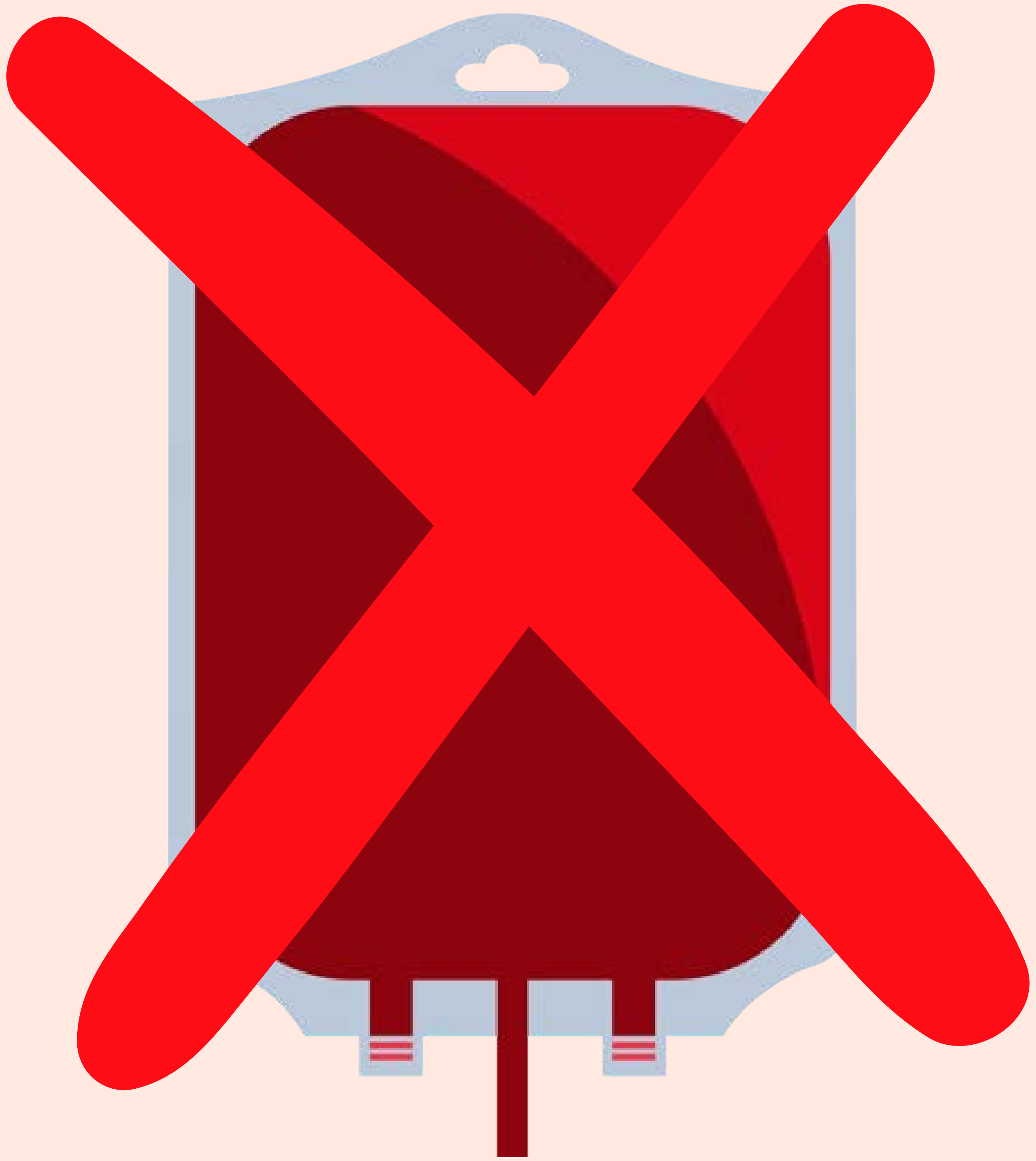
Normal protein created by the liver which gets mopped up when red cells are broken down.

Haptoglobin is usually undetectable in haemolysis

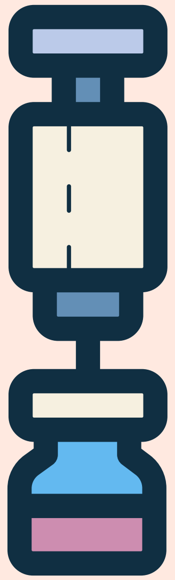
# DHTR - MANAGEMENT




Haematinic support



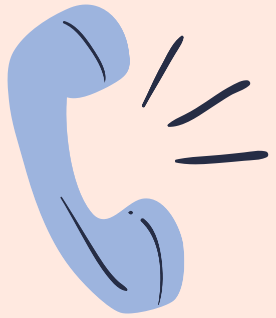
AVOID FURTHER TRANSFUSION!



IV steroids and other medications

IVIG

# WHAT ABOUT MAJOR HAEMORRHAGE?



**Clear communication** with haematology and the lab is key

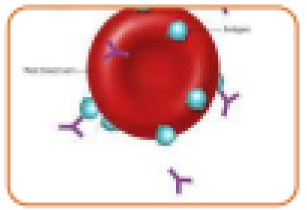
## “Nobody should die due to lack of blood”

**SHOT Bite No. 8:**

**Massive Haemorrhage Delays**

SHOT Serious Hazards of Transfusion

July 2021



**Transfusion support in the presence of red cell antibodies:** Where the antibody screen is positive or the patient has known antibodies for which compatible blood is not readily available, ABO/D, Rh & K matched red cells may be given. Approximately 80% of patient antibodies are to antigens in the Rh & Kell systems. Discuss with a clinical haematologist regarding the need for methylprednisolone +/or IVIg and monitoring (including urine output) for delayed haemolytic transfusion reactions, if incompatible blood is transfused

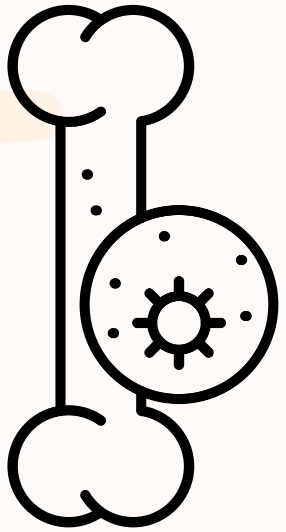
# INFECTION

## Mechanism

Patients with sickle cell disease become functionally asplenic in the first year of life, before becoming radiologically asplenic. This increases the risk of encapsulated organisms

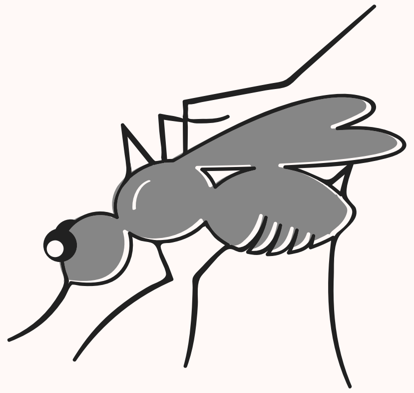
## Prevention

Patients are offered lifelong penicillin V prophylaxis and recommended to keep up to date with vaccinations (meningitis, pneumococcal vaccination).



Risk of osteomyelitis caused by encapsulated organisms

Pneumococcus or haemophilus infection



Consider malaria if appropriate travel history

Yersinia enterocolitica if on iron chelation therapy

# HAEMATURIA

## Mechanism

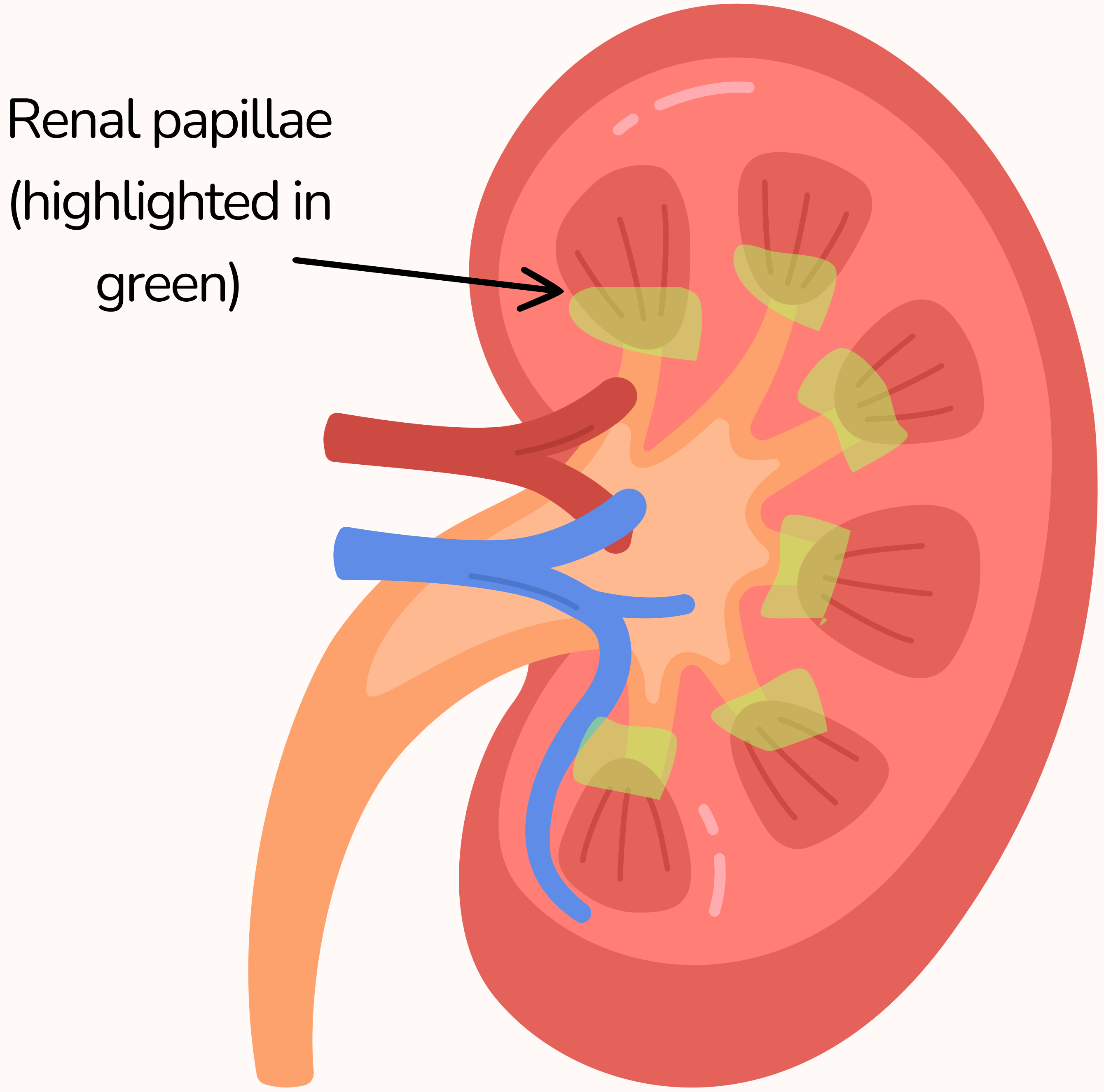
Haematuria (both microscopic and macroscopic) is common and often occurs due to microinfarcts of renal papillae or renal papillary necrosis. Necrosis occurs due to ischaemic injury and haemolysis-induced pro-inflammatory environment.

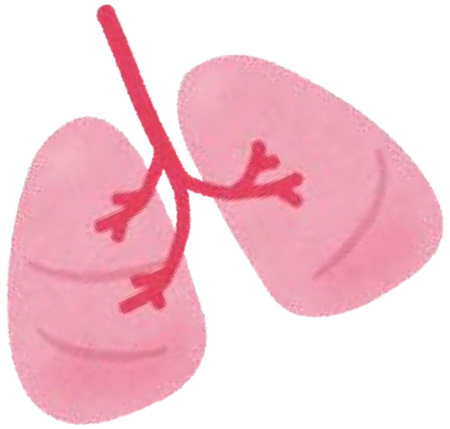
## Clinical presentation

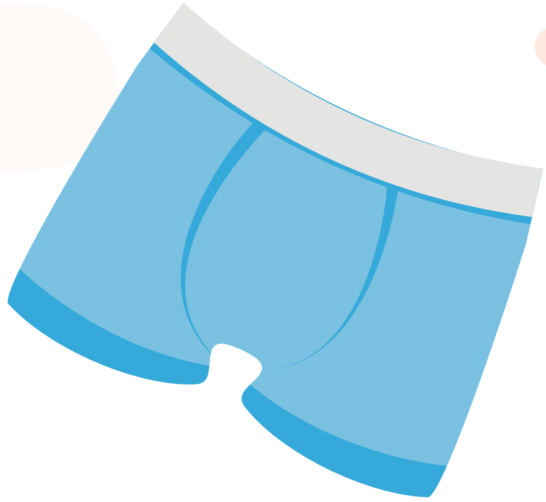
Is is usually self-limiting but can cause colicky pain and rarely urinary obstruction.

Always consider UTI in this patient group.

RARE but serious - renal medullary carcinoma - USS abdomen








# THANK YOU!