Rolando fracture Causes,Pathophysiology and Treatment

Rolando fracture is a **comminuted intra-articular fracture** at the **base of the first metacarpal** (thumb), often exhibiting a **Y-shaped or T-shaped pattern** . It is more severe than the closely related **Bennett fracture** due to its comminution and articular involvement.

Anatomy

- The **thumb carpometacarpal (CMC) joint** provides **~50% of hand function** , enabling precise pinch and grip.
- It is a **saddle joint** formed by the base of the **first metacarpal and the trapezium** .
- Stability is provided by multiple ligaments and muscular attachments (e.g., *abductor pollicis longus, adductor pollicis*).

Etiology

- Caused by **axial loading** along the metacarpal, often from:
  - Fall on an outstretched hand (FOOSH) with the thumb adducted.
  - Direct trauma (e.g., punching an object or person).
- Analogous in mechanism to a **pilon fracture** of the distal tibia.

Pathophysiology

- The injury leads to **intra-articular comminution** .
- Displacement occurs due to:
  - **Abductor pollicis longus** ? dorsal and radial pull.
  - **Adductor pollicis** ? volar and ulnar displacement.
  - **Flexor and extensor pollicis longus** ? shortening of thumb ray.
- Result: **varus deformity** and disruption of joint congruity.

Clinical Features

- Pain, swelling, and tenderness at the base of the thumb.
- Decreased thumb mobility.
- Possible visible deformity (varus), although often obscured by swelling.
- **Neurovascular injuries are rare** .

Diagnosis

Imaging

- **Standard Views** : AP, lateral, and oblique X-rays of the thumb.
- **Special Views** :
  - **Robert's view** : true AP of the thumb CMC joint.
  - **CT scan** : essential for detailed visualization of fracture pattern and surgical

planning.

Differential Diagnosis

- **Bennett fracture** : less comminuted, single fragment dislocation.
- **Thumb base avulsion fracture**
- **Metaphyseal extra-articular fractures**

Management

Non-operative (rare; only for non-displaced fractures):

- Thumb spica splint or cast.
- Close radiographic monitoring.

Operative (preferred due to intra-articular involvement):

- **Open Reduction and Internal Fixation (ORIF)** :
  - Curvilinear dorsal incision at thumb base.
  - Preserve superficial radial nerve and lateral antebrachial cutaneous nerve.
  - Reconstruct articular surface with **K-wires** and secure with a **T-plate** .
  - Intraoperative imaging confirms reduction.
  - Post-op: **thumb spica splint** .
- **External Fixation** :
  - Used for highly comminuted, unstable fractures.
  - May be combined with limited internal fixation and bone grafting.
  - Two methods:
    1. Pins in first and second metacarpals (quadrilateral frame).
    2. Pins in **trapezium and first metacarpal shaft** for distraction.

Complications

- **Post-traumatic arthritis** from joint incongruity.
- Thumb stiffness and reduced range of motion.
- Malunion or nonunion.
- Chronic pain or instability.

Prognosis

- Depends on **anatomical restoration of the articular surface** .
- Prompt surgical management improves long-term thumb function.
- Delayed or inadequate treatment may result in **functional loss** or **CMC osteoarthritis** .

Key Comparison: Bennett vs Rolando Fracture

Feature	**Bennett Fracture**	**Rolando Fracture**
Type	Partial intra-articular	Comminuted intra-articular
Fracture line	Oblique	Y-shaped or T-shaped
Number of fragments	Two	Three or more

Feature	**Bennett Fracture**	**Rolando Fracture**
Stability	Relatively more stable	Unstable
Treatment	Often ORIF	ORIF or external fixation
Prognosis	Generally good	More guarded due to comminution

High-Yield Points for Exams

- **Thumb contributes to 50% of hand function** —fractures at its base are functionally significant.
- **Rolando fracture = comminuted + intra-articular** fracture of first metacarpal.
- **ORIF is the mainstay** of treatment; external fixation for comminution.
- Goal: restore **joint congruity** and **prevent post-traumatic arthritis** .
- **CT scan** is often essential for diagnosis and surgical planning.