

NGN NCLEX 2026 · STUDY SERIES · CARDIOVASCULAR SYSTEM

Cardiac *Diagnostics*

From 12-leads to left heart cath — the complete priority guide to what the numbers, waves, and wires are telling you.

BIOMARKERS

EKG · HOLTER · STRESS

ECHO · TEE

CARDIAC CATH

EPS · ABLATION



01 Definition & Overview

THE BIG PICTURE

*Cardiac diagnostics are the tools that let us see **electrical activity, muscle damage, blood flow, and structure** — the four questions every cardiac workup is trying to answer.*

4

CORE QUESTIONS ANSWERED

2

NON-INVASIVE / INVASIVE CATEGORIES

⚡ Electrical

EKG, Holter, stress test, EPS

🩸 Damage

Troponin, CK-MB, myoglobin, BNP

🫀 Structure

Echo (TTE/TEE), CXR, cardiac MRI/CT

🔬 Flow

Cardiac cath, angiography, perfusion scan

02 Pathophysiology of Detection

WHY TIMING MATTERS

When cardiac muscle dies, enzymes & proteins leak into the bloodstream on a **predictable schedule**. Each marker rises → peaks → falls at a different speed. That's why we trend *serial labs*, not just one draw.

Ischemia (→ chest pain) → Cell membrane damage → Intracellular proteins leak → Detectable in blood → Serial rise confirms MI.

🕒 Cardiac Biomarker Rise Timeline (Post-MI)



*Troponin is the **gold standard** — most sensitive & specific, and stays elevated longest.*

03 Cardiac Biomarkers

KNOW THE NUMBERS

MARKER	NORMAL VALUE	RISES	PEAKS	RETURNS	CLINICAL USE
Troponin I / T	< 0.04 ng/mL	3–6 hr	12–24 hr	10–14 days	Gold standard for MI
CK-MB	0–3 ng/mL (<5%)	4–6 hr	18–24 hr	2–3 days	Re-infarction / 2 nd MI
Myoglobin	< 90 mcg/L	1–3 hr (earliest)	6–9 hr	24 hr	Early (but not specific)
BNP	< 100 pg/mL	Released when ventricles stretch			Heart failure (>400 = severe)
Total Cholesterol	< 200 mg/dL	LDL <100 · HDL >40 M / >50 F · Triglycerides <150			CAD risk stratification

MARKER	NORMAL VALUE	RISES	PEAKS	RETURNS	CLINICAL USE
hs-CRP	< 1 mg/L (low risk)				Inflammation marker Adjunct CAD risk



Red-Flag Value

A **Troponin > 0.04 ng/mL** in a patient with chest pain is considered a positive MI until proven otherwise. **Draw serial troponins** — a single draw is never enough; trending confirms infarct.

04 Non-Invasive Studies

EKG · HOLTER · STRESS · ECHO

NON-INVASIVE

12-Lead EKG

WHAT IT SEES

- ▶ Electrical activity of heart
- ▶ Rhythm, rate, ischemia, MI, hypertrophy
- ▶ **STEMI** = ST elevation (full-thickness damage)
- ▶ **NSTEMI** = ST depression / T-wave inversion

NURSING PREP

- ▶ 10 electrodes → 12 views
- ▶ Clean & dry skin with alcohol; clip hair if needed
- ▶ **No caffeine** before ambulatory EKGs
- ▶ Client remains **still & supine** during strip

NON-INVASIVE

Holter Monitor

PURPOSE

- ▶ Continuous ambulatory EKG (24–48 hr)
- ▶ Captures transient / exertional dysrhythmias

TEACH THE CLIENT

- ▶ Keep a **diary** — log activities & symptoms with times
- ▶ **Do NOT shower / swim** — electrodes must stay dry
- ▶ Avoid magnets, microwaves, metal detectors, electric blankets
- ▶ Live normally → point is to catch real-life arrhythmias

NON-INVASIVE

Stress Test (Exercise or Pharmacologic)

NON-INVASIVE

Echocardiogram

TYPES

- ▶ **Exercise:** treadmill / bike while monitoring
- ▶ **Pharmacologic:** Dobutamine, Adenosine, Dipyridamole (for clients who can't exercise)

PRE-PROCEDURE

- ▶ **NPO 2–4 hr** before
- ▶ **No caffeine, smoking, or alcohol × 24 hr** (especially w/ adenosine)
- ▶ Hold **beta-blockers** per HCP order (they blunt the stress response)
- ▶ Comfortable clothes & walking shoes

DURING / AFTER

- ▶ Monitor EKG, BP, chest pain, dysrhythmias continuously
- ▶ **Stop test** for chest pain, severe dyspnea, ST↓ >2 mm, SBP drop, dangerous rhythm

PURPOSE

- ▶ Ultrasound that visualizes **chambers, valves, EF, wall motion**
- ▶ Gold standard for **ejection fraction** (normal 55–70%)

CLIENT EDUCATION

- ▶ Painless, no contrast, no radiation
- ▶ Lie on left side, ~30–60 min
- ▶ Gel may feel cool; no special prep

TTE vs. TEE — Know the Difference

✓ NON-INVASIVE

TTE — Transthoracic

Probe on **chest wall**. Routine, outpatient, no prep.

- ▶ No NPO · No sedation
- ▶ Painless · 30–60 min
- ▶ May be limited by body habitus / lung tissue

VS

⚠ SEMI-INVASIVE

TEE — Transesophageal

Probe passed **down esophagus** for clearer images (clots, valves, endocarditis).

- ▶ **NPO 6 hr** before
- ▶ Informed consent required
- ▶ Conscious sedation · local throat anesthetic
- ▶ **NPO until gag reflex returns**
- ▶ Monitor: **perforation, bleeding, dysrhythmia, aspiration**

05 Cardiac Catheterization

GOLD STANDARD FOR CAD

A catheter is threaded via the **femoral or radial artery** up to the coronary arteries; contrast dye is injected and fluoroscopy shows blockages in real time. Can be **diagnostic** (angiogram) or **therapeutic** (PCI with balloon / stent). This is the single highest-yield NCLEX cardiac procedure.

Pre-Procedure

1

- › Informed **consent**
- › **NPO 6–8 hr**
- › Ask about **iodine / shellfish / contrast allergy** → pre-medicate with steroids/Benadryl if positive
- › Check **BUN & creatinine** — contrast is nephrotoxic
- › Check PT/INR, PTT, platelets
- › **Hold metformin 24–48 hr** before & after (risk of lactic acidosis with contrast)
- › **Mark distal pulses** (pedal, posterior tibial)
- › Void before → long bed rest after
- › Baseline VS, weight, IV access

During

2

- › Local anesthesia at insertion site; client awake with mild sedation
- › Warn: expect **flushing / warmth & metallic taste** when dye is injected — *normal*, lasts ~30 sec
- › May feel fluttering / palpitations → catheter on myocardium
- › Continuous EKG & BP monitoring
- › **Report: chest pain, SOB, nausea**

Post-Procedure

3

- › **Bed rest 4–6 hr** (femoral); shorter for radial
- › **Keep affected leg straight**; HOB ≤ 30°
- › VS & site check: q15min × 1 hr → q30min × 2 hr → q1hr
- › Assess **5 Ps** distal to site: Pain, Pallor, Pulse, Paresthesia, Paralysis
- › Inspect for **bleeding / hematoma / bruit**
- › **Push fluids** → flush contrast from kidneys
- › Watch for **chest pain** (stent thrombosis) → notify HCP STAT
- › Monitor for dysrhythmia & retroperitoneal bleed (back/flank pain, ↓BP, ↑HR)



Priority Post-Cath Red Flags

Chest pain = possible stent occlusion. **Cold, pale, pulseless extremity** = arterial compromise. **Flank/back pain + ↓BP + ↑HR** = retroperitoneal hemorrhage (femoral approach). All three = **notify HCP immediately**.

06 Electrophysiology Study (EPS)

RHYTHM MAPPING & ABLATION

Purpose

- › Catheter-based study of heart's **electrical pathways**

Nursing Care

- › Prep & post-care **mirrors cardiac cath**

- ▶ Provokes dysrhythmias in a controlled setting
- ▶ Guides **ablation therapy** or ICD placement

- ▶ **Hold anti-dysrhythmics** per order (so arrhythmia can be provoked)
- ▶ Fasting, consent, allergies, coags, renal function
- ▶ Post: bed rest, site monitoring, rhythm surveillance

07 Priority Nursing Interventions

ABCS • SAFETY • PRIORITIZATION

A Airway

- ▶ Post-TEE: **NPO until gag reflex returns**
- ▶ Watch for aspiration after sedation
- ▶ Stress test: stop for severe dyspnea

B Breathing

- ▶ Monitor SpO₂ throughout cath/EPS
- ▶ Assess lung sounds pre/post contrast (fluid overload risk)
- ▶ Report new SOB → possible PE or MI

C Circulation

- ▶ Baseline + serial **VS, peripheral pulses, cap refill**
- ▶ Continuous EKG during invasive studies
- ▶ Site assessment for bleeding/hematoma q15min initially
- ▶ Serial troponins when ACS suspected

💧 Kidney Protection

- ▶ Check **BUN & creatinine** pre-contrast
- ▶ **Hydrate before & after** (flush dye)
- ▶ Hold **metformin 24–48 hr** around contrast
- ▶ Monitor urine output ≥ 30 mL/hr post

🛡️ Safety

- ▶ Verify consent for invasive procedures
- ▶ Confirm NPO status
- ▶ Screen for **iodine / shellfish / contrast allergy**
- ▶ Fall precautions after sedation

🧠 Patient Teaching

- ▶ Explain sensations (flushing, palpitations) = normal
- ▶ Emphasize **reporting chest pain immediately**
- ▶ Reinforce bed rest & activity limits
- ▶ Teach s/s of complications before discharge

08 Pharmacology Considerations

DRUGS YOU HOLD, DRAW, OR GIVE

DRUG / CLASS	ACTION	NURSING CONSIDERATION
Metformin	Oral antidiabetic	Hold 24–48 hr before & after contrast (lactic acidosis w/ dye)
Beta-blockers (metoprolol, atenolol)	↓ HR, ↓ contractility	Hold before stress test (blunts HR response) per order
Caffeine / Theophylline	Stimulants	Hold 24 hr before adenosine/dipyridamole stress (blocks effect)
Anticoagulants (warfarin, DOACs, heparin)	Bleed risk	Check PT/INR, PTT; hold per HCP pre-cath; resume after hemostasis
Antidysrhythmics	Suppress arrhythmias	Hold before EPS (need arrhythmia to map it)
Nitroglycerin (PRN)	Coronary vasodilator	Give for chest pain during/after cath; monitor BP
Iodinated Contrast Dye	Opacifies vessels	Screen allergy → pre-medicate steroids/Benadryl; hydrate; monitor renal function

09 NCLEX Test Traps

WHERE STUDENTS LOSE POINTS

⚠ TRAP "One normal troponin rules out MI."	✓ TRUTH Troponin rises 3–6 hr post-infarct. Trend serial draws — a single negative means nothing early.
⚠ TRAP "Flushing and metallic taste during cath = allergic reaction, stop the dye."	✓ TRUTH Those are expected, normal responses to contrast — reassure the client. Stop only for hives, wheeze, or hypotension.
⚠ TRAP "Elevate the HOB high to make the post-cath client comfortable."	✓ TRUTH Keep HOB ≤ 30° with the affected leg straight for 4–6 hr after femoral cath → prevents bleed/hematoma.
⚠ TRAP "After TEE, start clear liquids as soon as client is awake."	✓ TRUTH NPO until gag reflex returns — the throat was anesthetized, aspiration risk is real.

⚠ TRAP "Hold the metformin only the day of the cath."	✓ TRUTH Hold metformin 24–48 hr before AND after contrast until renal function is confirmed stable.
⚠ TRAP "Continue caffeine and beta-blockers — they're routine meds."	✓ TRUTH Hold caffeine × 24 hr before pharmacologic stress, and hold beta-blockers per order — both blunt the test.
⚠ TRAP "Diet plays no role in a Holter study."	✓ TRUTH Client should live normally but avoid getting electrodes wet (no showering/swimming) and keep an accurate diary.

10 Patient Education

WHAT TO TEACH BEFORE DISCHARGE

- ✓ **Report immediately:** chest pain, SOB, bleeding/swelling at site, cold or numb extremity, back/flank pain, fever.
- ✓ **Post-cath activity:** no heavy lifting (>10 lb), no strenuous exercise, no tub bathing/swimming × 24–48 hr.
- ✓ **Hydrate generously** after contrast — flush kidneys.
- ✓ **Keep the site dry & clean;** a small bruise is normal, an expanding lump or bruit is not.
- ✓ **Take antiplatelets (ASA, clopidogrel) exactly as prescribed** after stent — do not stop without MD approval (stent thrombosis risk).
- ✓ **Holter monitor:** keep diary, avoid water, magnets, and electric blankets.
- ✓ **Stress test prep:** NPO 2–4 hr, no caffeine/smoking × 24 hr, wear comfortable clothes & walking shoes.
- ✓ **Lifestyle (ongoing):** smoking cessation, low-sodium/low-fat diet, BP control, cholesterol management, regular follow-up.

11 Clinical Judgment • NCJMM

NEXT GEN NCLEX 2026

The Clinical Judgment Measurement Model Applied

How the NGN tests your thinking on a post-cath client with new chest pain and a weak pedal pulse.



Recognize Cues

Chest pain, ↓ pedal pulse, cool pale foot, site hematoma, new dysrhythmia on monitor, ↓ BP, ↑ HR.



Analyze / Prioritize

Differentiate: stent thrombosis vs. arterial occlusion vs. retroperitoneal bleed. Prioritize chest pain → life-threatening.



Generate / Take Action

Notify HCP STAT, 12-lead EKG, serial troponins, apply pressure to site, O₂, IV fluids, prep for cath lab if reocclusion suspected.



Evaluate Outcomes

Pain resolved · BP stabilized · pulses return · EKG back to baseline · hematoma no longer expanding · UO ≥ 30 mL/hr.

12 Memory Boosters

MNEMONICS THAT STICK

5 Ps

Post-Cath Circulation Check

- P**ain
- P**allor
- P**ulse (distal)
- P**aresthesia
- P**aralysis

MONA

Acute MI Initial Tx

- M**orphine
- O**xygen
- N**itroglycerin
- A**spirin (chewed)

TIME

Troponin Rises on TIME

- T**roponin = gold standard
- I**n 3–6 hr (rises)
- M**aximum at 12–24 hr
- E**levated 10–14 days

SCARE

Pre-Cath Checklist

- S**hellfish / iodine allergy?
- C**onsent signed?
- A**llergies & meds (hold metformin)

DRY

Holter Monitor Rules

- D**iary of activities & symptoms
- R**egular life — no special diet
- Y**ou stay dry — no showers/swim

TEE

TEE = Throat Emptied & Eased

- T**hroat numbed → NPO until gag returns
- E**sophageal perforation is the risk
- E**cho pics are clearer than TTE

Renal labs (BUN/Cr)

Empty bladder, mark pulses

Cardiac Diagnostics · From cues to clinical judgment.

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