NGN NCLEX 2026 · MUSCULOSKELETAL SYSTEM · HIGH-YIELD STUDY CARD

Fractures *& complications*

A complete clinical-judgment reference: types, pathophysiology, priority assessments, ALL major complications with specific management, pharmacology, NCLEX traps, and teaching pearls aligned to the 2026 Clinical Judgment Measurement Model.

ORTHO | PRIORITY ACTION | NCJMM ALIGNED | NEUROVASCULAR CHECK | 6 P'S | CAST & TRACTION | COMPLICATION-FOCUSED

01 Definition & Overview

WHAT IT IS

A **fracture** is any break in the continuity of a bone — complete or incomplete — caused by direct trauma, indirect force, repetitive stress, or weakening from disease (pathological fracture).

Fractures are **classified** by pattern (transverse, oblique, spiral, comminuted), by communication with skin (**closed** vs **open/compound**), and by completeness. Each pattern carries a different risk profile.

WHY IT MATTERS

Missed neurovascular compromise can lead to **limb loss within 6 hours**. A fat embolism can kill within 72 hours of a long-bone fracture. Early recognition is the nurse's single most important action.

The nurse's role spans **rapid neurovascular assessment, immobilization, complication prevention, and rehabilitation**.

02 Common Fracture Types

PATTERN RECOGNITION

Transverse

Clean break straight across the bone; often direct-force trauma.

Oblique

Diagonal break; unstable, prone to displacement.

Spiral

Twisting force. In children = suspect abuse.

Comminuted

Bone shattered into 3+ fragments; high trauma.

Greenstick

Incomplete break, one side bent. Common in children.

Impacted

Bone ends driven into each other (think hip fx).

Open (Compound)

Bone pierces skin → infection risk. Surgical emergency.

Stress / Hairline

Repetitive microtrauma — athletes, runners.

Pathological

Through diseased bone (cancer, osteoporosis).

Depressed

Pushed inward (commonly skull).

Avulsion

Fragment pulled off by ligament/tendon.

Complete

Bone separated into two pieces.

03 Pathophysiology — 4 Stages of Bone Healing

MECHANISM

1 · 0–72h

Hematoma Formation

Blood vessels tear → hematoma & inflammation at fracture site.

2 · 3d–2wk

Fibrocartilage Callus

Fibroblasts & chondroblasts form soft callus bridging the break.

3 · 2–6wk

Bony Callus

Osteoblasts replace cartilage with spongy bone (hard callus).

4 · 6wk–1y

Remodeling

Osteoclasts reshape bone back to original contour & strength.

04 Signs & Symptoms

ASSESSMENT CUES

Classic / Local Findings

Red Flag — Complication Brewing

- **Pain** — sharp, worsens with movement
- **Deformity** — angulation, shortening, rotation
- **Edema & ecchymosis** at injury site
- **Crepitus** — grating sound of bone ends
- **Loss of function** / inability to bear weight
- **Muscle spasm** around fracture
- **Guarding** & reluctance to move limb
- Warmth over site (hematoma)

- **Pulselessness / pallor / cold extremity** distal to injury
- **Pain out of proportion** — unrelieved by opioids
- **Numbness, tingling, paralysis** (nerve damage)
- **Tight, shiny, tense skin** over muscle compartment
- **Petechiae** on chest/axilla/conjunctiva (fat embolism)
- **Sudden dyspnea, confusion, ↑RR** 24–72h post-fx
- **Unilateral calf swelling / Homans' sign** (DVT)
- **Bone visible / bleeding through skin** (open fx)

05 Complications & Specific Management

△ CORE NCLEX CONTENT

Test-prep priority: NGN items love asking "Which complication does the nurse anticipate?" Match the fracture type and timing to the complication. Long-bone & pelvic = fat embolism. Forearm/leg crush = compartment syndrome. Open fx = osteomyelitis. Hip fx = DVT/PE.

SURGICAL EMERGENCY

1 · Compartment Syndrome

Within 24-48 hrs

PATHOPHYSIOLOGY & CUES

Pressure inside a muscle compartment exceeds perfusion pressure → ischemia → necrosis → **rhabdomyolysis & limb loss within 4–6 hrs**.

NURSING MANAGEMENT

→ **Notify HCP immediately** — priority action

→ **Keep extremity at heart level** — NOT elevated (reduces arterial flow further) and NOT dependent

P Pain ↑↑	**P** Pallor	**P** Pulseless
P Paresthesia	**P** Paralysis	**P** Poikilothermia

→ **Loosen/remove** restrictive dressings, bivalve cast

→ Remove ice — cold worsens vasoconstriction

→ Prepare for **emergent fasciotomy**

→ Monitor for **myoglobinuria** (dark/tea-colored urine) → AKI risk

LIFE-THREATENING 2 · Fat Embolism Syndrome (FES)

24–72 hrs post-fx

PATHOPHYSIOLOGY & CUES

Fat globules from marrow enter bloodstream → lodge in **lungs, brain, skin**. Highest risk: **long-bone (femur), pelvic, multiple fractures**.

Respiratory	Neurologic	Petechial Rash
Dyspnea, tachypnea, ↓SpO_2, ARDS	Confusion, restlessness, ↓LOC	Chest, axilla, conjunctiva (pathognomonic)

NURSING MANAGEMENT

→ **PREVENT:** early immobilization & minimal fracture manipulation

→ **Priority:** High-Fowler's, administer O_2, notify HCP

→ Prepare for intubation/mechanical ventilation

→ Corticosteroids & IV fluids per orders

→ Monitor ABGs — expect respiratory alkalosis → acidosis

→ Strict **I&O**; anticipate ICU transfer

HIGH RISK 3 · DVT → Pulmonary Embolism

Days 2–14

PATHOPHYSIOLOGY & CUES

Virchow's triad: **stasis + vessel injury + hypercoagulability**. Highest in hip/pelvic fx, immobility.

→ **DVT:** unilateral calf swelling, warmth, redness, + Homans' sign (unreliable)

→ **PE:** sudden dyspnea, pleuritic chest pain, hemoptysis, tachycardia, anxiety, ↓SpO_2

NURSING MANAGEMENT

→ **PREVENT:** early ambulation, SCDs, TEDs, prophylactic LMWH (enoxaparin)

→ Leg exercises hourly while in bed

→ **Never massage** a suspected DVT — embolus risk

→ PE suspected → **High-Fowler's + O_2 + notify HCP STAT**

→ Anticipate anticoagulation, D-dimer, CT-PA

INFECTION

4 · Osteomyelitis

Days to weeks

PATHOPHYSIOLOGY & CUES

Bone infection (usually *S. aureus*), highest risk with **open fractures & external fixators/pins**.

- → Fever, chills, malaise
- → Localized **bone pain, warmth, erythema, drainage** (purulent, foul)
- → Elevated WBC, ESR, CRP; + blood/bone cultures
- → Positive MRI — gold standard

NURSING MANAGEMENT

- → **Strict sterile technique** for wound & pin care
- → Long-term IV antibiotics (often **4–6 weeks**) — PICC/central line
- → Monitor peak & trough levels (vancomycin)
- → Immobilize limb; monitor for sepsis
- → High-protein, high-calorie, vitamin C diet for healing
- → Prepare for possible surgical debridement

DELAYED

5 · Avascular Necrosis (AVN)

Weeks-months

PATHOPHYSIOLOGY & CUES

Disruption of blood supply → bone death. Classic sites: **femoral head (hip fx), scaphoid, talus**.

- → Progressive pain (often worse with weight-bearing)
- → ↓ Range of motion, limp
- → MRI confirms (earlier than X-ray)

NURSING MANAGEMENT

- → Teach **non-weight-bearing** precautions
- → Pain management (NSAIDs, opioids)
- → Anticipate **core decompression, bone graft, or joint replacement**
- → Refer to PT for ROM preservation

HEALING ISSUE

6 · Delayed Union / Nonunion / Malunion

Months

DEFINITIONS

- → **Delayed union:** healing slower than expected
- → **Nonunion:** no healing after 4–6 months

NURSING MANAGEMENT

- → **Smoking cessation** — nicotine impairs bone healing (huge NCLEX point)

→ **Malunion:** healed in wrong alignment

Risk factors: smoking, diabetes, poor nutrition, infection, inadequate immobilization, steroids.

→ Optimize nutrition: **protein, calcium, vitamin D, vitamin C**

→ Control blood glucose in diabetics

→ Electrical bone stimulation, bone grafting, or revision ORIF

ACUTE

7 · Hemorrhage & Hypovolemic Shock

Immediate

PATHOPHYSIOLOGY & CUES

Femur fx can lose **1–1.5 L blood**; pelvic fx can lose **≥ 2–3 L** into retroperitoneum.

→ ↓BP, ↑HR, ↓urine output (< 30 mL/hr)

→ Cool, clammy, pale skin; altered LOC

→ Expanding hematoma / ↑abdominal girth (pelvic)

NURSING MANAGEMENT

→ Apply **direct pressure** to open bleed; immobilize

→ **Two large-bore IVs** (18 g), isotonic fluids, type & crossmatch

→ Monitor VS & urine output hourly

→ Prepare for transfusion; OR for pelvic binder/angio-embolization

NEUROLOGIC

8 · Nerve Damage

At injury or delayed

PATHOPHYSIOLOGY & CUES

Direct laceration, stretch, or pressure from cast/edema. Common pairings: **humeral fx → radial nerve (wrist drop); hip fx → peroneal nerve (foot drop)**.

→ Numbness, tingling (paresthesia)

→ Weakness, inability to dorsiflex/extend wrist

→ Loss of sensation distal to injury

NURSING MANAGEMENT

→ **Neurovascular checks q1–2h** first 24 hrs, then q4h

→ Loosen restrictive cast if pressure-related

→ Protect insensate limb from injury/burns

→ PT consult for splinting & reconditioning

06 Fracture Management — Reduction & Immobilization

CORE INTERVENTIONS

Closed Reduction

NON-SURGICAL · MANIPULATION

- ✓ HCP manually manipulates bone back into alignment
- ✓ Conscious sedation or regional anesthesia
- ✓ Followed by cast or splint immobilization
- ✓ **Nurse:** monitor sedation, neurovascular checks post-procedure

Open Reduction (ORIF)

SURGICAL · SCREWS, PLATES, RODS

- ✓ Used for unstable, comminuted, or displaced fx
- ✓ **Pre-op:** NPO, consent, baseline neuro-vasc, antibiotic prophylaxis
- ✓ **Post-op:** monitor incision, drainage, infection signs
- ✓ Early mobilization per HCP — reduces DVT/PE risk

Splinting & Casting

EXTERNAL IMMOBILIZATION

- ✓ Plaster: 24–72 h to dry; fiberglass: < 30 min
- ✓ Support with **palms, not fingertips** while wet (prevents indentations)
- ✓ Elevate limb above heart first 24–48 h to reduce edema
- ✓ Apply ice packs over cast first 24 h
- ✓ Assess neurovascular (6 P's) & skin integrity q2–4 h

External Fixation

PINS THROUGH SKIN TO EXTERNAL FRAME

- ✓ Used for open, comminuted, or infected fx
- ✓ **Pin care:** sterile technique; clean with prescribed solution (often chlorhexidine or NS)
- ✓ Assess for **drainage, redness, loosening** — signs of infection
- ✓ Never adjust clamps or pins — HCP only
- ✓ Teach pt that device is temporary and painful movement is expected

Traction — Types & Nursing Rules

PULLS TO REALIGN BONE & REDUCE MUSCLE SPASM

Buck's Traction

Skin traction. Boot/straps on lower leg. Common pre-op for hip fractures to reduce spasm.

SKIN · TEMPORARY · 5-10 LBS

Russell's Traction

Skin traction with a sling under the knee, adds vertical + horizontal pull. For femoral fx.

SKIN · SLING UNDER KNEE

Skeletal Traction

Pin/wire through bone (Steinmann pin). Long-term, heavier weights (15–30 lbs). Requires pin care.

INVASIVE · LONG-TERM

Bryant's Traction

Pediatric (< 2 yrs or < 30 lb). Both legs suspended vertically at 90°; buttocks off bed.

PEDIATRIC · FEMUR FX

🦴 Universal Traction Rules

ALWAYS DO

- ✓ Keep weights **hanging freely** — off floor & bed
- ✓ Ensure ropes are **in pulley grooves**
- ✓ Maintain **correct body alignment**
- ✓ Perform neurovascular checks q1–2 h initially
- ✓ Pin-site care per protocol (sterile)
- ✓ Trapeze for repositioning

NEVER DO

- ✗ **Never** lift or remove weights without HCP order
- ✗ **Never** let weights rest on floor
- ✗ **Never** allow knots at pulleys
- ✗ **Never** position pt so feet touch footboard
- ✗ **Never** change patient position that alters traction angle

🦴 Cast Care — Do's & Don'ts

DO

- ✓ **Elevate** above heart first 24–48 h
- ✓ Apply **ice packs** over cast first 24 h
- ✓ Use **palms** to handle wet cast

DON'T

- ✗ **Don't get plaster cast wet**
- ✗ **Don't insert objects** (coat hangers, pencils) to scratch
- ✗ **Don't use heat source** (hair dryer) to dry

- ✓ Allow plaster cast to **air dry** (24–72 h)
- ✓ Check for **hot spots** (infection)
- ✓ **Petal** cast edges to protect skin
- ✓ Isometric exercises of muscles within cast

- ✗ **Don't cover** a wet cast (traps heat)
- ✗ **Don't ignore** musty odor, drainage, or fever → osteomyelitis
- ✗ **Don't ignore** ↑ pain unrelieved by meds → compartment syndrome

07 Priority Nursing Actions (ABCs First)

CLINICAL JUDGMENT

A

Airway / Breathing

- Assess for signs of fat embolism (dyspnea, ↓SpO_2)
- Monitor for PE in hip/pelvic fx patients
- O_2 via NC per protocol if SpO_2 < 92%

C

Circulation

- Assess for shock — BP, HR, UOP, LOC
- Monitor for hemorrhage (expanding hematoma, ↑ abd girth)
- Two large-bore IVs for femur/pelvic fx

N

Neurovascular (6 P's)

- Check **CMS** (color, movement, sensation) q1–2 h initially
- Compare bilaterally; include pulses distal to injury
- Doppler if pulse not palpable

I

Immobilize

- Splint "as it lies" — do **NOT reduce** in field
- Immobilize **joint above & below** the fracture
- Open fx: cover with sterile saline-moist gauze; do not push bone back

P

Pain & Comfort

- Administer analgesics; reassess in 30–60 min
- Ice first 24 h; elevate (except in compartment syndrome)
- Repositioning, distraction, relaxation

P

Prevent Complications

- DVT prophylaxis: SCDs, LMWH, early mobility
- Pressure injury: turn q2 h, skin checks
- Pneumonia: IS, cough & deep breathe q2 h
- Constipation: fluids, fiber, stool softener

08 Pharmacology

MEDS & MONITORING

DRUG / CLASS	PURPOSE / MECHANISM	KEY SIDE EFFECTS	NURSING CONSIDERATIONS
Morphine / Hydromorphone OPIOID ANALGESIC	Binds μ-receptors → severe pain relief	Resp depression, hypotension, sedation, constipation, N/V	Assess RR before & 30 min post; naloxone at bedside; bowel regimen

DRUG / CLASS	PURPOSE / MECHANISM	KEY SIDE EFFECTS	NURSING CONSIDERATIONS
Ketorolac (Toradol) NSAID	Blocks COX → anti-inflammatory, analgesic	GI bleed, renal injury, delayed bone healing	Max 5 days; take with food; monitor BUN/Cr; avoid in nonunion risk
Cyclobenzaprine MUSCLE RELAXANT	Relieves muscle spasm around fracture	Sedation, anticholinergic (dry mouth), dizziness	Fall precautions; avoid alcohol; short-term use
Enoxaparin (Lovenox) LMWH ANTICOAGULANT	DVT/PE prophylaxis after hip, pelvis, long-bone fx	Bleeding, HIT, injection-site hematoma	SQ abdomen 2 in from umbilicus; do NOT aspirate or massage; monitor platelets, anti-Xa if needed
Cefazolin / Vancomycin ANTIBIOTICS	Prophylaxis (open fx) or treatment (osteomyelitis)	Nephrotoxicity, Red Man syndrome (vanco), C. diff	Infuse vanco over ≥ 60 min; peak/trough; monitor BUN/Cr
Calcium + Vitamin D BONE SUPPLEMENT	Supports osteoblast activity & callus formation	Constipation, hypercalcemia, renal stones	Take with food; ↑ fluids; monitor calcium level
Alendronate (Fosamax) BISPHOSPHONATE	Inhibits osteoclasts — osteoporotic/pathologic fx	Esophagitis, jaw osteonecrosis, musculoskeletal pain	Take AM, empty stomach with full glass of water; stay **upright 30 min**
Docusate (Colace) STOOL SOFTENER	Prevent constipation from opioids + immobility	Generally well-tolerated; cramping	Start with opioid therapy; ↑ fiber and fluids
Tetanus toxoid VACCINE	Prevent tetanus in open/contaminated fx	Injection-site soreness, low-grade fever	Administer if > 5 yrs since last dose in dirty wound

09 NCLEX Test Traps & Common Errors

DON'T FALL FOR THESE

	✗ WRONG CHOICE	✓ CORRECT
1	"Elevate the extremity" when **compartment syndrome** is suspected.	Keep at **heart level**. Elevation reduces arterial inflow and **worsens** ischemia.
2	"Give more pain medication" for sudden, severe, unrelenting pain distal to cast.	Assess neurovascular status → **loosen/bivalve cast** and **notify HCP** — this is compartment syndrome.
3	Treating petechiae on the chest 48 h after femur fx as a "harmless rash."	**Fat embolism syndrome** — notify HCP immediately, High-Fowler's, O_2, prepare for ICU.
4	Massaging a swollen, tender calf to "improve circulation."	**Never massage a suspected DVT** — risk of dislodging clot → PE.
5	Using a hair dryer on a wet plaster cast to speed drying.	Allow to **air dry 24–72 h**; heat can cause burns and crack the cast.
6	Lifting traction weights "just briefly" to reposition the patient.	Weights must hang **freely and continuously**. Removing them interrupts reduction and worsens spasm.
7	Pushing an exposed bone back into the wound of an open fracture.	Cover with **sterile saline-moist dressing**; immobilize; give tetanus + antibiotics; prepare for OR.
	✗ WRONG CHOICE	✓ CORRECT

8	Ignoring "pins and needles" distal to a new cast because "some numbness is normal."	Paresthesia = **early nerve compression**. Loosen cast, neurovascular recheck, notify HCP.

10 Patient & Family Education

TEACH-BACK POINTS

🦴 Cast Home Care

- Keep cast **clean & dry** (cover for shower)
- Never insert objects to scratch
- Elevate limb first 24–48 h & ice
- Wiggle fingers/toes frequently
- Report: numbness, blue/cold digits, drainage, foul smell, fever, ↑ pain

🦯 Crutch Walking

- Bear weight on **hands, not axillae** (nerve damage)
- Elbows flexed 30°
- **Tripod** stance; crutches 6 in ahead & to side
- **Up stairs:** good leg first; **down:** crutches + bad leg first ("up with the good, down with the bad")
- Non-skid shoes; remove throw rugs

🍎 Nutrition for Healing

- **Protein:** eggs, lean meats, dairy
- **Calcium:** milk, yogurt, leafy greens
- **Vitamin D:** sunlight, fortified milk
- **Vitamin C:** collagen formation
- Adequate fluids; limit caffeine/alcohol

🚭 Lifestyle Changes

- **Stop smoking** — nicotine causes vasoconstriction & nonunion
- Limit alcohol; adequate rest
- Control diabetes (↑ infection risk)
- Weight-bearing exercise after healing to prevent osteoporosis

🚨 When to Call HCP

- Severe pain unrelieved by medication
- Fingers/toes cold, blue, numb, or tingling
- Drainage, foul odor, or hot spots on cast
- Fever > 101°F (38.3°C)
- Shortness of breath, chest pain, calf swelling

💉 Medication Safety

- Take opioids only as prescribed; do not drive
- Use stool softener with opioids
- Bisphosphonates: AM, empty stomach, upright 30 min
- LMWH: rotate SQ sites, no massaging

- Report unusual bruising/bleeding on anticoagulants

11 NCJMM — Clinical Judgment Framework

NGN 2026

STEP 1

Recognize Cues

↑ Pain, pallor, pulselessness, numbness, petechiae, sudden dyspnea, unilateral leg swelling, drainage or fever from cast/pin site.

STEP 2

Analyze & Prioritize Hypotheses

Match fx + timing to complication: long-bone + 24–72h = FES; tight cast + 6 P's = compartment syndrome; hip fx + calf swelling = DVT; open fx + fever = osteomyelitis.

STEP 3

Take Action

ABCs first. Immobilize. Neurovascular check. Loosen/bivalve constrictive cast. Give O_2, fluids, analgesics. Notify HCP. Prepare for fasciotomy, ORIF, or ICU as indicated.

STEP 4

Evaluate Outcomes

Distal pulses restored, pain ↓, SpO_2 ≥ 95%, normal LOC, no drainage/fever, UOP ≥ 30 mL/hr, mobility regained, patient verbalizes cast & DVT precautions.

12 Memory Boosters & Mnemonics

BRAIN HOOKS

6 P's of Compartment Syndrome

DISTAL TO INJURY

P — **Pain** — out of proportion, ↑ with passive stretch

FAT Triad for Fat Embolism

SIGN = ALERT

F — **Fat** — free fat globules in blood/urine

P **Pallor** — pale, dusky

P **Pulselessness** — late finding

P **Paresthesia** — numbness, tingling

P **Paralysis** — late; permanent damage

P **Poikilothermia** — cool to touch

A **Altered** mental status (confusion, restlessness)

T **Tachypnea / Tachycardia + petechiae**

CAST — Do's

AFTER CAST APPLICATION

C **Cleanliness** — keep dry & clean

A **Assess** neurovascular status q2h

S **Swelling** — elevate & ice

T **Temperature** — feel for hot spots

RICE — Acute Injury

INITIAL HOME/FIELD CARE

R **Rest** the injured area

I **Ice** 20 min on / off, first 24–48 h

C **Compression** (not so tight = ischemia)

E **Elevate** above heart level

Crutches — Stairs

"UP WITH THE GOOD, DOWN WITH THE BAD"

Going UP: good (unaffected) leg steps up first, then crutches + bad leg follow

Going DOWN: crutches + bad leg go down first, then good leg follows

Bone Healing Nutrients — Protein CCD

EAT TO HEAL

P **Protein** — tissue repair

C **Calcium** — bone matrix

C **Vitamin C** — collagen

D **Vitamin D** — calcium absorption

NGN NCLEX 2026 · FRACTURE MASTERY CARD · RECOGNIZE → ANALYZE → PRIORITIZE → EVALUATE