NGN NCLEX 2026 ENDOCRINE • PHARMACOLOGY • MED-SURG VISUAL REFERENCE

Insulin *Pumps* — Continuous Subcutaneous Insulin Infusion

CSII therapy delivers a steady micro-infusion of *rapid-acting insulin only*, mimicking physiologic pancreatic secretion. Mastery of pump troubleshooting, DKA risk, and patient teaching is essential for safe care.

SOURCE DISCLOSURE

Topic not present in your uploaded personal notes. Content drawn from standard NGN NCLEX 2026 references (Saunders, ATI, Lippincott) and clinical guidelines (ADA Standards of Care 2025, AACE).

1

Definition / Overview

WHAT IS A CSII DEVICE

- A small computerized device that delivers **rapid-acting insulin** (lispro, aspart, glulisine) through a **subcutaneous catheter** 24 hours a day.
- Delivers **basal** (continuous background) and **bolus** (mealtime + correction) doses — closest approximation of physiologic insulin secretion.
- Indicated for Type 1 DM (most common), poorly controlled Type 2, gestational diabetes, dawn phenomenon, and brittle diabetes.
- **Never** contains long-acting insulin (glargine, detemir, degludec) or NPH — only rapid-acting.

A

Pump Types

KNOW THE DIFFERENCES

Tethered

MEDTRONIC • TANDEM

Pump worn on belt; tubing connects to subQ catheter.

Tubeless / Patch

OMNIPOD

Wireless pod adheres directly to skin; controlled by handheld.

Hybrid Closed-Loop

CONTROL-IQ • 780G

Integrates with CGM; auto-adjusts basal & gives auto-corrections.

2

How the Pump Works

MECHANISM FLOW

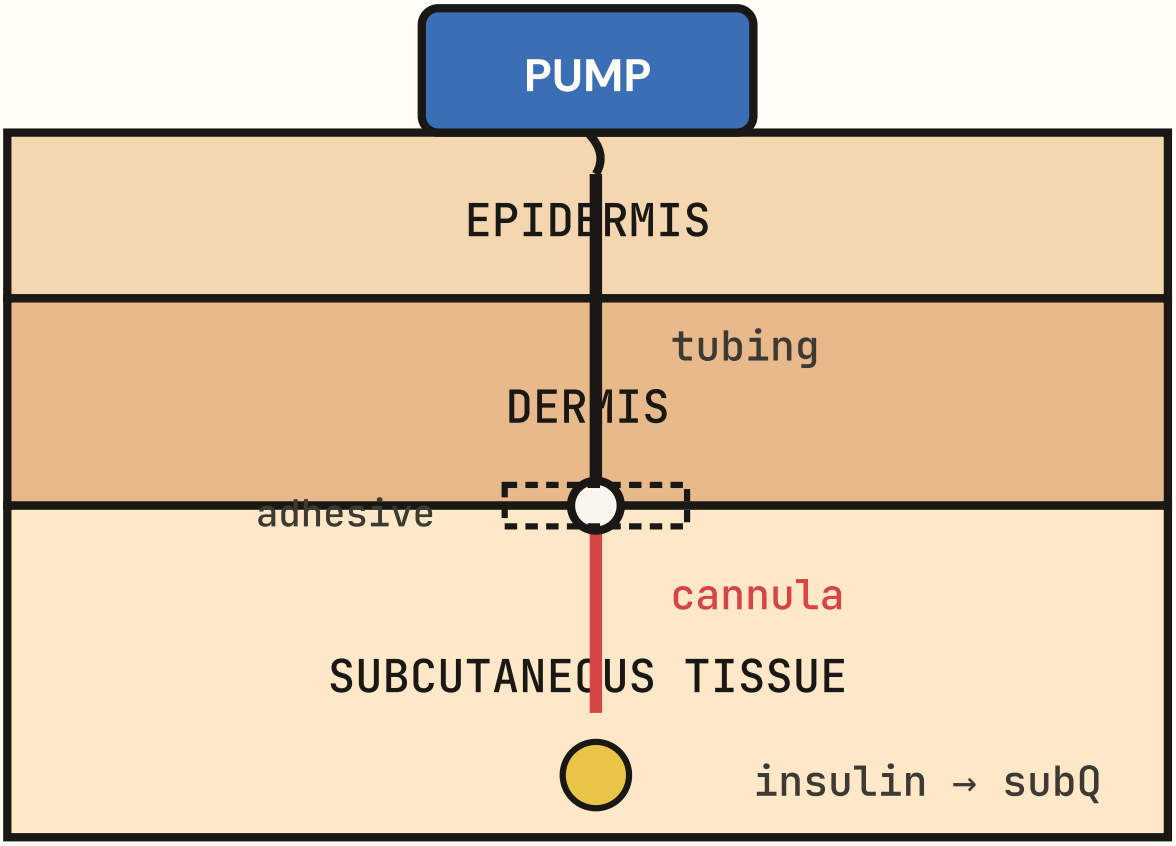
The pump replaces both the **basal background insulin** the pancreas normally secretes and the **bolus surges** that follow meals.

1. **Reservoir** filled with rapid-acting insulin → changed every 2–3 days
2. **Basal rate** (units/hr) infuses continuously → can be programmed in multiple time-blocks
3. **Patient enters carb count** before meal → pump calculates bolus using insulin-to-carb ratio
4. **Correction bolus** calculated from current BG, target BG, and correction factor (ISF)
5. **Closed-loop systems**: CGM feeds BG to pump → algorithm auto-adjusts basal q5 min

B

Anatomy of a Pump Site

VISUAL REFERENCE



PUMP → TUBING → CANNULA → SUBQ TISSUE. SITE CHANGED Q2-3 DAYS.

3

Pump Problem Recognition

WHAT TO WATCH FOR

Because there is **no long-acting insulin reservoir** in the body, any interruption in pump delivery can lead to **DKA within 2–4 hours**. Early recognition is critical.

⚠️ Early Signs of Pump Failure

- Unexplained hyperglycemia (BG >250) — especially morning rise
- BG not responding to correction bolus
- Pump alarm (occlusion, low reservoir, low battery)
- Site redness, mild itching, or tape lifting
- Mild thirst, increased urination
- "No delivery" or "no flow" warning

🚨 Late / Severe (DKA Developing)

- BG >300, ketones positive (urine or blood)
- Nausea, vomiting, abdominal pain
- Kussmaul respirations (deep, rapid)
- Fruity (acetone) breath
- Dehydration, hypotension, tachycardia
- Confusion → lethargy → coma
- Site infection: warmth, pain, purulent drainage, fever

🚨 RED FLAG

BG >250 × 2 readings + ketones present = STOP pump, change site/set/insulin, give correction by syringe, evaluate for DKA. Do NOT troubleshoot for hours.

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Priority Nursing Interventions

ABC + SAFETY FRAMEWORK

Nursing care of a pump patient on admission, during hospitalization, and during procedures.

A

Airway / Acidosis

- If DKA suspected → assess for Kussmaul respirations, fruity breath
- Monitor ABG / serum bicarbonate, anion gap
- If pump removed / failure: **cover with subQ rapid-acting insulin q4h until pump restarted OR start IV insulin infusion**

B

Blood Glucose Monitoring

- Check fingerstick BG before meals, at bedtime, and at 2–3 AM minimum
- Verify pump settings: basal rates, I:C ratio, correction factor, target BG
- Compare CGM reading with fingerstick before dosing decisions
- Document insulin given (basal + boluses) — pump history is the source of truth

C

Catheter / Site Care

- Inspect insertion site every shift: redness, swelling, leakage, pain, lifted tape
- Change infusion set every 2–3 days; rotate site (abdomen, upper buttock, thigh, upper arm)
- Avoid sites within 2 inches of umbilicus, scars, or lipohypertrophy
- Use sterile technique for site changes

D

Disconnection / Diagnostic Imaging

- **MRI:** REMOVE pump completely — magnetic field damages pump and may cause uncontrolled insulin delivery
- **CT with contrast / X-ray:** disconnect pump and cover (manufacturer-specific)
- **Surgery / NPO:** may continue basal at reduced rate OR convert to IV insulin per protocol
- If disconnected >1 hr: give correction subQ to prevent DKA
- Always keep backup insulin pen + supplies at bedside

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Pharmacology — Insulin in the Pump

ONLY RAPID-ACTING BELONGS IN CSII

INSULIN	BRAND	ONSET	PEAK	DURATION	USE IN PUMP?
Lispro	Humalog	15 min	30–90 min	3–5 hr	✅ Yes
Aspart	NovoLog	15 min	40–50 min	3–5 hr	✅ Yes
Glulisine	Apidra	15 min	30–90 min	3–5 hr	✅ Yes
Regular	Humulin R	30–60 min	2–4 hr	5–8 hr	⚠️ Rare / older protocols only
NPH	Humulin N	1–2 hr	4–12 hr	14–24 hr	❌ Never
Glargine	Lantus / Basaglar	1–2 hr	none	20–24 hr	❌ Never
Detemir	Levemir	1–2 hr	3–9 hr	up to 24 hr	❌ Never
Degludec	Tresiba	1 hr	none	>42 hr	❌ Never

Key teaching: The pump replaces basal needs with continuous micro-doses of rapid-acting insulin. There is no long-acting insulin onboard — if the pump stops, insulin coverage stops within minutes.

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Complications

WHAT GOES WRONG

🚨 DKA

- From pump occlusion, dislodged catheter, dead battery, empty reservoir
- Onset within **2–4 hours** of interruption
- Most dangerous complication

🚨 Severe Hypoglycemia

- From over-bolusing, miscalculated carbs, exercise without basal reduction
- Hybrid pumps suspend at threshold

Site Infection

- Erythema, induration, warmth, purulent drainage
- Site abscess → remove set, culture, antibiotics

Catheter Occlusion / Kink

- Triggers "no delivery" alarm
- Persistent hyperglycemia despite bolusing

Lipohypertrophy

- Fatty lumps from repeated use of same site
- Erratic absorption

Skin Reactions

- Allergic dermatitis to adhesive or cannula material
- Pressure ulcers under pod

Mechanical Failure

- Battery dies, screen fails, electronics malfunction
- Backup MDI plan is essential

Psychological Burden

- Pump fatigue, body image issues
- Especially in adolescents

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NCLEX Test Traps ⚠️

WHERE STUDENTS LOSE POINTS

TRAP #1 — INSULIN TYPE IN THE PUMP

❌ WRONG

"I'll fill my pump with my Lantus tonight."

✅ RIGHT

Pump contains **only rapid-acting** insulin (lispro, aspart, glulisine). Long-acting insulin is NEVER used in a pump.

TRAP #2 — HOW FAST DKA DEVELOPS

❌ WRONG

"If my pump stops, I have a day before I have to worry."

✅ RIGHT

DKA can develop **within 2–4 hours** of pump failure because no long-acting insulin is onboard.

TRAP #3 — MRI

❌ WRONG

"I'll just disconnect the tubing and leave the pump in the room."

✅ RIGHT

Pump must be **completely removed from the MRI suite** — magnets damage electronics and can cause uncontrolled delivery.

TRAP #4 — PERSISTENT HYPERGLYCEMIA

❌ WRONG

Keep giving correction boluses through the pump and wait.

✅ RIGHT

If BG remains high after 2 corrections: **change the site, change the insulin reservoir, and give a correction by syringe/pen.** Suspect occlusion.

TRAP #5 — SITE CHANGE FREQUENCY

❌ WRONG

"I change my set once a week."

✅ RIGHT

Every 2–3 days. Longer use ↑ infection risk and ↓ insulin absorption.

TRAP #6 — SICK DAY RULES

❌ WRONG

"I have the flu and can't keep food down, so I turned off the pump."

✅ RIGHT

Never stop the basal on sick days — illness raises insulin needs. Check BG and ketones q2–4h, hydrate, contact provider.

TRAP #7 — EXERCISE

❌ WRONG

"I'll keep my normal basal during my marathon."

✅ RIGHT

Reduce basal or set a temporary basal rate before/during prolonged exercise to prevent hypoglycemia.

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Patient & Family Education

TEACHING PRIORITIES

1 Site Care

- Change set every 2–3 days
- Rotate sites: abdomen, thigh, upper arm, upper buttock
- Avoid waistband, scars, beltline, areas within 2 in. of umbilicus
- Inspect daily for redness, swelling, pain
- Wash hands & cleanse skin before insertion

2 Carb Counting

- Learn to count carbs accurately at every meal/snack
- Enter carbs into pump → calculates bolus from I:C ratio
- Bolus 15 min before eating for best result

3 BG Monitoring

- Check fingerstick before meals, bedtime, and if you feel "off"
- Pair pump with CGM if possible
- Verify CGM with fingerstick before stacking corrections

4 Backup Plan

- Always carry insulin pen + extra infusion set + batteries
- Have a printed schedule of basal rates and I:C ratios
- Wear medical-alert ID at all times
- Know your "MDI rescue dose" if pump fails

5 Sick Days

- Never stop basal insulin
- Check BG and ketones q2–4 hours
- Drink fluids, take small carbs if BG dropping
- Call provider for vomiting, BG >240 × 2, or ketones moderate/large

6 Exercise

- Lower basal 30–60 min before activity (temp basal)
- Check BG before, during long activity, after
- Disconnect <1 hour during contact sports OK; cover after

7 Showering / Water

- Tethered pumps: disconnect at site for showers/swimming (most are not waterproof)
- Patch pumps (Omnipod) are waterproof
- Reconnect within 1 hour to prevent hyperglycemia

8 Travel

- Carry pump + double supplies in carry-on (not checked bag)
- Bring written prescription and provider letter
- Notify TSA — pumps should NOT go through full-body scanners or x-rays (request hand inspection)
- Adjust basal across time zones with provider guidance

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Memory Mnemonics

QUICK-RECALL TOOLS

PUMP

P — Pen backup always available

U — Use rapid-acting only

M — Monitor BG ≥ 4×/day

P — Prevent DKA (change set q2–3d)

DKA in 2–4 HRS

D — Disconnected pump?

K — Kinked catheter?

A — Alarm ignored?

→ DKA can hit fast — **no long-acting insulin onboard**.

SITE

S — Sterile technique

I — Inspect every shift

T — Two-to-three-day rotation

E — Educate on signs of infection

3 R's BEFORE MRI

Remove pump

Replace with subQ insulin coverage

Resume pump after scan

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NCJMM Clinical Judgment Walkthrough

NEXT-GEN 6-STEP MODEL

SCENARIO

A 16-year-old client with Type 1 diabetes on an insulin pump arrives at the ED with her mother. She reports nausea, vomiting, and abdominal pain since this morning. BG 412 mg/dL, urine ketones large. The pump screen shows an "occlusion detected" alert from 6 hours ago that she "snoozed and forgot about." Vital signs: T 99.4°F, HR 128, RR 32 deep and labored, BP 96/58. She is sleepy but arousable.

1 — RECOGNIZE CUES

BG 412 (severe hyperglycemia) • Large urine ketones • N/V/abdominal pain • Kussmaul respirations (RR 32, deep) • Tachycardia 128 • Hypotension 96/58 • Sleepy/decreased LOC • Pump occlusion alarm 6 hours old.

2 — ANALYZE CUES

Pump delivered no insulin × 6 hours. Because the pump uses only rapid-acting insulin, the patient had **no insulin coverage at all** for 6+ hours. Cells switch to fat metabolism → ketogenesis → metabolic acidosis. Findings = classic DKA.

3 — PRIORITIZE HYPOTHESES

#1 — Diabetic Ketoacidosis (DKA) from pump occlusion (highest priority — life-threatening acidosis, dehydration, electrolyte derangement). #2 — Volume depletion. #3 — Possible site infection. Rule out: appendicitis, gastroenteritis (DKA mimics them).

4 — GENERATE SOLUTIONS

Disconnect pump • Establish 2 large-bore IVs • IV 0.9% NS bolus (15–20 mL/kg) • IV regular insulin infusion (start ~0.1 units/kg/hr) • Stat labs: BMP, ABG, anion gap, ketones, magnesium, phosphorus, HbA1c, urinalysis • Continuous cardiac monitoring (watch for K shifts) • Hourly BG checks.

5 — TAKE ACTION

Stop pump, remove infusion set, save for inspection • Establish IV access, draw labs • NS 1 L bolus, then maintenance fluids per protocol • Start IV regular insulin infusion (only IV-compatible insulin) • Replace K^+ once urine output is established and K^+ <5.0 • Add D5 to fluids when BG <200 to prevent rapid drop • Reorient patient, support airway, notify provider, document.

6 — EVALUATE OUTCOMES

Improvement: BG steadily decreasing (~50–75 mg/dL/hr), anion gap closing, ketones clearing, RR normalizing, LOC improving, urine output ≥0.5 mL/kg/hr, electrolytes within target. Transition to subQ insulin only after anion gap closed AND patient eating. **Education before discharge:** never ignore pump alarms, sick-day rules, when to call provider, importance of carrying backup MDI insulin.