

KK Women's and Children's Hospital SingHealth

# My Fracture Journey

### A guide for parents, caregivers and patients

Information about problems and symptoms to look out for in the care of fractures



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### Introduction to Paediatric Fractures

Fractures are quite common in children and can occur from falls at the playground, during sports activities, or traffic accidents. Diagnosing fractures typically involves both X-rays and a clinical assessment. A fracture is defined as any disruption, break, or crack in the bone, whether complete or incomplete.

### How many types of fractures are there?

There are various types of fractures possible depending on the mechanism of injury, and these include:





**Open Fracture** (fractured bone is exposed through a skin wound; it is an emergency due to blood loss & increased risk of infection)

High Energy Injuries



**Comminuted Fracture** 



**Transverse Fracture** 



**Oblique Fracture** 







### **Spiral Fracture**

**Undisplaced Fracture** 





Children's bones have unique characteristics:

- 1. They heal more quickly than adult bones.
- 2. They are more flexible, allowing them to bend and deform before breaking.
- 3. They contain growth plates (scientific name: *physis*)
  - These are cartilage-rich areas at the ends of bones that facilitate growth.
  - These growth plates are more vulnerable and often involved in fractures
  - Fractures affecting the growth plates are categorized using the Salter Harris Classification [see next page for diagram].
  - Some of these injuries can lead to growth arrest and result in shortening (limb length discrepancy) or progressive deformity.
- 4. They have great remodelling potential.
  - Even after a fracture heals, children's bones undergo a process of remodelling to improve alignment and restore their shape.
  - More details on this remodelling process will be discussed in Section 5 of this information booklet.

### Examples of fractures unique to children's bones:









Buckle Fracture (bone outline crumples but remains intact with no breaks)

**Greenstick Fracture** (one side of the bone breaks while the opposite side bends)

Plastic Deformation (the bone bends but the outline remains intact with no breaks)

### Salter-Harris Fractures (Classification)

A Salter-Harris fracture is a specific type of fracture that occurs in children and adolescents, involving the growth plate (physis) of a long bone. These fractures are classified based on the severity and pattern of the fracture:













Type 1 (fracture goes straight through the growth plate)



Type 2 (fracture goes through the growth plate and out through the adjacent bone / metaphysis)



Type 3 (fracture goes through the growth plate and into the end of the bone / epiphysis, extending into the joint surface)



Type 4 (fracture goes through the growth

plate and involves

both metaphysis and

epiphysis)

Type 5

(compression across the growth plate)

No / low risk of growth arrest

Higher risk of growth arrest

### **Common Paediatric Fractures**

Below are the some of the common elbow, wrist, ankle fractures encountered:

### Elbow Fractures



Fracture

**Radial Neck Fracture** 

### Wrist Fractures



**Buckle Fracture** 



**Greenstick Fracture** 









Salter Harris Type I

**Triplane Fracture** 

**Tillaux Fracture** 

Your child's Orthopaedic specialist doctor will speak with you and your child to explain the fracture diagnosis and point it out on the X-ray during the consultation.

### Broad Overview of Initial Fracture Management

Majority of fractures initially present at urgent care clinics or emergency departments. The specific treatment for a fracture will be determined by an orthopaedic specialist, who will consider your child's age, overall health, and the type and severity of the fracture.

Some fractures may need to be realigned acutely through manipulation and reduction under sedation. Subsequent fracture management options include casting, splinting, and, in some cases, surgery. A follow-up appointment with the orthopaedic clinic will be scheduled as needed, usually in a week's time.

The goal of fracture management is to restore an acceptable alignment of the bone and joint surface, allow for early return of function, and to avoid or minimise the presence of long-term complications.





### Why backslab and not a full cast?

A backslab is a half cast that is not circumferential (does not encircle the limb) and is held in position using a crepe bandage, whereas a full cast refers to a cast applied circumferentially around the limb.



An above elbow backslab, applied and secured with crepe bandage (as shown below).





An above elbow full cast, with the fibreglass material providing support circumferentially.



Backslabs are applied in the acute setting (within 1st week from date of injury) for fracture immobilisation in anticipation of and to give allowance for limb swelling. Backslabs are temporary and will usually be replaced by a full cast at the orthopaedic fracture clinic appointment.

They should be kept clean and dry and should not be removed unless instructed to do so, or done by a healthcare professional. *More information would be available in the section on "Follow-Up and Cast Care"*.

Another type of backslab would be the removable backslab that is created from splitting (and removing) the full cast. This is performed only after progress in fracture healing is seen on radiographs, and the full cast can be safely removed without disturbing fracture alignment and healing.





### Why does my child require a backslab even though the X-ray done at the Emergency department shows no obvious fractures?

Even if an X-ray doesn't show any obvious fractures, a backslab will still be recommended for the following reasons:

### 1. Occult / Hairline Fractures

Sometimes, occult or hairline fractures might not be immediately visible on X-rays, but only show up on subsequent repeat X-rays when the healing process has occurred. Immobilising the area with a backslab helps prevent accidental movements that can lead to worsening of these injuries.

### 2. Soft Tissue Injury

The injury sustained by your child might involve damage to the soft tissues (such as ligaments, tendons, or muscles), which will still benefit from immobilisation to rest these soft tissues to prevent further damage, and to reduce pain.

#### 3. Pain Management

Immobilisation helps alleviates pain by reducing movement that can exacerbate discomfort.

At the follow-up appointment with the orthopaedic clinic, your child's injury will be re-evaluated. The orthopaedic specialist will provide more details about the diagnosis and recommend any necessary treatment.

If immobilization is no longer required, the backslab will be removed.

### First Days - What to Expect

In the first few days after a fracture, you and your child can expect several symptoms and changes as your child's body begins the healing process.

### <u>Pain</u>

Fractures can be quite painful because the bone's lining contains nerve endings. Pain typically results from the movement of the broken bones and swelling caused by bleeding at the fracture site. The first 2-3 days are usually the most painful, with pain gradually improving over the next few weeks. Painkillers are crucial in managing this discomfort following an injury. A "pain ladder" guides the appropriate type and dosage of painkillers, based on the severity of the pain and the individual's needs.



<u>Paracetamol</u> and <u>Ibuprofen</u> are commonly used for managing fracture pain in children, combining them in regular intervals provides good pain relief. You can alternate between Paracetamol and Ibuprofen to manage pain effectively while minimising the risk of side effects. Make sure to take the medications on time as scheduled, as you do not want to wait for the pain to come back before you take the next dose of medications. Ensure that the total daily dose of each medication does not exceed the prescribed recommended limits. In certain cases, stronger painkillers like <u>Oxycodone</u> may be required for better pain control.

### <u>Swelling</u>

Fractures typically cause swelling due to bleeding from the broken bone ends and from the muscles around the fracture site. For low-energy injuries, like a simple fall, the swelling is usually mild. However, with high-energy injuries, more swelling can be expected. Swelling reflects the extent of soft tissue damage around the broken bone.

There are two main concerns with swelling in the affected limb after an injury:

- 1. Increased swelling can lead to more pain.
- 2. If swelling occurs inside a plaster slab or cast, it can become too tight and cause circulatory problems.

To reduce swelling in the affected limb, it is important to keep the injured limb elevated above the level of the body. You can stack pillows or cushions under the injured limb to keep it elevated. Ensure that the support is stable and that the limb is comfortably positioned, avoiding any pressure points on the skin.

Keep the limb elevated as much as possible, especially during the first 3-5 days after the injury, even while sleeping. For lower limb fractures, it is important not to keep the foot in a dependent position especially when seated. Raise the affected foot on a foot rest or another chair, and if possible, use a pillow or cushion to help elevate it.



Ways of elevating upper and lower limb fractures.



For the lower limb, it is also important to offload the heel to prevent pressure injury. Place pillow(s) beneath the leg to elevate the heels off the mattress. and ensure there is a space between the heel and the mattress.

### <u>Bruising</u>

Bruising after a fracture is a common occurrence. When a bone fractures, bleeding occurs from the ends of the broken bones into the surrounding tissues. The surrounding blood vessels can also be damaged, causing blood to leak into the surrounding tissues. The body's response to a fracture includes increasing blood flow to the area, which then exacerbates the bruising and swelling.

Over time, the blood in the bruised area will be broken down and reabsorbed, and the colour of the bruise will change from reddish to purple to bluish green, then yellow, and eventually fades away.

### Issues that require early medical attention:

### 1. Tight plaster cast or skin issues

If your backslab / cast feels too tight or is causing skin issues, it will need to be removed or changed to relieve the swelling and pain. Increased pain, numbness and tingling, or changes in the colour or temperature of the skin of the extremities could indicate issues like poor circulation or pressure from the immobilization device.

#### 2. Ongoing bleeding

In certain cases, a skin wound occurs together with the fracture injury. The wound should be cleaned and dressed. Most wound bleeding should stop within a few hours, and dressings might look a bit bloodstained. But if the bleeding soaks through your dressings, you should get it reassessed and have the dressings changed.

### Follow-Up and Cast Care Advice

A full cast is applied when the initial swelling has decreased, and it is done to immobilize the fracture and maintain a proper alignment during the healing process. The timing and type of cast depends on the fracture's location, severity, and the patient's overall condition.

Examples of types of casts in the treatment of paediatric fractures:

### **Upper Limb Casts**



1) Below Elbow Neutral









3) Extension

4) Hanging Arm

5) Muenster

6) Flexion



2) Above Elbow Neutral



7) Thumb Spica Cast



8) Scaphoid Cast



9) Intrinsic Cast

### Lower Limb Casts



### <u>Mobility after a Fracture</u>

Weight bearing status after a fracture is determined by your child's orthopaedic specialist. It depends on several factors, including the type and location of the fracture, the definitive treatment, and the healing process. The types of weight bearing statuses include:

- <u>Non weight bearing (NWB)</u>
  Do not put any weight on the affected limb (crutches or wheelchairs are required to assist with mobility). Carry small children.
- <u>Partial weight bearing (PWB) / Toe touch weight bearing (TTWB)</u> Some weight is allowed on the affected limb, but only as much as is necessary for balance or a percentage of body weight.
- <u>Weight bearing as tolerated (WBAT)</u> Your child can put as much weight on the limb as he / she can tolerate without experiencing excessive pain or discomfort.
- <u>Full weight bearing (FWB)</u> Your child can put his / her full body weight on the affected limb.

### Why do I need to come back weekly to do X-rays (alignment check)?

In the first 1-2 weeks after a fracture, new bone formation has not yet begun, leaving the fracture ends unstable and prone to displacement. During this crucial period, maintaining proper alignment is vital for ensuring effective healing and preventing complications.

If a fracture is unstable and at risk of misalignment, surgery may be required. This surgical intervention is typically considered within the initial 1-2 weeks, although the exact timing depends on the fracture's severity and the patient's overall condition. Regular follow-up during this time is essential to make timely decisions and achieve the best possible outcome from the fracture.

Below shows an example of an elbow lateral condyle fracture showing progressive displacement on follow-up at 1 week and 2 weeks post-injury.



Injury film



1 week post-injury (further displacement)



2 weeks post-injury (further displacement)



Surgical fixation performed

### Cast Care Advice



Keep the cast dry.

- Let the cast dry naturally.
- Cover the cast completely with a plastic bag and seal the end using duct tape onto the skin for showering (only for the short duration of a shower).
- Do not wet or soak the cast as it may cause skin irritation and wound infection.



Examples of skin irritation (maceration) and infection from prolonged contact with a wet cast / wet padding material.

Raise the plastered limb when your child is resting.

• This can be done by placing pillows underneath the affected limb.



For casted lower limbs, it is best to

- Elevate the affected limb to prevent / reduce swelling.
- Drink plenty of fluids.
- Wiggle / exercise the toes frequently to decrease the chance of developing blood clots in the leg.
- Remember to off load the heel!



For the upper limbs, it is recommended to

- Elevate / support the limb with a blanket or pillow.
- Exercise the fingers frequently to reduce swelling on the hand.



To minimise itch,

- Do not go under the sun.
- Keep your child in a cool environment (e.g., stay indoors) as the itch / odour is often caused by accumulated sweat.
- Minimise unneccessary movements.

If your child experiences severe itch, you may consider the following:

- Use a hairdryer on COLD setting or under the fan (or handheld fan) to blow and dry the accumulated sweat / moisture.
- If the above fails, please ask your doctor for some anti-itch medicines (antihistamines). Please bear in mind that the medicine does not entirely relieve the itching and is to be used only when necessary.

DO NOT attempt to trim or reshape the cast.

• Your child's cast has been constructed to provide maximum / optimum support for the fracture during the healing process. Cutting or altering the cast may affect (lengthen) your child's recovery period.

DO NOT insert anything into the cast

- Almost every cast will cause itching, but your child should not insert anything into the cast to scratch the skin as this can result in severe skin damage, especially if the item gets stuck and causes pressure injury.
- If your child experiences persistent or severe itching, you should contact the hospital immediately.



Coins discovered to be within a cast on X-ray.



LEFT: Pen shown within a cast on X-ray



Pressure injury on the skin caused by a marker pen cap that was inserted and left within the cast for a few days

DO NOT bear full weight on the non-walking cast. Use crutches for support.

DO NOT jump, run, or tiptoe with the walking cast. It is only meant for weight bearing for normal walking.

DO NOT attempt to remove any bandages from your cast until your appointment date.

If any of the following problems occur, you should bring your child to seek medical attention immediately:

- Loose, cracked, or broken cast.
- Numb, cold, or discoloured (blue) toes / fingers of the affected limb.
- "Pins and needles" sensation or numbness of the limb.
- Pain or burning sensation of the limb.
- Stained or smelly cast.
- Severe or persistent itching.

### General care

- A sling may be provided to support the upper limb (optional).
- Toes and fingers should be pink and warm.
- Your child is likely to feel some discomfort even after going home. A mild painkiller such as paracetamol can be given.



• Cover walking casts with fully strapped sandals when walking (above).

### Travelling with a cast

- It is best to check with the doctor if your child is fit to fly with a cast on.
- It is also beneficial for the patient to inform the airline of their condition and their need for assistance ahead of scheduled travel.
- A full cast is generally required to be split (bivalved) prior to flying, to accommodate any potential swelling during the flight. It should be done for the following circumstances:
  - A full cast applied less than 48 hours prior to scheduled flight.
  - Flights of long duration (>3 hours flying time).

During a flight, the cabin pressure is lower than that at sea level. This can cause swelling in your limb. With a circumferential cast, swelling can lead to increased pressure within and even a complication known as compartment syndrome (a serious condition where increased pressure affects blood circulation to the region and results in tissue death).



The fracture healing process is an organised sequence of events that allows a broken bone to repair and regain its strength. Generally, healing times for fractures range from 6 to 16 weeks, depending on the type and location of the fracture, age of patient and the health of patient. Children's bones tend to heal faster than those of adults.

General stages and timeline of bone healing:

- 1. Haematoma (blood clot) and inflammation (Days 1-7)
- 2. Soft Callus (fresh new bone) formation (Weeks 1-3)
- 3. Hard Callus (ossified new bone) formation (Weeks 4-6)

Regular follow-up appointments are essential to monitor the healing progress through physical examinations and imaging (X-rays).



Progression of fracture healing (callus) on X-rays: day of injury, week 1, week 6.

### Should I be worried about the alignment?

Remodelling takes place in children's bones for months to years even after the fractures have healed. It involves reshaping of the bone by the active bone cells, and the new bone tissue is gradually remodelled into its original shape and strength as the bone adapts to the stresses and loads it experiences.

The extent of remodelling depends on:

### Age of patient

Younger patients have higher remodelling potential.

### Location of the fracture

Better remodelling if the fracture is closer to the growth plate.

### Plane of movement

Better remodelling if the fracture angulation / deformity is in the plane of the joint motion.



The above radiographs show progression in fracture healing and eventual remodelling with improvement in the alignment in an 8 year old patient, over a period of 9 months.

### Cast Removal and After-Care

Hurray, your child's fracture is healing well, and the cast can be removed! During cast removal, the plaster technicians will use a special tool called a cast cutter to cut and remove the cast.

It sounds scary only because it is noisy (like the sound of a vacuum cleaner). Your child will feel some vibrations or a bit of pressure when the cast is being cut, but the removal process is swift and will not hurt.



Your child may bring along a comfort toy for emotional support, and headphones or ear plugs to block out the noise. A tablet with videos / cartoons or games can keep them distracted to help keep their mind off the process. Some children also feel more comforted when they have something to chew or suck on (e.g. candy / sweet).

### What to expect after cast removal?

### Stiffness

The joints and muscles around the fractured area will be stiff after a period of immobilisation. When your child first starts to move the affected joints after cast removal, they may feel some discomfort or pain. This is normal as the body adjusts to movement after being immobilised in a cast.

Begin with gentle movements and range of motion exercises to gradually increase the movement across a joint. It is important to perform joint range of motion consistently. In most cases, the range of motion returns to normal after a couple of weeks. In cases that continue to remain stiff, physiotherapy may help by introducing stretching and further exercises to improve joint mobility.

Here are some simple range of motion exercises for the upper limb joints:





Wrist flexion and extension

Images source: "Upper Limb Active Movement Exercises" from HealthXchange.sg by Singhealth

### Skin condition

The skin under the cast may appear dry and flaky, discoloured, or wrinkled. It may also have an unpleasant odour. Gently wash the skin with mild soap and water to remove any dried skin and odour. Apply a moisturiser after drying to help with skin dryness and itching. In certain cases, the skin in the area that was covered by the cast appears hairier. This is due to pressure and friction on the skin from the cast, which can stimulate hair follicles. In most of these cases, the increased hairiness is temporary and should improve over time.

### Swelling

It is common to experience residual swelling immediately after cast removal. It should gradually improve as your child starts moving the affected joints more and continue to elevate the limb.

### Hypergranulation

In some cases (if surgery for closed reduction and percutaneous pinning is performed), hypergranulation develops at the pin sites. These irregular heaped tissues develop and grow to a level higher than the surrounding healthy tissue/skin. They do not require antibiotic treatment. Silver nitrate application helps to stop bleeding and shrink the hypergranulation tissue.





### **Return to Activity**

Pay attention and adhere to the advice provided by your orthopaedic specialist.

Resuming physical activities after a fracture depends on several factors, including the type of fracture, the location, and the overall healing progress. Generally, your child should wait until the fracture is fully healed before resuming strenuous activities. This is typically confirmed through follow-up X-rays and assessments. Even after healing, start with gentle, low-impact activities first and gradually increase the intensity as your child's strength and mobility improve. Resume full activities (e.g., competitive sports / contact sports / high-risk activities) only when allowed by your orthopaedic specialist and if your child is pain free doing the activity.

Cases of refractures have occurred, commonly in forearm fractures.

Case 1 (forearm fracture treated conservatively with casting)







Refracture occurred at 14 weeks

Case 2 (forearm fracture treated with titanium elastic nail surgery)







## Complications

Complications from paediatric fractures vary depending on the type and severity of the fracture, as well as the treatment and recovery process. Some potential complications include:

- Joint stiffness: occurs commonly due to prolonged immobilisation
- Malunion: the fracture heals in disrupted alignment, leading to deformity
- **Growth plate issues**: fractures involving growth plates can impact bone growth, potentially leading to limb length discrepancies or deformities
- Increased sensitivity to pain

Regular follow-up with healthcare providers, including orthopaedic specialists and therapists, can help monitor and manage these potential complications.



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"Better a broken bone than a bruised spirit" Wishing all patients a speedy recovery!