Fluids, IV Therapy and Electrolytes

IV fluids by tonicity, fluid deficit vs overload, infiltration, extravasation and phlebitis, six electrolyte pairs and safe IV potassium

IV FLUIDS BY TONICITY

Exam study summary, not a bedside tool. Plasma is about 280–310 mOsm/L.

Label osmolarity. Exams call D5/0.45% NaCl (406) and D5LR (525) hypertonic, true in the bag; once the dextrose is used, D5/0.45% acts hypotonic and D5LR isotonic.

TYPE	EXAMPLES (MOSM/L)	USED FOR	MAIN HAZARD
Isotonic	0.9% NaCl (308); lactated Ringer's (273)	Volume loss: bleeding, GI losses, burns, surgery; NS with blood	Overload (heart or kidney failure). LR has K: avoid with high K or severe kidney disease
Isotonic in the bag, then hypotonic	D5W (252)	Free water, high sodium	Not a resuscitation fluid; can drop Na and swell the brain
Hypotonic (water into cells)	0.45% NaCl (154)	Cellular dehydration, high sodium	Cerebral edema, low BP. Avoid with raised ICP, burns, trauma, liver failure
Hypertonic (water out of cells)	3% NaCl (1027); D10W (505)	3%: severe symptomatic low Na (ICU)	Overload, high Na, vein damage (large or central vein); high glucose

EXAM TIP Shock or bleeding: isotonic first. Raised ICP: no hypotonic fluid. D5W gives water, not volume.

FLUID VOLUME DEFICIT VS EXCESS

CHECK	DEFICIT (HYPOVOLEMIA)	EXCESS (HYPERVOLEMIA)
Vitals, pulse	Low BP, fast HR, weak pulse, orthostatic drop	High BP, fast breathing, low SpO_2, bounding pulse
Neck, lungs	Possible shortness of breath	JVD, crackles (bases first), S3, dyspnea
Skin, mouth	Tenting, dry sticky mouth, slow refill	Pitting edema, tight shiny skin
Urine	Low, concentrated, high specific gravity	Can also be low (failing heart or kidneys)
Weight (1 kg ≈ 1 L)	Loss over 1 kg in 24 h	Gain over 1 kg in 24 h
Labs	Hct, BUN, osmolality high	Hct, BUN, osmolality low

- Deficit: fluids within reach, isotonic IV as ordered, I&O, orthostatic vitals (SBP drop over 20, DBP over 10 or dizziness: fall precautions).
- Excess: HOB up, diuretics, fluid and sodium limits, ice chips, elevate edematous limbs, turn often.
- Both: daily weight, same scale, time and clothing. Report urine under 30 mL/h (0.5 mL/kg/h).

SAFETY New crackles, dyspnea or edema on IV fluids: raise the HOB, check SpO_2 and lungs, notify the provider. Older adults and heart or kidney failure overload fastest.

IV SITE COMPLICATIONS

Vesicants: many chemo drugs, norepinephrine (antidote phentolamine), calcium, concentrated K, hypertonic dextrose.

PROBLEM	WHAT YOU SEE	NURSE ACTION
Infiltration (non-vesicant fluid in tissue)	Swelling, cool pale skin, tightness, leaking, slowed flow	Stop, remove, elevate, compress per policy, restart at a new site
Extravasation (vesicant in tissue)	Pain, swelling, redness or blanching, lost blood return; later blisters, necrosis	Stop, disconnect, aspirate (no flush), remove, mark borders, elevate, notify, antidote per protocol
Phlebitis	Redness, warmth, tenderness along the vein, palpable cord	Remove, restart at a new site, warm compress, notify
Site infection	Redness, warmth, tenderness, fever	Remove, notify; antibiotics as ordered

EXAM TIP Cool, pale and puffy: infiltration. Red, warm and corded: phlebitis. Check the site at every client contact; hourly in children.

ELECTROLYTES: SIGNS AND NURSING PRIORITIES

Na 135–145, K 3.5–5.0 mEq/L; Ca 8.8–10.3, Mg 1.7–2.2, phos 2.8–4.5 mg/dL. Doses: Electrolyte Imbalances page.

IMBALANCE	SIGNS	ECG	PRIORITY ACTIONS
Low Na	Headache, nausea, confusion, seizures	—	Seizure precautions; fluid limit (SIADH, overload) or NS (deficit); rise ≤8 mEq/L in 24 h
High Na	Thirst, sticky mouth, confusion, seizures	—	Free water (oral, D5W, 0.45%), slowly; neuro checks
Low K	Weakness, cramps, ileus, dysrhythmias	ST sag, flat T, U wave	Replace K, check Mg; monitor; digoxin risk
High K	Weakness, cramps, diarrhea, paralysis	Peaked T, long PR, wide QRS, lost P, sine wave	Monitor; stop K sources; IV calcium, insulin-dextrose, binders, dialysis
Low Ca	Tingling, Chvostek, Trousseau, tetany, laryngospasm, seizures	Long QT	Airway, seizure precautions; IV calcium slowly on a monitor; fix Mg
High Ca	Constipation, polyuria, stones, weakness, confusion	Short QT	IV saline, then loop diuretic; mobilize; digoxin caution
Low Mg	Tremor, brisk reflexes, tetany, seizures	Long QT, torsades	Replace Mg; seizure precautions; replace K and Ca too
High Mg	Lost reflexes, low BP, slow breathing, lethargy	Long PR, wide QRS	Stop Mg; reflexes, RR, urine; IV calcium; support breathing
Low phos	Weakness, breathing failure, confusion (refeeding, alcohol, DKA recovery)	—	Replace, IV only if severe, slowly; watch Ca
High phos	Often none; low-Ca signs	Low-Ca changes	Binders with meals, low-phosphate diet, dialysis

EXAM TIP Ca and phos move in opposite directions. Low Mg keeps K and Ca low.

SAFE IV POTASSIUM

- Check urine output and kidney function first.
- Premixed bags; concentrate is kept off patient-care units.
- Always diluted, always on a pump; if added to a bag, mix fully.
- Peripheral: usually 10 mEq/h or less. Burning: slow per protocol, check for infiltration.
- Faster: central line and continuous ECG per policy; label allows 40 mEq/h only if K is under 2 with ECG changes or paralysis.
- Recheck K; watch the ECG and the site.

SAFETY Never give potassium IV push: undiluted KCl can stop the heart at once.

Sources (25) are listed with links at rnbasics.com/sheets/fluids-iv-electrolytes.html. For education and exam preparation only. Not medical advice; follow current guidelines and your institution's protocols. RN Basics is an independent study aid not affiliated with any certifying body.