

MUSCULOSKELETAL • NGN NCLEX 2026

Bone Fractures

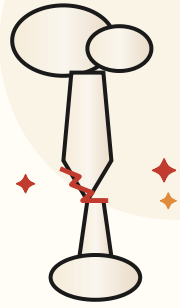
Types, Classifications, Management & Priority Nursing Care

HIGH YIELD

PRIORITY TOPIC

COMPARTMENT SYNDROME

NCJMM READY



1

Definition & Overview

Break in continuity of bone — caused by trauma, disease, or stress

What it is

A **fracture** is any disruption in bone integrity — partial or complete. Bone is dynamic tissue; force exceeding its strength causes failure.

Why it matters

Fractures cause **hemorrhage, nerve damage, compartment syndrome, fat embolism, infection, and shock** — all NCLEX priority emergencies.

Types of Fractures (Know All)



Closed (Simple)

Bone broken — **skin intact**. No exposure to environment.



Open (Compound)

Bone **protrudes through skin**. ⚠️ High infection risk.



Complete

Bone broken **all the way through**. Two or more separate pieces.



Incomplete

Break **partway through** the bone. Bone still in one piece.



Greenstick

One side breaks, other side **bends**. Common in **children**.



Comminuted

Bone shattered into **3+ fragments**. High-impact trauma.



Transverse

Break runs **straight across** bone — perpendicular line.



Oblique

Break at an **angle/slant** across the bone.



Spiral

Twisting force. ⚠️ **Red flag for abuse** in children.



Compression

Bone **crushed/collapsed**. Common in **vertebrae** (osteoporosis).



Impacted

Fragments **driven into each other**. Telescoping injury.



Pathologic

Break from **disease** (cancer, osteoporosis, Paget's). Minimal force.



Stress (Hairline)

Overuse microfracture. Runners, athletes, military.

Avulsion

Tendon/ligament pulls bone fragment off. Sports injury.

Depressed

Bone **pushed inward** (skull). Blunt trauma.

2

Pathophysiology — Bone Healing

5-stage cascade from injury to remodeled bone

1

Hematoma Formation

0–72 hours

Blood clot at fracture site; inflammation begins



2

Cellular Proliferation

3 days – 2 weeks

Granulation tissue replaces hematoma



3

Callus Formation

2–6 weeks

Fibrocartilage callus bridges gap



4

Ossification

3 wks – 6 months

Bony callus replaces soft callus



5

Remodeling

6 months – 1 yr

Bone returns to original shape & strength



Healing Time Factors:

Slower healing → **elderly, smokers, diabetics, steroid users, poor nutrition, infection, inadequate immobilization.**
Children heal fastest.

3

Signs & Symptoms

Local vs systemic findings — and the deadly complications



Local (At Site)

- **Pain** — sharp, severe, ↑ with movement
- **Deformity** — abnormal position, angulation
- **Swelling & bruising** (ecchymosis)
- **Crepitus** — grating sound on movement
- **Loss of function**, guarding
- **Shortening** of extremity
- **Open wound** with bone visible (compound)



Systemic / Severe

- **Tachycardia, hypotension** → blood loss
- **Pallor, cool clammy skin** → shock
- **Anxiety, restlessness**
- **↓ Hgb/Hct** (especially pelvic, femur)
- **Fever** → infection (open fx)
- **Dyspnea, confusion** → fat embolism
- **Petechiae** on chest/axilla → FES classic



RED FLAG COMPLICATIONS — Call HCP NOW



Compartment Syndrome (6 P's)

Pain

unrelieved by opioids, out of proportion

Pallor

.

Pulselessness

(late)

Paresthesia

.

Paralysis

.

Poikilothermia

. Onset 6–8 hrs post-injury. Emergency fasciotomy.



Fat Embolism Syndrome (FES)

Triad:

respiratory distress

+

altered mental status

+

petechiae

(chest, axilla, conjunctiva). 24–72 hrs post long-bone or pelvic fx. ARDS risk.



Hemorrhage / Shock

Pelvic fx can lose

1,500–3,000 mL

; femur

1,000–1,500 mL

. Watch for hypotension, tachycardia, ↓ urine output.



VTE / DVT / PE

Immobility ↑ clot risk. Unilateral leg swelling, calf pain, sudden dyspnea, chest pain, hemoptysis = PE.



Osteomyelitis / Infection

Open fx → bacterial entry. Fever, ↑ WBC, purulent drainage, ↑ pain at site days later.



Avascular Necrosis (AVN)

Disrupted blood supply → bone death. Common in **hip (femoral head)**

& scaphoid fx. Chronic pain, ↓ ROM.

4

Priority Nursing Interventions

ABCs first — then neurovascular checks, immobilize, treat pain

1

Assess ABCs & Hemodynamics

Airway, breathing, circulation. Major fx (pelvis, femur)
→ hemorrhage risk. Monitor vitals, mental status.

2

Neurovascular Checks (5 P's)

Pain • Pallor • Pulse • Paresthesia • Paralysis

. Check distal to fracture. Q1h × 24 hrs, then Q4h.
Compare bilaterally.

3

Immobilize Before Moving

Splint
above & below
the fracture site. Never reduce in field. Maintain
alignment during transport.

4

Pain Management

Opioids (morphine, hydromorphone) IV initially.
NSAIDs may delay healing — use cautiously.
Reassess pain 30 min post-dose.

5

Elevate Extremity (R-I-C-E)

R
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C
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E
levate above heart × 24–48 hrs. ⚠ Do NOT elevate
in compartment syndrome.

6

Cast Care

Support wet cast with
palms not fingertips
(prevents indentation). Air-dry uncovered. Keep dry.
Check for hot spots (infection).

7

Traction Maintenance

Weights hang
free
, never on floor. Ropes in pulleys. Maintain
countertraction. Never remove without HCP order.

8

Prevent Complications

DVT prophylaxis (SCDs, enoxaparin).
Turn/cough/deep breathe. Incentive spirometer. Skin
care under cast.

9

Open Fracture = Sterile + Tetanus

Cover with sterile saline-moistened dressing.
Tetanus prophylaxis
. IV antibiotics within 1 hr. NPO for OR.

10

Nutrition for Healing

High
protein, calcium, vitamin D, vitamin C, zinc
. ↑ fluids. Smoking & alcohol delay union.

5

Pharmacology

Drugs commonly used in fracture management

Drug / Class	Mechanism	Side Effects	Nursing Care
Morphine / Hydromorphone <i>Opioid analgesic</i>	Binds mu receptors → blocks pain transmission in CNS	Sedation, respiratory depression, constipation, hypotension, N/V	Monitor RR (hold if <12), pain reassess in 30 min, Narcan available, fall risk
Acetaminophen <i>Non-opioid analgesic</i>	Inhibits central prostaglandins; minimal anti-inflammatory	Hepatotoxicity at >4 g/day (3 g if liver disease)	Check LFTs; avoid alcohol; safe in early healing (no NSAID effect)
Ibuprofen / Ketorolac <i>NSAIDs</i>	Inhibits COX → ↓ prostaglandins → ↓ inflammation & pain	GI bleed, renal injury, may delay bone healing	Give with food; monitor BUN/Cr; ketorolac max 5 days; caution in elderly
Cyclobenzaprine <i>Muscle relaxant</i>	Central acting; reduces skeletal muscle spasm	Drowsiness, dry mouth, dizziness, anticholinergic effects	Fall precautions, no driving, avoid alcohol/CNS depressants
Enoxaparin (Lovenox) <i>LMWH anticoagulant</i>	Inhibits factor Xa → prevents clot formation	Bleeding, thrombocytopenia (HIT), injection site bruising	SubQ in abdomen (≥2 in. from umbilicus); don't aspirate/rub; monitor platelets, Hgb
Cefazolin / Vancomycin <i>IV antibiotics</i>	Bactericidal — for open fx & osteomyelitis prevention	Allergy, nephrotoxicity (vanc), red man syndrome (vanc)	Infuse vanc over ≥60 min; trough levels; monitor renal function
Tetanus Toxoid (Tdap) <i>Vaccine</i>	Active immunity to <i>C. tetani</i> toxin	Injection site pain, low-grade fever	Required for open fx if not vaccinated within 5 years
Calcium + Vitamin D <i>Supplements</i>	Promotes osteoblast activity & bone mineralization	Constipation, hypercalcemia, kidney stones	↑ fluids; take with food; teach dietary sources
Alendronate (Fosamax) <i>Bisphosphonate</i>	Inhibits osteoclasts → ↑ bone density (osteoporotic fx)	Esophagitis, jaw osteonecrosis, atypical femur fx	AM, empty stomach, full glass water, upright × 30 min
Docusate (Colace) <i>Stool softener</i>	↓ surface tension → ↑ water in stool	Minimal — abdominal cramping	Routine with opioids to prevent constipation

6

NCLEX Test Traps !

Where students lose points — the wrong vs right answer

Trap #1 — Compartment Syndrome Position

If suspected, **do NOT elevate above heart and do NOT apply ice** — this reduces arterial flow and worsens ischemia.

✗ **WRONG**

"Elevate the leg on two pillows and apply ice pack."

✓ **RIGHT**

"Keep limb at **heart level**, loosen restrictive dressings, notify HCP STAT."

Trap #2 — Pain Unrelieved by Opioids

This is the **earliest and most reliable** sign of compartment syndrome — not pulselessness (that's late).

✗ **WRONG**

"Give another dose of morphine and reassess in 30 minutes."

✓ **RIGHT**

"Pain out of proportion + opioid-resistant = compartment syndrome. **Notify HCP immediately.**"

Trap #3 — Wet Cast Handling

Pressure points from fingertips cause indentations → skin breakdown underneath.

✗ **WRONG**

"Grasp the wet cast firmly with fingertips to reposition."

✓ **RIGHT**

"Support wet cast with **palms** of hands; allow air drying; never use heat lamp."

Trap #4 — Traction Weights

Weights must hang **free at all times** — never on bed or floor.

✗ **WRONG**

"Lift weights and place them on the bed when repositioning the client."

✓ **RIGHT**

"Weights hang freely; ropes in pulleys; **never remove traction** without order."

Trap #5 — Fat Embolism vs PE

Both cause dyspnea — but **petechiae on chest/axilla** = FES. Timing differs.

✗ **WRONG**

"Treat 36-hour post-femur-fx dyspnea + confusion + petechiae as PE."

✓ **RIGHT**

"Triad of **respiratory + neuro + petechiae** within 24–72 hrs of long-bone fx = **FES**. Supportive O₂, ICU."

Trap #6 — Open Fracture Wound Care

Don't push bone back in; don't apply dry gauze.

✗ **WRONG**

✓ **RIGHT**

"Gently push the protruding bone back and cover with a dry dressing."

"Cover with **sterile saline-moistened gauze**, immobilize as-is, antibiotics & tetanus, prep for OR."

Trap #7 — Spiral Fracture in a Child

In a non-ambulatory infant or with conflicting history, spiral fx is a **red flag for abuse**.

✗ WRONG

"Document parent's story and discharge home with cast care instructions."

✓ RIGHT

"Assess for inconsistencies, document objectively, **report to CPS** per mandated reporter duty."

7

Patient & Family Education

Discharge teaching to prevent readmission



Cast Care

- ✓ Keep cast clean and **dry**
- ✓ Do NOT insert objects to scratch
- ✓ Wiggle fingers/toes hourly while awake
- ✓ Elevate above heart × 48 hrs (unless told otherwise)
- ✓ Report: hot spots, foul odor, increasing pain



When to Call HCP

- ✓ **Pain unrelieved** by prescribed meds
- ✓ Numbness, tingling, or color change
- ✓ Cool, pale, or blue fingers/toes
- ✓ Fever > 101°F (38.3°C)
- ✓ Drainage or odor from cast
- ✓ Sudden chest pain or shortness of breath



Mobility & Assistive Devices

- ✓ Crutches: **2 finger widths** below axilla
- ✓ Weight on **hands**, not axilla (nerve damage)
- ✓ Walker: advance walker, then weak leg, then strong
- ✓ Stairs UP: good leg first ("up with the good")
- ✓ Stairs DOWN: bad leg first ("down with the bad")



Nutrition for Healing

- ✓ High **protein**: lean meat, eggs, beans
- ✓ High **calcium**: dairy, leafy greens
- ✓ **Vitamin D**: sun, fortified milk, fish
- ✓ **Vitamin C**: citrus, peppers (collagen)
- ✓ ↑ **Fluids** (2–3 L/day) + fiber
- ✓ AVOID smoking — delays healing > 60%



DVT / Clot Prevention

- ✓ Take enoxaparin as prescribed
- ✓ Do leg/ankle pumps hourly
- ✓ Avoid crossing legs or prolonged sitting
- ✓ Wear compression stockings if ordered
- ✓ Report: calf swelling/pain, sudden SOB



Home Safety

- ✓ Remove throw rugs, clear pathways
- ✓ Night lights in bathroom & hall
- ✓ Non-slip mats in tub/shower
- ✓ Use shower seat if needed
- ✓ Phone within reach
- ✓ Fall prevention is #1 priority

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Memory Boosters & Mnemonics

Pattern recognition to lock in NCLEX recall

6 P's — Compartment Syndrome

- P Pain**— unrelieved, out of proportion (EARLIEST)
- P Pallor**— pale, cool skin
- P Pulselessness**— LATE sign
- P Paresthesia**— numbness, tingling
- P Paralysis**— loss of motor function
- P Poikilothermia**— coolness compared to other limb

5 P's — Neurovascular Checks

- P Pain**— quality, location, intensity
- P Pallor**— color, capillary refill ≤ 3 sec
- P Pulse**— bilateral, distal
- P Paresthesia**— sensation intact?
- P Paralysis**— can patient move it?

FAT BAT — Fat Embolism Triad

- F Fever** (low-grade)
- A Altered mental status**, confusion
- T Tachycardia & tachypnea**
- B Breathing trouble** (dyspnea, hypoxia)
- A Anxiety**, restlessness
- T Tiny petechiae** (chest/axilla)

RICE — Acute Fracture Care

- R Rest**— immobilize the site
- I Ice**— first 24–48 hrs, 20 min on/off
- C Compression**— elastic wrap, don't over-tighten
- E Elevate** — above heart (NOT in compartment syndrome!)

Cane / Crutch / Stairs

-  **UP with the GOOD**— good leg goes up the step first
-  **DOWN with the BAD** — bad leg goes down the step first
-  **Cane on STRONG side**— advance with weak leg
-  Crutches: weight on **HANDS**, not axilla

Fast Facts

-  **Greenstick**= kids ("green" branch bends)
-  **Spiral** in non-ambulatory child = abuse alert
-  Compartment syndrome onset: **6–8 hrs**
-  Fat embolism onset: **24–72 hrs**
-  Pelvic fx = up to **3 L** blood loss
-  NSAIDs may **delay** bone healing

9

NCJMM Clinical Judgment Scenario

Next Generation NCLEX 6-Step Model in action

Scenario: A 22-year-old male is admitted following a motorcycle crash with a **closed mid-shaft femur fracture**. A long-leg cast was applied 4 hours ago. He now rates pain **10/10** despite two doses of IV morphine. He reports his leg "feels tight" and his toes "feel funny." On assessment: toes are pale, cool, cap refill 5 seconds, ↓ sensation, pedal pulse weak. Vital signs: HR 118, BP 142/88, RR 22, SpO₂ 97%.

1

Recognize Cues

Relevant cues: Pain 10/10 unrelieved by opioids (red flag), tight sensation, paresthesia, pallor, coolness, cap refill >3 sec, weak pulse, tachycardia. Recent cast application within 6–8 hr window.

2

Analyze Cues

Findings cluster as **5 of 6 P's of compartment syndrome** — Pain, Pallor, Paresthesia, Poikilothermia, and impending Pulselessness. Pain disproportionate to injury + opioid-resistant is the hallmark. The cast is acting as a constricting envelope.

3

Prioritize Hypotheses

#1 Acute compartment syndrome (highest priority — limb-threatening, time-sensitive). **#2** Inadequate analgesia. **#3** Early fat embolism (less likely — no respiratory or neurologic changes, no petechiae). Time-to-fasciotomy < 6 hrs prevents permanent damage.

4

Generate Solutions

Expected outcomes: restore perfusion, relieve pressure, prevent rhabdomyolysis & limb loss. Interventions to consider: **notify HCP STAT**, prepare for **bivalving or cast removal**, keep limb at **heart level** (not elevated), withhold further opioids until evaluated, IV fluids, prepare for possible **fasciotomy**, baseline CK & renal labs.

5

Take Action

1 Call HCP/rapid response immediately. **2** Position limb at heart level — do NOT elevate. **3** Prepare bivalve cutter; HCP will bivalve or remove cast. **4** Place 2 large-bore IVs, send CK, BMP, CBC. **5** NPO in case of OR. **6** Continuous neurovascular checks Q15 min. **7** Provide emotional support — explain urgency.

6

Evaluate Outcomes

Effective: Pain decreases to ≤4/10 after cast bivalved, toes pink & warm, cap refill <3 sec, sensation and movement return, pedal pulse strong, no rise in CK, urine output ≥30 mL/hr. **Ineffective:** persistent ischemia, dark/tea-colored urine (myoglobinuria) → prepare for emergency fasciotomy.