

NGN NCLEX 2026 · VISUAL STUDY GUIDE

Crystalloids & Colloids

The nurse's pocket guide to IV fluid therapy — tonicity, indications, and the red flags the NCLEX loves to test.

PHARMACOLOGY

FLUID & ELECTROLYTE

IV THERAPY

PRIORITY CONCEPT

01

DEFINITION & OVERVIEW

What are they, *and* why they matter

All IV fluids fall into two main families — separated by the size of their molecules and where they live in the body.

SMALL MOLECULES

Crystalloids

Clear solutions of water + electrolytes ($\pm$ dextrose). Molecules are **small enough to cross capillary membranes**, so fluid moves between the vascular space, interstitium, and cells.

Examples: 0.9% NS, LR, D5W, $\frac{1}{2}$ NS, 3% NS, D5NS

LARGE MOLECULES

Colloids

Solutions containing **large protein or starch molecules** that cannot cross the capillary wall. They stay in the vessels and pull fluid in by oncotic pressure — true volume expanders.

Examples: Albumin (5% & 25%), Hetastarch, Dextran, PPF, Blood products

02

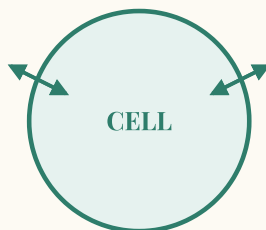
PATHOPHYSIOLOGY · OSMOSIS SIMPLIFIED

How tonicity *moves* water

Water chases solute. The tonicity of the IV fluid — compared to the patient's plasma — decides which direction water flows.

ISOTONIC

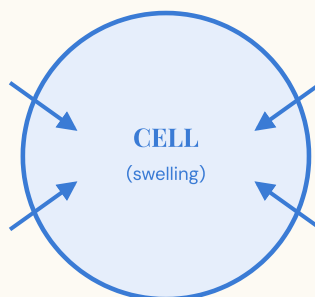
Water stays put



Same solute concentration
inside and outside cell

HYPOTONIC

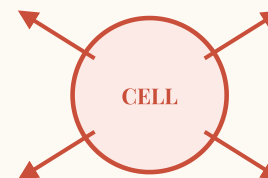
Water IN — cell swells 💧



More water outside → rushes IN
⚠️ **Risk: cerebral edema**

HYPERTONIC

Water OUT — cell shrinks



More solute outside → pulls water OUT
⚠️ **Risk: fluid overload**

1

Plasma Osmolarity

Normal $\approx 275\text{--}295$ mOsm/L. IV fluids are compared to this baseline.

2

Solute Gradient

Water moves from LOW solute → HIGH solute concentration (passive osmosis).

3

Capillary Crossing

Crystalloids shift freely; colloids stay vascular — pulling fluid IN via oncotic pressure.

4

Clinical Effect

Rehydrate · expand volume · treat hyponatremia · reduce cerebral edema.

03

CRYSTALLOID TONICITY · SIDE-BY-SIDE

The three *crystalloid* families

Memorize the solutions. Then memorize who should — and should never — receive them.

STAYS

SAME AS PLASMA

Isotonic

275–295 mOsm/L · Expands vascular volume

SOLUTIONS

- 0.9% Normal Saline (NS)
- Lactated Ringer's (LR)
- D5W (isotonic in bag · hypotonic after metabolism)

USE FOR

- Hypovolemia · shock · blood loss
- Dehydration · surgery · burns (initial)
- DKA (NS is first-line)
- Blood administration — **NS only**

AVOID IN

- Heart failure, HTN, renal failure (overload risk)
- LR → avoid in liver disease (can't metabolize lactate)

SWELLS

LOWER THAN PLASMA

Hypotonic

< 275 mOsm/L · Hydrates cells

SOLUTIONS

- 0.45% NaCl (½NS) — most common
- 0.33% NaCl (⅓NS)
- 0.225% NaCl (¼NS)

USE FOR

- Cellular dehydration (hypernatremia)
- DKA — after initial NS bolus
- Gastric fluid loss (NG suction)

NEVER GIVE TO

- **Head injury / ↑ ICP** (worsens cerebral edema)
- Burns · trauma · liver disease
- Third-spacing conditions

SHRINKS

HIGHER THAN PLASMA

Hypertonic

> 295 mOsm/L · Pulls fluid into vessels

SOLUTIONS

- 3% & 5% NaCl (ICU only · central line)
- D5 ½NS · D5NS · D5LR
- D10W · TPN

USE FOR

- Severe symptomatic hyponatremia
- Cerebral edema / ↑ ICP (3% NS)
- Third-spacing (shifts fluid to vessels)

WATCH CLOSELY FOR

- **Fluid overload · pulmonary edema**
- Heart failure, renal disease, dehydration
- Infuse slowly · monitor Na⁺ & lungs

04

SIGNS & SYMPTOMS

Recognize *overload* vs. deficit

Every IV fluid can tip the scale. Know the earliest cues — they show up first on the NGN.

Fluid Volume Overload

Red Flag

HYPERTONIC · ISOTONIC · RAPID COLLOIDS

- ▶ Crackles & wet lung sounds · dyspnea
- ▶ Bounding pulse · tachycardia · hypertension
- ▶ Jugular venous distention (JVD)
- ▶ Peripheral & dependent edema
- ▶ Weight gain > 2 lb / day (1 L ≈ 1 kg)
- ▶ Cough · pink frothy sputum (pulmonary edema)
- ▶ ↓ Hct & hemoglobin (dilution)
- ▶ Anxiety, confusion, orthopnea

Fluid Volume Deficit

UNDER-RESUSCITATED · HYPOTONIC SHIFTS CELLS

- ▶ Dry mucous membranes · poor skin turgor
- ▶ Thready weak pulse · tachycardia
- ▶ Hypotension · orthostatic drops
- ▶ ↓ Urine output (< 30 mL/hr)
- ▶ Flat neck veins · sunken eyes
- ▶ ↑ Hct & BUN (hemoconcentration)
- ▶ Cerebral edema cues with hypotonic misuse: headache, confusion, ↓ LOC
- ▶ Restlessness — early sign of poor perfusion

05

PRIORITY NURSING INTERVENTIONS · ABC FRAMEWORK

What you *do* — in priority order

Lungs and circulation come first. Every IV fluid decision is a hemodynamic decision.

A

Airway

- Auscultate lungs **before & during**
- HOB ↑ if any sign of overload
- Hold infusion & notify HCP for crackles/dyspnea

B

Breathing

- Monitor SpO₂ · RR · effort
- Watch for pulmonary edema (pink frothy sputum)
- Apply O₂ · notify rapid response if needed

C

Circulation

- Baseline & q1h VS · daily weight
- Strict I & O · urine output > 30 mL/hr
- Assess JVD · peripheral edema · pulses
- Verify correct fluid, rate, IV pump

S

Safety

- Verify with **2 identifiers** · check order
- Hypertonic/3%NS → central line, pump, ICU
- Never infuse hypotonic to ↑ICP pt
- Blood products: NS only · 18-g IV

06

PHARMACOLOGY · FLUIDS QUICK REFERENCE

Every fluid, *one* table

The test-day cheat sheet. Tonicity · action · use · watch-fors.

FLUID	TONICITY	PRIMARY USE	KEY NURSING CONSIDERATIONS
0.9% NS Normal Saline	ISOTONIC	Shock, hypovolemia, DKA first-line, blood administration, sodium replacement	Only fluid compatible with blood. Risk: fluid overload, hypernatremia, hyperchloremic acidosis with large volumes.
Lactated Ringer's (LR)	ISOTONIC	Surgical loss, burns, severe dehydration, trauma resuscitation	Contains K ⁺ , Ca ⁺⁺ , Na ⁺ , Cl ⁻ , lactate. Avoid in liver disease (can't convert lactate to bicarb). Not with blood.
D5W 5% Dextrose in Water	ISO → HYPO	Cellular rehydration, free water delivery, diluent for IV meds	Becomes hypotonic after dextrose is metabolized. Don't give to ↑ICP, head injury. Not with blood.
0.45% NaCl ½NS	HYPOTONIC	Hypernatremia, DKA (post-NS), cellular dehydration, maintenance fluid	Never in ↑ICP, head trauma, burns, liver disease. Monitor for cerebral edema.
3% NaCl Hypertonic Saline	HYPERTONIC	Severe symptomatic hyponatremia, cerebral edema, ↑ICP	ICU only. Central line · pump · frequent Na ⁺ . Risk: pulmonary edema, heart failure.
D5 ½NS	HYPERTONIC	Common maintenance fluid, provides calories + water	Monitor glucose · fluid status. Caution in HF, renal, & diabetic patients.
D5NS	HYPERTONIC	Hypovolemia + hyponatremia, post-op, temporary replacement	Not routine maintenance. Monitor for overload, hyperglycemia.
Albumin 5%	COLLOID	Volume expansion, hypovolemic shock, burns	Monitor BP, lungs, I&O. Risk: overload, allergic reaction. Warm to room temp; use filter.

FLUID	TONICITY	PRIMARY USE	KEY NURSING CONSIDERATIONS
Albumin 25%	COLLOID	Hypoalbuminemia, third-spacing (liver failure, nephrosis), cerebral edema	Pulls fluid INTO vessels aggressively — high overload risk. Slow infusion. Assess lungs frequently.
Hetastarch (Hespan)	COLLOID	Volume expansion in shock, burns, surgery	Risk: bleeding (↓ platelets), renal injury, anaphylaxis. Max dose limits apply.
Dextran	COLLOID	Volume expansion, prevention of DVT	Interferes with platelet function & cross-matching. Draw type & cross BEFORE starting. Anaphylaxis risk.

07

NCLEX TEST TRAPS

Where students *slip*

The distinctions item writers hide inside long stems. Burn these in.



"D5W is isotonic — so it's safe for head injury"

D5W is isotonic in the bag only. Once dextrose is metabolized, it becomes **free water (hypotonic)**, worsens cerebral edema, and is **contraindicated** in ↑ICP patients.

✓ Use isotonic 0.9% NS for head-injured patients.



"Lactated Ringer's is the safest isotonic — give it to everyone"

LR contains lactate, which the liver converts to bicarbonate. In **liver failure**, lactate accumulates. LR is also **not compatible with blood** (calcium can cause clotting).

✓ Use 0.9% NS with blood products and liver patients.



"Hypertonic saline is just for severe hyponatremia"

3% NS is **ICU-only**. It requires a central line, a pump, and q2–4h sodium checks. Too-rapid correction causes **osmotic demyelination syndrome** (central pontine myelinolysis).

✓ Raise Na⁺ no faster than 8–12 mEq/L in 24 hours.



"Overload = stop IV and discontinue"

First action for overload is **slow the rate** (to KVO), raise HOB, apply O₂, and notify HCP. Don't pull the IV — you may need access for diuretics (furosemide).

✓ Slow rate · HOB up · O₂ · notify · prepare diuretic.



"Colloid = automatic correct answer for shock"

Crystalloids (isotonic NS or LR) are the **first-line** in hypovolemic shock. Colloids are used when crystalloids fail or in specific situations (burns, severe hypoalbuminemia).

✓ Start with isotonic crystalloid bolus · reassess.



"½NS expands the vascular space"

Hypotonic fluids move INTO cells, not vessels. They **hydrate cells** but can **drop BP** and worsen shock. Never use ½NS to resuscitate a hypotensive patient.

✓ For BP support: isotonic (NS/LR) or colloids.

o8

NCJMM · CLINICAL JUDGMENT IN ACTION

Recognize · Analyze · *Act*

The NGN tests your thinking, not just your memorization. Walk through this scenario.

SCENARIO: A 68-year-old client with a history of heart failure is admitted for dehydration. The HCP orders **0.9% NS at 150 mL/hr**. Two hours into the infusion, the client reports difficulty breathing. Assessment reveals crackles in both lung bases, RR 28, SpO₂ 88% on room air, BP 158/92, HR 112, and 2+ pitting edema to the ankles. The client is sitting upright, visibly anxious.

RECOGNIZE CUES

What matters here?

Crackles · tachypnea · SpO₂ 88% · hypertension · tachycardia · peripheral edema · HF history + isotonic fluid at 150 mL/hr. Classic **fluid volume overload** picture.

ANALYZE CUES

What's happening?

Isotonic NS expanded the vascular space faster than this failing heart could handle. Fluid is backing up into the pulmonary circulation → **pulmonary edema**. Airway/gas exchange is now threatened.

PRIORITIZE HYPOTHESES

Which problem first?

Impaired gas exchange > fluid overload > anxiety. ABC rules — hypoxia kills faster than edema. Respiratory compromise is the priority nursing diagnosis.

GENERATE SOLUTIONS

What can you do?

Slow IV to KVO · raise HOB to high Fowler's · apply O₂ · auscultate lungs · notify HCP · prepare to give IV furosemide · obtain daily weight · monitor I&O strictly.

TAKE ACTION

Do it, in order.

1. HOB ↑ Fowler's → 2. O₂ via NC → 3. Slow IV to KVO → 4. Call HCP/rapid response → 5. Administer furosemide as ordered → 6. Reassess lungs, SpO₂ VS.

EVALUATE OUTCOMES

Did it work?

SpO₂ > 94% · RR 12–20 · lungs clearing · HR & BP trending down · UOP > 30 mL/hr (response to diuretic) · reduced edema · client denies dyspnea. Document, trend, continue to monitor.

09

PATIENT & FAMILY EDUCATION

Teach before you *hang*

The best-infused fluid can still be pulled out by an uninformed patient. Set expectations.



Report Symptoms Early

Tell the nurse immediately if you feel short of breath, chest tight, your hands/face swell, or you cough up pink frothy sputum.



Daily Weights Matter

Same scale · same time · same clothing. A 2 lb gain in 24 hours means about 1 L of retained fluid — report it.



Don't Adjust the Pump

IV rates are calculated for your condition. Never pause, disconnect, or change the rate — call the nurse with any concern.



Protect the IV Site

Report coolness, swelling, pain, redness, or leaking around the site — these can be infiltration or phlebitis.



Fluid & Sodium Limits

If you have HF or kidney disease, the team may limit your total fluid and sodium intake — including water and ice chips.



Mobilize Safely

Move slowly when standing — IV fluids can cause dizziness, especially if you're receiving blood or colloids. Call before getting up.

10

MEMORY BOOSTERS · BURN THESE IN

Mnemonics that *save* you

When you can't remember which tonicity does what — one of these will fire in your brain first.



"Same as Cell"

ISOtonic = **ISO**-cell — same concentration inside and out. No shift. Just fills the vascular tank. **Used for:** shock, blood loss, dehydration.



"Hypo = H₂O In"

HYPOtonic sends water **IN**to the cells (cells swell). 🚫 Never in **H**ead injury — **HYP**O + **H**EAD = **HAZARD**. Both start with H. Banned together.



"Hyper = Hyper-draw"

HYPERtonic is the **tanker truck** — drags fluid **OUT** of cells **INTO** the vessels. Risk: pulmonary edema. Think 3% NS for cerebral edema.



"NS + Blood = BFFs"

Only 0.9% NS is compatible with blood. D5W lyses RBCs · LR has calcium (clots). **18-gauge IV, large vein.**



"LR ≠ Liver"

LR contains lactate — the liver must convert it. **Avoid LR in liver failure.** Simple rule: L for Lactate = L for Liver-loaded.



"Colloids PULL, Crystalloids FILL"

Colloids (albumin, Hetastarch) = big molecules that **PULL** fluid into vessels. **Crystalloids** = small molecules that **FILL** and shift freely.

Exam-Day Quick Reference

PLASMA OSMOLARITY

Normal: **275–295 mOsm/L**

BLOOD COMPATIBILITY

0.9% NS ONLY — 18-g IV

MAX IV RATE (ADULT)

175–250 mL/hr routine · >250 emergency only

UOP MINIMUM

> **30 mL/hr** — renal perfusion

DAILY WEIGHT ALERT

Gain > 2 lb / 24 hr = **1 L fluid**

NA⁺ CORRECTION RATE

≤ **8–12 mEq/L per 24 hr** (prevent ODS)

NGN NCLEX 2026 · CRYSTALLOIDS & COLLOIDS · *For study use only — always follow facility protocol.*

