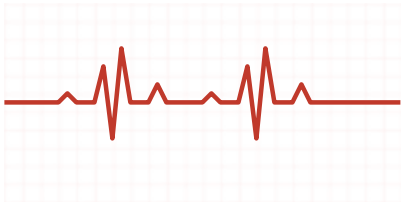
CARDIAC | NGN NCLEX 2026 | HIGH YIELD

ECG Interpretation

Reading the electrical story of the heart — waves, intervals, and the rhythms every nurse must recognize on sight.



01 Definition / Overview

THE BASICS

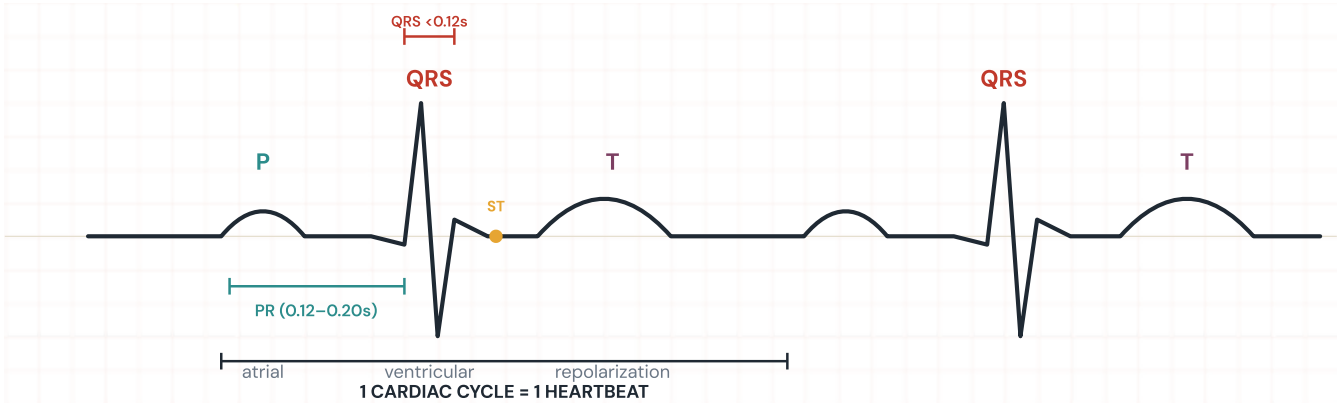
- **ECG / EKG** = electrocardiogram — a graphic recording of the heart's electrical activity captured through skin electrodes.
- **12-lead ECG** looks at the heart from 12 angles (10 electrodes); used to diagnose MI, ischemia, and chamber enlargement.
- **Telemetry / continuous monitoring** uses 3–5 leads for ongoing rhythm surveillance in hospitalized patients.
- **Why it matters:** Early rhythm recognition guides priority interventions — every minute counts in lethal arrhythmias.

STANDARD SPEED & VOLTAGE

PAPER SPEED	25 mm/sec
SMALL BOX	1 mm = 0.04 sec
LARGE BOX	5 mm = 0.20 sec
VOLTAGE	10 mm = 1 mV
5 LARGE BOXES	= 1 second

02 Wave Anatomy & Conduction

ELECTRICAL PATHWAY



P WAVE

Atrial Depolarization

The SA node fires → atria contract. Should be upright, rounded, < 0.12 sec.

QRS COMPLEX

Ventricular Depolarization

Impulse spreads through ventricles → contraction. Normal width 0.06–0.10 sec (< 0.12).

T WAVE

Ventricular Repolarization

Ventricles "reset." Upright in most leads. Tall peaked T = think hyperkalemia.

⚡ CONDUCTION PATHWAY **SA node → AV node → Bundle of His → Right & Left Bundle Branches → Purkinje fibers** → ventricular contraction. The SA node is the heart's natural pacemaker (fires 60–100/min).

03 Rhythms You Must Recognize

PATTERN RECOGNITION

✓ NORMAL & SINUS RHYTHMS

Normal Sinus Rhythm (NSR)

STABLE

RATE
60–100 bpm

RHYTHM
Regular

P WAVES
Upright, 1 before each QRS

PR / QRS
0.12–0.20 / < 0.12 sec

Sinus Bradycardia

OFTEN STABLE

Rate < 60 bpm, regular rhythm, normal waves. Causes: athletes, vagal stim, MI, beta-blockers, increased ICP.

Tx if symptomatic: Atropine 1 mg IV → transcutaneous pacing → epi/dopamine drip.

Sinus Tachycardia

TREAT CAUSE

Rate 100–150 bpm, regular. Causes: pain, fever, dehydration, anxiety, hypoxia, hyperthyroid, caffeine.

Tx: Treat the cause! Beta-blockers if cardiac origin.

⚠ ATRIAL ARRHYTHMIAS

Atrial Fibrillation (A-fib)

STROKE RISK ⚠

RHYTHM
Irregularly irregular

P WAVES
Absent — chaotic fibrillatory waves

RISK
Mural thrombi → stroke (CHA_2DS_2-VASc)

TX
Anticoagulants + rate/rhythm control

Atrial Flutter

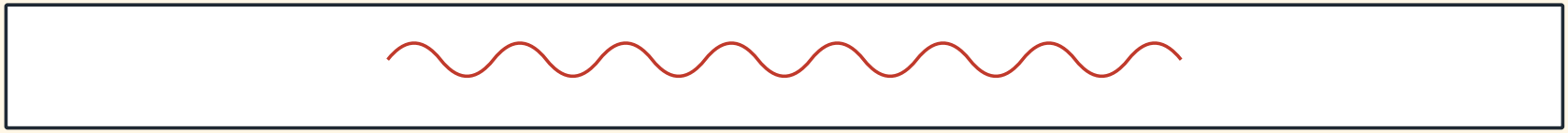
SAWTOOTH PATTERN

Sawtooth flutter waves (most clearly in lead II). Atrial rate 250–350; ventricular response varies (2:1, 3:1, 4:1 conduction). Same risks/treatment as A-fib.

🚨 LETHAL VENTRICULAR RHYTHMS

Ventricular Tachycardia (V-tach)

SHOCKABLE



RATE / RHYTHM

QRS

150–250 bpm, regular

Wide, bizarre (> 0.12 sec)

P WAVES

None visible

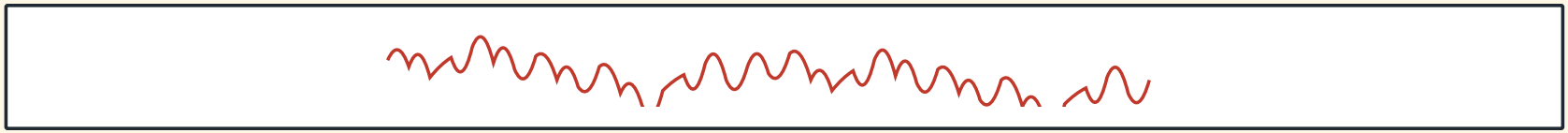
TX PULSELESS

CPR + DEFIBRILLATE + epi

> **Stable V-tach (with pulse):** Amiodarone IV. **Unstable with pulse:** Synchronized cardioversion. **Pulseless V-tach:** Treat like V-fib → DEFIBRILLATE.

Ventricular Fibrillation (V-fib)

LETHAL · SHOCKABLE



RHYTHM

Chaotic, no recognizable waveform

PATIENT

Unresponsive, pulseless, apneic

#1 ACTION

DEFIBRILLATE immediately!

DRUGS

Epi 1mg q3–5min, amiodarone 300mg

Asystole ("Flatline")

LETHAL · NOT SHOCKABLE

RHYTHM

Absent — confirm in 2 leads

#1 ACTION

HIGH-QUALITY CPR + Epi

DRUGS

Epinephrine 1 mg IV q3–5 min

DO NOT

Defibrillate (no electrical activity)

Pulseless Electrical Activity (PEA)

LETHAL · NOT SHOCKABLE

Organized rhythm on the monitor **but no pulse**. Treat like asystole: CPR + Epi. Find and reverse the cause: **5 H's & 5 T's** (Hypovolemia, Hypoxia, H+ acidosis, Hyper/hypoK, Hypothermia · Tension PTX, Tamponade, Toxins, Thrombosis pulm/coronary).

⚡ OTHER KEY PATTERNS

PVC

WATCH ≥6/MIN

Premature Ventricular Contraction — early, wide, bizarre QRS with no preceding P. Concerning if > 6/min, multifocal, couplets, or "R-on-T" (can trigger V-tach).

SVT

150–250 BPM

Supraventricular Tachycardia — narrow QRS, very fast, regular. **Tx:** Vagal maneuvers → **Adenosine 6 mg rapid IV push** (warn pt: brief asystole feeling).

AV Heart Blocks (Quick Reference)

PR INTERVAL CLUES

BLOCK	HALLMARK	TX
1st degree	PR > 0.20 sec, all P's conduct	Usually none — observe
2nd° Type I (Wenckebach)	PR *progressively lengthens* until QRS dropped	Atropine if symptomatic
2nd° Type II (Mobitz II)	Constant PR, sudden dropped QRS — 🚨 can progress to 3°	Pacemaker (often permanent)
3rd degree (complete)	P's & QRS *independent* — no relationship	🚨 Transcutaneous pacing → permanent pacemaker

🚨 **ST-SEGMENT & T-WAVE CHANGES** **ST elevation** (≥1 mm in 2 contiguous leads) = **STEMI** — full-thickness MI, immediate cath lab! · **ST depression / T-wave inversion** = ischemia or NSTEMI · **Tall peaked T waves** = hyperkalemia · **Pathologic Q waves** = old MI · **Prolonged QT** (> 0.46 sec) = risk for Torsades de Pointes

04 Priority Nursing Interventions

ABC + SAFETY

When You See an Abnormal Rhythm — Step by Step

1. ASSESS the patient — not the monitor!
2. Check pulse, BP, LOC, SpO_2
3. Confirm in 2 leads (rule out artifact)
4. Call rapid response / code if unstable
5. Initiate ACLS algorithm

GOLDEN RULE **"Treat the patient, NOT the monitor."** Always assess responsiveness and pulse FIRST. A loose lead can mimic asystole — but a flatline patient is unresponsive.

STABLE PATIENT

- Continuous ECG monitoring
- Obtain 12-lead ECG
- Establish IV access
- O_2 if SpO_2 < 94%
- Identify & treat cause
- Notify provider

UNSTABLE / PULSELESS

- **Start CPR** immediately if pulseless
- Call code / activate rapid response
- **Defibrillate** V-fib / pulseless V-tach
- Epi 1 mg IV q 3–5 min
- Secure airway, IV/IO access
- Treat reversible causes (5 H's & T's)

DEFIBRILLATION VS CARDIOVERSION **Defibrillation** = *unsynchronized* shock for V-fib & pulseless V-tach (no organized rhythm to sync to). · **Synchronized cardioversion** = times shock with R wave; used for unstable A-fib, A-flutter, SVT, V-tach *with* pulse. · Always:

> "Clear!" — no one touching pt or bed.

05 Pharmacology — Cardiac Code Drugs

ACLS ESSENTIALS

Atropine

ANTICHOLINERGIC / ANTIMUSCARINIC

USE	Symptomatic **bradycardia**, AV blocks (1st & 2nd Type I)
ACTION	Blocks vagal tone → ↑ HR & AV conduction
DOSE	1 mg IV push, repeat q 3–5 min (max 3 mg)
⚠ WATCH	Tachycardia, dry mouth, urinary retention; NOT for Mobitz II or 3° block (won't help)

Epinephrine

ADRENERGIC AGONIST (ALPHA + BETA)

USE	**All cardiac arrest rhythms** (V-fib, pulseless V-tach, asystole, PEA), anaphylaxis
ACTION	↑ HR, ↑ contractility, vasoconstriction → ↑ coronary & cerebral perfusion
DOSE	1 mg IV/IO q 3–5 min during arrest
⚠ WATCH	HTN, tachy-arrhythmias, tissue necrosis with extravasation

Amiodarone

CLASS III ANTIARRHYTHMIC

USE	V-fib/pulseless V-tach (after epi); stable V-tach; A-fib conversion
DOSE	Arrest: 300 mg IV bolus → 150 mg ; Stable: 150 mg over 10 min

⚠ WATCH	**Pulmonary fibrosis**, hepatotoxicity, thyroid dysfunction, blue-gray skin, prolonged QT

Adenosine

ANTIARRHYTHMIC — AV NODAL BLOCKER

USE	**SVT** conversion (drug of choice)
DOSE	6 mg *rapid* IV push followed by 20 mL NS flush; may repeat 12 mg ×2
⚠ WATCH	Brief asystole/flushing/chest pressure (warn patient!); ½-life < 10 sec — push FAST through closest port

Lidocaine

CLASS IB ANTIARRHYTHMIC

USE	Alternative to amiodarone for V-fib/V-tach
DOSE	1–1.5 mg/kg IV bolus, then 0.5–0.75 mg/kg q 5–10 min
⚠ WATCH	Toxicity: confusion, slurred speech, seizures, tinnitus, bradycardia

Magnesium Sulfate

ELECTROLYTE / ANTIARRHYTHMIC

USE	**Torsades de Pointes** (polymorphic V-tach with prolonged QT)
DOSE	1–2 g IV over 5–60 min
⚠ WATCH	Hypotension, ↓ DTRs, respiratory depression (signs of mag toxicity)

06 NCLEX Test Traps

⚠ WATCH OUT!

TRAP #1 — DEFIBRILLATE VS. CARDIOVERT

Students reach for the paddles for *any* tachy-rhythm. **Correct:** Defibrillate ONLY pulseless V-tach and V-fib. Use **synchronized cardioversion** for unstable A-fib, SVT, or V-tach *with a pulse*. NEVER defibrillate asystole or PEA.

TRAP #2 — TREATING THE MONITOR, NOT THE PATIENT

A flat line on the monitor does NOT automatically mean asystole. **Correct:** Always assess the *patient first* — check responsiveness, pulse, and lead placement. The first action with a "flat line" on a stable, talking patient is to check the leads.

TRAP #3 — ATROPINE FOR ALL BRADYCARDIA

Atropine doesn't fix every slow rhythm. **Correct:** Atropine works on the AV node — it's *ineffective* for Mobitz II (2°) and 3° complete heart block. These need **transcutaneous pacing**.

TRAP #4 — PUSHING ADENOSINE SLOWLY

Half-life is < 10 seconds. If you push it slowly, it's metabolized before reaching the heart and won't work. **Correct:** RAPID IV push followed immediately by a 20 mL NS flush, port closest to the heart, arm raised.

TRAP #5 — FORGETTING TO ANTICOAGULATE A-FIB

A-fib's biggest threat isn't the rhythm itself — it's the *clot*. **Correct:** A-fib lasting > 48 hours requires anticoagulation (warfarin, DOACs) before cardioversion to prevent embolic stroke.

TRAP #6 — CONFUSING PVC VS. PAC

PACs come early with a P wave (just looks different); PVCs come early with NO P wave and a wide bizarre QRS. **Correct:** PVCs are ventricular = wider, scarier, and *can* trigger V-tach (especially R-on-T phenomenon).

TRAP #7 — TALL PEAKED T-WAVES MEAN MI

Wrong! Tall peaked T's are a **hyperkalemia** hallmark, not an MI. **Correct:** ST elevation = STEMI; tall, narrow, "tented" T-waves = check that K^+ level. Both need urgent action — but for very different reasons.

TRAP #8 — SKIPPING THE PULSE CHECK ON V-TACH

Treatment for V-tach hinges on one question: pulse or no pulse? **Correct:** *Pulseless V-tach* → defibrillate. *Stable V-tach with pulse* → amiodarone. *Unstable with pulse* → synchronized cardioversion.

07 NCJMM Clinical Judgment

NGN FRAMEWORK

Apply the NCSBN Clinical Judgment Measurement Model to a *patient on telemetry whose monitor suddenly shows a wide-complex tachycardia*:

STEP 1

Recognize Cues

Wide QRS > 0.12 sec, rate ~180, no P waves, regular rhythm. Patient: chest pain, lightheaded, pale, BP 82/50.

STEP 2

Analyze Cues

Pattern = V-tach. BP & symptoms = unstable. Pulse *present* on palpation → unstable V-tach with pulse.

STEP 3

Prioritize Hypotheses

#1 risk: deterioration to pulseless V-tach / V-fib. Secondary: hemodynamic collapse from poor perfusion.

STEP 4

Generate Solutions

Synchronized cardioversion · IV access · O_2 · sedation · prepare amiodarone · call rapid response.

STEP 5

Take Action

Activate rapid response → place pads → sedate → synchronized cardioversion at 100 J → reassess pulse/rhythm.

STEP 6

Evaluate Outcomes

Rhythm converted to NSR? BP recovering? LOC improved? If not — escalate; if pulseless → CPR + defibrillate.

08 Patient & Family Education

TEACH-BACK TOPICS

Before & During the ECG

- **Painless & non-invasive** — no electrical shock, only records.
- Lie still, breathe normally, don't talk during recording.
- No lotions/oils on chest day-of (electrodes won't stick).
- Test takes 5–10 min; results read by provider.
- Telemetry: don't remove leads; report skin irritation.

When to Call 911

- Chest pain or pressure lasting > 5 minutes
- Palpitations with dizziness, syncope, or shortness of breath
- Pulse < 50 or > 120 with symptoms
- New irregular heartbeat with weakness
- "Skipping" beats with chest discomfort

💊 **LIFESTYLE TEACHING** Take cardiac meds **exactly as prescribed** · check pulse before beta-blockers/digoxin (hold if < 60) · avoid stimulants (caffeine, decongestants) · monitor for bleeding on anticoagulants · maintain follow-up & lab work · weight-bear & low-sodium diet for HF · CPR class for family if at risk.

09 Memory Boosters & Mnemonics

STICK IT IN YOUR BRAIN

"I PASS"

5-step ECG interpretation:

I nterval (PR, QRS, QT)
P wave (present? upright?)
A xis & rhythm regularity
S egments (ST, baseline)
S peed/Rate (300/large boxes)

"Shock VF & VT"

Shockable rhythms:

V -Fib (Ventricular Fibrillation)
V -Tach (Pulseless)

NOT shockable: Asystole & PEA

(If there's no pulse and an organized rhythm → it's PEA)

"Long, Longer, Longer, Drop"

2nd-degree Type I (Wenckebach):

PR gets *progressively longer* until you "drop" a QRS. **Type II**: "Some P's just don't get through" — constant PR, sudden drops.

"H's & T's"

Reversible PEA/asystole causes:

5 H's: Hypovolemia · Hypoxia · H^+ acidosis · Hyper/Hypokalemia · Hypothermia
5 T's: Tension PTX · Tamponade · Toxins · Thrombosis (pulm) · Thrombosis (coronary)

"300 / 150 / 100 / 75 / 60 / 50"

Quick rate count using big boxes between R-waves:

1 box = 300 · 2 = 150 · 3 = 100 · 4 = 75 · 5 = 60 · 6 = 50

"P-QRS-T = One Beat"

Wave story:

P arty starts (atria fire) → **QRS** the dancing peak (ventricles fire) → **T** akes a rest (repolarize). Repeat.

🎯 NCLEX PATTERN RECOGNITION **Wide & weird = ventricular · Narrow & fast with no P = SVT · Irregularly irregular + no P = A-fib · Sawtooth = Flutter · Flatline = Asystole (verify in 2 leads!)**