Quick Reference Guide

1. Patient with High BP (Hypertensive)

S/S to check

- Headache, vision changes, photophobia
- Neuro: confusion, slurred speech, unilateral weakness, facial droop
- Chest pain, SOB, palpitations
- Nausea/vomiting (think increased ICP / hypertensive emergency)
- Pregnancy status in appropriate patients (preeclampsia s/s)

V/S & monitoring

- Trend BPs (look at last 24 hrs, not just the one bad number)
- **MAP** (often target range ordered) or 60-80 by default
- HR & rhythm on tele → tachy, brady, new arrhythmia?
- RR, SpO_2, pain score
- Weight / I&O if volume overload is suspected

Labs to consider

- BMP (Na, K, BUN/Cr – kidney function, electrolyte issues)
- Troponin, BNP if chest pain/heart failure symptoms per orders
- UA/protein if pregnancy-related concerns
- Prior imaging: last echo, CT head, etc. (just review, not order)

Meds to review

- Scheduled antihypertensives:
    - ACEI/ARB (lisinopril, losartan, etc.)

- Beta blockers (**metoprolol**, carvedilol)
- CCBs (amlodipine, diltiazem)

- PRN BP meds on MAR (**hydralazine, labetalol**, etc.)
- Diuretics (**furosemide**, bumetanide) if fluid overload - will help with chronic HTN
- Any meds recently **held** or **missed** that might explain the spike

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2. Patient with Low BP (Hypotensive)

S/S to check

- Dizziness, lightheadedness, syncope
- Mental status: new confusion, agitation, “not acting right”
- Chest pain, SOB, new/worse fatigue
- Cool, clammy skin, delayed cap refill
- Decreased urine output, dark/concentrated urine
- Consider over diuresis
- Any obvious or occult bleeding (drains, stool, urine, emesis, surgical sites)

V/S & monitoring

- Confirm: recheck BP manually + check correct cuff size
- **MAP** (most places worry < 65 unless otherwise ordered)
- HR & rhythm: new tachycardia, bradycardia, heart block, arrhythmias
- RR, SpO_2, temp (fever → consider sepsis)
- I&O trend over the last 4–24 hrs

Labs to consider

- CBC (H/H → bleeding? WBC → infection?)
- BMP (Cr/BUN → renal perfusion, K+ changes)
- Lactate, blood cultures (if sepsis suspected per protocol)
- Troponin (if chest pain/ischemia picture)
- ABG/VBG if respiratory compromise

Meds to review

- Recently given antihypertensives (if yes, which + when)
- Diuretics (lasix, bumex) → volume depletion?
- Opioids, sedatives, anxiolytics → vasodilation / decreased sympathetic tone
- Vasodilators, nitrates, PDE inhibitors, etc.
- Any dialysis/CRRT treatments or fluid removals

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3. Low H/H (Anemia / Possible Bleed)

S/S to check

- SOB at rest or with minimal exertion
- Chest pain, palpitations, tachycardia
- Dizziness, syncope, fatigue, weakness
- Pale or cool skin, diaphoresis
- S/S of active bleeding:
    - Hematemesis, coffee-ground emesis
    - Melena, hematochezia
    - Hematuria
    - Oozing from IV sites, central lines, drains

V/S & monitoring

- HR (often ↑ before BP drops)
- BP & MAP, including orthostatic trends if appropriate
- RR & SpO_2 (especially on exertion)
- Tele for new ST changes or arrhythmias
- I&O, drain outputs, any chest tube/JP output trends

Labs to consider

- H/H trends (how fast falling, not just the number)
- Platelets, INR/PTT (coagulopathy?)
- Type & screen / type & crossmatch
- BMP (BUN often ↑ in upper GI bleed)
- Iron studies/B12/folate if chronic anemia workup is in progress

Meds to review

- Anticoagulants (heparin, enoxaparin, warfarin, DOACs)
- Antiplatelets (aspirin, clopidogrel, etc.)
- NSAIDs (risk for GI bleed)
- Any orders for blood products (PRBCs, platelets, FFP, cryo) → check status and consent

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4. High/Low Electrolytes (Quick Pattern Guide)

Potassium (K^+)

Hyperkalemia (high K^+):

- S/S: weakness, paresthesias, palpitations, possible flaccid paralysis
- V/S/monitor: tele for **peaked T waves, widened QRS, arrhythmias**, brady/asystole risk
- Labs: K^+ trend, BUN/Cr (renal function), other electrolytes
- Meds to review:
    - K^+ supplements (scheduled and PRN)
    - ACEI/ARB, spironolactone, eplerenone
    - Trimethoprim, NSAIDs, etc.
- Treat Hyperkalemia with **A DICK**:
    - *A - Albuterol Nebulizer
    - *D - 50% Dextrose IV push
    - *I - Regular Insulin IV push
    - *C - Calcium Gluconate IV
    - *K - Kayexalate orally or rectally
    - *S - Sodium Bicarbonate IV (if patient is acidotic)

Hypokalemia (low K^+):

- S/S: muscle cramps, weakness, constipation/ileus, palpitations
- Monitor: tele for **U waves, PVCs, VT**, prolonged QT
- Labs: K^+ trend, Mg^{2+} (often low together)
- Meds to review:
    - Loop/thiazide diuretics
    - Insulin/dextrose, albuterol (shifts K^+ intracellular)
    - Laxatives, steroids

Sodium (Na^+)

Hypernatremia:

- S/S: confusion, lethargy, irritability, possibly seizures
- V/S: orthostatic hypotension, tachycardia (dehydration)
- Labs: Na^+ trend, BUN/Cr, serum osmolality, urine studies if available
- Meds: high-dose diuretics, osmotic diuretics, NS/3% saline infusions

Hyponatremia:

- S/S: confusion, headache, nausea, vomiting, seizures, decreased LOC
- V/S: may be normal or slightly low BP; watch for fluid overload signs (edema, crackles)
- Labs: Na^+ trend, serum osmolality, urine Na^+ if available
- Meds: thiazide diuretics, antidepressants, anticonvulsants, desmopressin, etc.

Magnesium (Mg^{2+}) & Calcium (Ca^{2+}) – ultra quick

Low Mg^{2+} / Low Ca^{2+}:

- S/S: twitching, tremors, tetany, Trousseau/Chvostek, arrhythmias
- Monitor: tele (prolonged QT, torsades with low Mg^{2+})
- Meds: diuretics, PPIs, poor intake/TPN issues

High Mg^{2+} / High Ca^{2+}:

- S/S: weakness, decreased DTRs, bradycardia, hypotension (esp. Mg^{2+}), confusion
- Think: renal failure, excess supplements, malignancy (for Ca^{2+})

5. Abnormal Coags (High INR / Long PT/PTT)

S/S to check

- Easy bruising, petechiae, ecchymoses
- Oozing from IV sites, gums, nose
- Hematuria, GI bleeding, heavy menses
- Any recent invasive procedures (line placements, biopsies, surgeries)

V/S & monitoring

- BP, HR for signs of bleeding/shock
- Neuro checks: sudden headache, confusion, focal deficits → ICH concern
- I&O (hematuria, low urine output)

Labs to consider

- INR, PT, aPTT
- Platelet count
- Fibrinogen, D-dimer (if DIC concern)
- LFTs (liver function)
- H/H trend

Meds to review

- Warfarin (check last dose + indication)
- Heparin/LMWH, DOACs (apixaban, rivaroxaban, etc.)
- Antiplatelets (ASA, clopidogrel, ticagrelor)
- Herbal/supplements (ginkgo, ginseng, etc. if documented)

6. LVADs (Very High-Level View)

> ⚠️ Every LVAD program has **strict protocols**. This is just a pattern checklist; always follow your VAD team's instructions.

S/S to check (patient first, device second)

- Neuro: any stroke-like symptoms (weakness, slurred speech, confusion, vision loss)
- Perfusion: LOC, cap refill, skin temp, urine output
- SOB, chest pain, dizziness, syncope
- Bleeding: GI bleed, epistaxis, hematuria, driveline bleeding

Device assessments

- Is the pump "hum" present and continuous? (HM3 will have the High and Low Hum)
- Controller: Any alarms/messages?
- Power: Are **two power sources** connected (batteries/wall)?
- Driveline: Dressing intact, no pulling, no redness/purulence

V/S & monitoring

- Many LVAD pts have **no palpable pulse** and weird NIBPs
- Use **Doppler MAP** per protocol (Normal target 60–80 MAP)
- Tele for arrhythmias (AFib, VT can decrease flow), but most have AICD - PM.

Labs to consider

- H/H (hemolysis/bleeding)
- LDH, haptoglobin, bilirubin (hemolysis markers)
- INR (if on warfarin—often a target range)

- BMP (renal perfusion, K^+)

Meds to review

- Anticoag: warfarin (with set INR goal)
- Antiplatelet: aspirin ± others
- HF meds: beta blockers, ACEI/ARB/ARNI, diuretics, etc., as ordered
- Any ACHS (antibiotics for driveline infection, etc.)

Alarms – very general

- **Low flow**: think low volume, RV failure, obstruction, tamponade, big arrhythmia
- **Low battery/power**: fix power FIRST, per protocol - Cart or Emergency bag should be available at all times
- **Controller issues**: VAD coordinator guidance, contact CNC, New controller is located in Emergency Bag

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7. Art Lines: Over vs Under Damping (Quick Visual Cue Sheet)

Always:

- Check the patient first (does reading fit the picture?)
- Check transducer level and zero (phlebostatic axis in correct position)
- Ensure pressure bag at ~300 mmHg and continuous flush

Over-damped waveform

- **Appearance:** Sluggish, rounded waveform, little/no dicrotic notch
- **Numbers:**
    - SBP falsely **low**
    - DBP falsely **high**
    - Narrow pulse pressure
- **Common causes:**
    - Air bubbles, clot, kinks in tubing
    - Loose connections
    - Catheter against the vessel wall
- **Nurse troubleshooting:**
    - Inspect and flush the line
    - Remove air, straighten tubing, and check all connections
    - Re-zero and level
    - Compare with cuff BP

Under-damped waveform

- **Appearance:** Very tall, “spiky” waveform with lots of oscillations
- **Numbers:**
    - SBP falsely **high**
    - DBP falsely **low**
    - Wide pulse pressure
- **Common causes:**
    - Tubing too long or stiff
    - Excessive stopcocks
- **Nurse troubleshooting:**
    - Ensure standard-length tubing
    - Check for extra stopcocks/devices
    - Re-zero, re-level
    - Compare with cuff BP

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8. CVP: Basic Troubleshooting Framework

Think: **1) Line & equipment, 2) Patient position, 3) Hemodynamics.**

Check the setup

- Transducer level at phlebostatic axis
- Zeroed correctly at start of shift and with bed changes
- No air, no kinks, all clamps open
- Correct port (distal lumen in CVC/PA cath per policy)

Patient factors

- Patient flat or at ordered HOB angle when reading?
- On mechanical ventilation? (PEEP and intrathoracic pressure can raise CVP)
- Recent fluid bolus, diuresis, or bleeding?

Patterns (very simplified)

- **Low CVP** (if accurate):
    - Possible hypovolemia, vasodilation, dehydration
    - Check: dry mucous membranes, poor skin turgor, tachycardia, low BP/MAP, low UOP
- **High CVP** (if accurate):
    - Possible fluid overload / RV failure / pulmonary HTN / tamponade
    - Check: JVD, edema, crackles, hepatomegaly, low UOP, hypotension

Meds & interventions to be aware of

- Recent diuretics or large fluid boluses
- Vasopressors or vasodilators
- Inotropes that affect RV/LV function

9. Big Picture: How to Think About Vasopressors

“Pressors” = meds that ↑ BP/MAP by:

- Squeezing vessels (**vasoconstriction**)
- Increasing contractility (**inotropy**)
- Increasing HR (**chronotropy**)

Most act on **α (alpha)** and **β (beta)** receptors:

- **α_1**: vasoconstriction → ↑ SVR → ↑ BP
- **β_1**: ↑ HR & contractility → ↑ CO
- **β_2**: vasodilation/bronchodilation (usually weaker in this context)

Many require a **central line**, **cardiac monitoring**, and **frequent reassessment**.

Quick Mental Cheat - IMC

- **Dobutamine** – IV, **β_1**, “**pump helper**,” may ↓ BP, watch HR/arrhythmias
- **Milrinone** – IV, **PDE-3 inodilator**, “**pump + vasodilate**,” good for RV/pulm HTN, long half-life, watch BP & kidneys
- **Midodrine** – oral **α_1**, “**daytime squeeze pill**,” chronic/step-down hypotension, watch for supine hypertension

1. Norepinephrine (Levophed)

Receptors / Effect

- Strong **α_1** (vasoconstriction), some **β_1** (inotropy)
- ↑ SVR and MAP with less HR bump than dopamine/epi

Commonly used for

- First-line in many forms of **septic shock** and **vasodilatory shock** in guidelines

What to remember

- Go-to **"workhorse" pressor** in many ICUs
- Watch:
    - Fingers/toes for **ischemia** on high doses (intense vasoconstriction)
    - HR/rhythm – tachyarrhythmias possible, but less than dopamine/epi
- Prefer **central line**; if peripheral:
    - Check site **very frequently**
    - Know your **extravasation protocol** (e.g., phentolamine, elevation, notify provider)

2. Epinephrine

Receptors / Effect

- Mixed **α_1 + β_1 + β_2**
- ↑ HR, ↑ contractility, ↑ SVR (dose-dependent)

Commonly used for

- **Cardiac arrest** (ACLS) - 1mg - 1:10,000 IV Blous from Preloads in crash cart
- Allergic reaction - 0.3mg - 1:1,000 IM from glass ampules
- Drip in refractory **septic shock** or **cardiogenic shock** per protocol

What to remember

- Very **pro-arrhythmic** (watch for SVT, VT, AFib with RVR)
- Can cause **lactic acidosis** and **hyperglycemia**
- Expect ↑ HR and often ↑ ectopy/PVCs
- **Central line strongly preferred** for continuous infusion

3. Phenylephrine (Neo-Synephrine)

Receptors / Effect

- Almost pure **α_1 agonist**
- Vasoconstriction → ↑ SVR, ↑ BP
- Little direct effect on HR/contractility

Commonly used for

- Hypotension with **tachyarrhythmias** when you don't want β_1 stimulation
- OR/ICU and procedural areas for **transient hypotension** (boluses/drips)

What to remember

- Good when **HR is already high** and you just need more **squeeze**
- Can cause **reflex bradycardia**
- Watch for **decreased organ perfusion**:
    - MAP looks "fine" but extremities are cold, mottled → too much clamp

4. Vasopressin (ADH analog)

Receptors / Effect

- Acts on **V_1 receptors** → vasoconstriction
- Acts on **V_2 receptors** in kidneys → water reabsorption
- **Non-adrenergic** (not α or β) → often used as an **add-on** to catecholamines

Commonly used for

- Adjunct in **septic shock** when norepi alone isn't enough
- Some protocols for **GI bleeding**, **post-cardiac surgery**, etc.

What to remember

- Often run at a **fixed dose** (not titrated) in many protocols
- Can help **reduce norepi requirements**
- Watch for **decreased perfusion** to gut, skin, extremities (intense vasoconstriction)
- Older ACLS algorithms used it; now **epi** is preferred, but you may still see references

5. Dopamine

Receptors / Effect (dose-dependent conceptually)

- Low-dose: dopaminergic (renal/mesenteric vasodilation – “renal dose” is now considered **outdated**)
- Mid-dose: **β_1** → ↑ HR & contractility
- High-dose: **α_1** → vasoconstriction

Commonly used for

- Historically for **shock & bradycardia**
- Many guidelines now prefer **norepi or other agents** due to arrhythmia risk

What to remember

- Big risk: **tachyarrhythmias** (SVT, VT)
- Not as common in many modern ICUs; if you see it, it’s fine to wonder:
    - “Why dopamine instead of norepi/epi?” (just ask respectfully)
- Monitor HR, rhythm, UOP, and watch for **ectopy**

6. Dobutamine (Inotrope)

What it is / Receptors

- Mainly **β_1 agonist**, some β_2
- Think: **"more squeeze, mild vasodilation"**

Hemodynamic effect

- ↑ **Contractility** and **cardiac output**
- Mild ↓ SVR → **BP can drop** even though CO improves

Common uses

- **Cardiogenic shock** with low CO
- Decompensated **systolic HF**
- Sometimes in combo with norepi:
    - **Norepi = squeeze**
    - **Dobutamine = squeeze + pump**

What to remember

- BP: may **lower BP**; don't be surprised if MAP dips when starting/titrating
- HR/rhythm: **tachycardia, PVCs, SVT, VT** → continuous tele
- Chest pain/ischemia: ↑ myocardial O_2 demand
- Often **central line preferred**, ICU-level monitoring
- Think of it as: **"help the heart squeeze," not primarily a BP drug**

7. Milrinone (Inotrope / “Inodilator”)

What it is

- **PDE-3 inhibitor** → ↑ intracellular cAMP in heart & vessels
- Think: **“dobutamine’s cousin that also relaxes the vessels and lungs”**

Hemodynamic effect

- ↑ **Contractility (inotropy)**
- **Vasodilation** of systemic & pulmonary vasculature → ↓ SVR & ↓ PVR
- Can significantly **drop BP**, especially if volume-depleted

Common uses

- Advanced **systolic heart failure** (acute decompensation)
- **Cardiogenic shock**, especially with RV involvement or **pulmonary HTN**
- Post–cardiac surgery, **LVAD** patients as bridge/support
- Sometimes used long-term as a **continuous home infusion**

Key pharmacology pearls

- **Renal clearance** → doses often adjusted in kidney dysfunction
- **Long half-life** vs dobutamine:
    - Changes take **longer to show up**
    - Bad effects (like hypotension) can **linger**

What to remember

- BP: careful monitoring for **hypotension** and dizziness
- HR/rhythm: risk of **ventricular arrhythmias**
- Renal function: watch **Cr/BUN and UOP** (affects drug level)
- Watch perfusion:
    - Better: **warm extremities, improved UOP, clearer mentation**
    - Worse: **cold, mottled, low UOP, rising lactate**

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8. Angiotensin II (Giapreza)

Receptors / Effect

- Synthetic **angiotensin II → potent vasoconstriction**
- ↑ SVR and MAP

Commonly used for

- **Refractory vasodilatory shock** (e.g., septic shock) not responding to catecholamines + vasopressin
- Typically in **advanced/tertiary ICUs**

What to remember

- You may **not see it often** unless you're in a big cardiac/medical ICU
- Requires **very close monitoring** and is usually tightly controlled by ICU team + pharmacy
- **Thrombotic risk** – patients often on DVT prophylaxis as ordered

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9. Midodrine (Oral Vasopressor)

What it is / Effect

- Oral **α_1 agonist** → vasoconstriction
- Think: **"daytime squeeze pill"** often used to keep BP up when weaning off IV pressors or for chronic orthostatic hypotension

Hemodynamic effect

- ↑ SVR → ↑ BP / MAP
- No direct inotropy; effect is mostly **vascular**, not "pump"

Common uses

- **Chronic orthostatic hypotension**
- Step-down/IMC: **weaning from IV pressors** in pts who still run soft but are otherwise stable
- Helps avoid restarting an IV pressor every time they stand up / ambulate

What to remember

- **Timing**
  - Usually given **during the day** (when pt is upright & active)
  - Often **avoided near bedtime** due to risk of **supine hypertension**
- **BP monitoring**
  - Check BP **before** and ~1 hour **after** dose (per unit policy)
  - Know **hold parameters** (e.g., "hold if SBP > ___ or MAP > ___")
- **Side effects**
  - Supine hypertension (headache, vision changes, chest pain when lying flat)

    - “Goosebumps,” scalp tingling/itching, urinary retention

- **Not for crashing hypotension**
    - Onset is **not instant** → think **supportive, not rescue**
    - You still need **IV pressors** for acute shock per protocol

10. Quick Safety Checklist for Any Vasopressor

When you see a pressor or inotrope, quickly ask yourself:

1. Do I understand the reason it's ordered?

- Septic, cardiogenic, neurogenic, post-op, etc.

2. Is access appropriate?

- Central line vs peripheral policy
- Site checks **documented** and performed

3. What's the ordered MAP/BP goal?

- Even if you didn't choose it, know what you're aiming for

4. What is the titration order?

- Minimum and maximum rates
- How often you can adjust
- Documentation requirements

5. What am I watching for?

- HR & rhythm: **brady vs tachy vs ectopy**
- Extremities: **warm vs cold, mottled, cyanotic digits**
- UOP, mental status, **lactate trends** (per provider orders)

6. What's the backup plan?

- If BP tanks despite titration → **who do I call, what protocol?**
- If **extravasation** occurs → know your facility's protocol (e.g., phentolamine, elevation, notify provider)

10. General Cardiac Medications Overview

1. Beta Blockers

Examples (common ones you'll see)

- **Metoprolol** (Lopressor, Toprol XL)
- **Carvedilol** (Coreg – also has some α-blocking)
- **Atenolol**, **Bisoprolol**
- **Labetalol** (mixed α/β – often IV for BP control)
- **Esmolol** (IV drip, short-acting, ICU/OR)

Think of it as…

> "**Brake pedal** for the heart" – slows HR and decreases squeeze to reduce O_2 demand.

Common uses

- Rate control in **AFib**, SVT (some situations)
- **Chronic HF** (carvedilol, metoprolol succinate, bisoprolol)
- **Post-MI**, CAD, angina (reduce workload)
- BP control (often not first-line alone, but commonly used)

Watch for

- **HR & BP**:
    - Hold parameters like HR < 50–60, SBP < 90–100 (per order set)
- **Signs of intolerance**:
    - Dizziness, fatigue, near-syncope

- Worsening SOB/edema in pts with decompensated HF if started/aggressively titrated

- **Asthma/COPD**:
  - Non-selective β-blockers (propranolol) can worsen bronchospasm
  - Cardioselective (metoprolol, bisoprolol) are “safer” but still use caution
- **Masking hypoglycemia**:
  - Can blunt tachycardic response in diabetics
- **Never stop abruptly**:
  - Rebound tachycardia, hypertension, angina/MI risk — usually tapered

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2. Nitrates

Examples

- **Nitroglycerin** (SL, IV drip, paste, spray)
- **Isosorbide mononitrate/dinitrate**

Think of it as…

> “**Venous and coronary vasodilator**” – drops preload and improves coronary blood flow = less chest pain.

Common uses

- **Acute angina** and chronic angina prevention
- ACS (with appropriate BP and no contraindications)
- Sometimes in acute HF to reduce preload/afterload (IV nitro)

Watch for

- **BP**:
    - Hypotension, especially after multiple SL tabs or starting IV drip
    - Check BP before and after dosing per protocol
- **Headache & flushing**:
    - Very common; reassure patient but also assess severity
- **Chest pain assessment**:
    - Re-check pain, vitals, and EKG if ordered after each SL dose
- **Contraindications**:
    - Recent **PDE-5 inhibitors** (sildenafil/Viagra, tadalafil/Cialis, etc.) → risk of profound hypotension
- **Tolerance**:
    - Long-term oral/topical nitrates often have **"nitrate-free" intervals** (e.g., at night) to prevent tolerance

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3. Pulmonary Hypertension (PH) Meds

a) PDE-5 inhibitors (for PH)

- **Sildenafil (Revatio)**, **Tadalafil (Adcirca)** for pulmonary arterial HTN (PAH)
- **Think:** vasodilation of pulmonary vasculature → ↓ PVR, improved RV output

Watch for

- BP (systemic hypotension)
- Headache, flushing
- **Absolutely avoid nitrates** (same interaction as Viagra for ED)

b) Endothelin Receptor Antagonists (ERAs)

- **Bosentan**, **Ambrisentan**, **Macitentan**

Think of it as…

> "Block a powerful vasoconstrictor (endothelin)" → pulmonary vasodilation, ↓ vascular remodeling.

Watch for

- **Liver function** (LFT monitoring)
- Edema, anemia (check CBC)
- Teratogenic → strict pregnancy precautions in women of childbearing age

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c) Prostacyclin Analogues / Prostacyclin Receptor Agonists

- **Epoprostenol (Flolan, Veletri)** – continuous IV
- **Treprostinil (Remodulin)** - IV, SQ, inhaled, PO
- **Iloprost** (inhaled)
- **Selexipag** (oral prostacyclin receptor agonist)

Think of it as…

> "**Very potent vasodilators + antiplatelet**" effects in the pulmonary circulation.

Watch for

- **Line safety**:
    - For continuous IV epoprostenol/treprostinil → **infusion must NEVER be interrupted** → risk of rebound PH and death

- BP: systemic hypotension, flushing, jaw pain, headache
- Bleeding risk (antiplatelet effect)
- For inhaled: bronchospasm, cough

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d) Soluble Guanylate Cyclase Stimulators

- **Riociguat**

Think of it as…

"Boosts NO pathway" → vasodilation in pulmonary circulation.

Watch for

- BP (hypotension)
- **Contraindicated with PDE-5 inhibitors or nitrates** (stacked vasodilation)
- Pregnancy precautions

For new grads: you don't need to be a PH pharmacist.
Your job:

- Know **this is a specialty med**
- Don't allow missed doses without escalating
- Watch **BP, symptoms, and timing** (especially for continuous infusions and paired drugs like nitrates/PDE-5s)

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4. Diuretics

a) Loop Diuretics

Examples

- **Furosemide** (Lasix)
- **Bumetanide** (Bumex)
- **Torsemide**

Think of it as…

"**Big gun fluid remover**" – pulls fluid off fast, especially from lungs.

Common uses

- Acute **HF exacerbation** (pulmonary edema)
- Volume overload (edema, ascites)
- Sometimes for HTN (adjunct)

Watch for

- **I&O, daily weights** – are we actually pulling fluid?
- **Electrolytes**:
  - ↓ K^+, ↓ Mg^{2+}, sometimes ↓ Na^+, metabolic alkalosis
- **Renal function**:
  - Watch BUN/Cr, UOP (oliguria → maybe kidneys are not happy)
- **BP**: orthostatic hypotension
- **Symptoms**: dizziness, weakness, cramps (low K^+/Mg^{2+})

b) Thiazide & Thiazide-like Diuretics

Examples

- **Hydrochlorothiazide (HCTZ)**
- **Chlorthalidone**
- **Metolazone** (often used with loops in HF)

Think of it as…

"**Gentler, longer-acting diuretics**" – more for BP control and mild-mod edema.

Common uses

- **Hypertension** (very common outpatient med)
- Chronic edema, HF adjunct (metolazone + loop = "sequential nephron blockade")

Watch for

- Electrolytes:
  - ↓ K^+, ↓ Na^+
  - ↑ Ca^{2+}
- **Glucose & lipids**: can worsen in diabetics (long term)
- Dehydration, dizziness, orthostasis

c) Potassium-Sparing / Aldosterone Antagonists

Examples

- **Spironolactone**
- **Eplerenone**
- **Amiloride**, **Triamterene** (usually combined with thiazides)

Think of it as…

> "**Milder diuretics that spare K^+ and block aldosterone**."

Common uses

- **HF with reduced EF** (spironolactone, eplerenone – mortality benefit)
- Cirrhosis/ascites (spironolactone)
- Adjunct to prevent hypokalemia from loops/thiazides

Watch for

- **High K^+ (hyperkalemia)**:
  - Especially with ACEI/ARB, ARNI, or K^+ supplements
- **Renal function**: decreased GFR → higher K^+ risk
- Spironolactone: can cause **gynecomastia**, menstrual irregularities

d) Osmotic Diuretics

Example

- **Mannitol**

Think of it as…

> "**Sugar water that pulls fluid**" – shifts fluid from brain/eye into blood then out via kidneys.

Common uses

- ↑ ICP, cerebral edema
- Certain cases of acute glaucoma

Watch for

- Initial **fluid overload** (pulled into intravascular space) → then diuresis
- BP and signs of HF decompensation in fragile hearts
- Renal function and UOP (needs functioning kidneys)

Cheat Sheet

Class	Examples	Think of it as…	Key watches
Beta blockers	Metoprolol, Carvedilol, Labetalol	Heart **brake pedal**	HR/BP, bronchospasm, masking hypo
Nitrates	Nitro, Isosorbide	**Chest pain reliever**, vasodilator	BP, headache, NO PDE-5s (PHTN)
PH meds	Remodulin, Sildenafil, Bosentan, Epoprostenol	**Pulm vasodilators**	BP, line safety, drug interactions
Loop diuretics	Lasix, Bumex	**Big gun fluid off**	I&O, K^+/Mg^{2+}, BP, kidney function
Thiazides	HCTZ, Metolazone	**Gentler, BP diuretics**	Na^+/K^+, Ca^{2+}, glucose, orthostasis
K-sparing	Spironolactone, Eplerenone	**K^+-friendly aldosterone blockers**	HyperK, renal function, gynecomastia
Osmotic	Mannitol	**Brain/eye fluid shift**	ICP, volume status, kidneys

11. External Pacing – Safety & Values

1. **Transcutaneous pacing** – pacing pads via defib/monitor

2. **Temporary transvenous pacing** – a pacing wire in the heart attached to an **external pacemaker box**

You'll see both, but external **boxes** and wires (TVP) are very common in cardiac units/ICUs. Make sure they are capped and cared for if not being actively used.

Core concepts (apply to both)

Four basic ideas to understand:

- **Rate (bpm)** – how fast the pacemaker is trying to pace
- **Output (mA)** – how strong the electrical stimulus is
- **Sensitivity (mV)** – how well the pacemaker "sees" the patient's own beats
- **Capture** – did the pacer actually make the heart beat?

A. Transcutaneous Pacing (pads on chest)

When used:

- Usually **emergent/short-term** for symptomatic bradycardia while you fix the cause or place a transvenous/permanent pacer.

Stepwise mental model:

1. **Apply pads correctly** - anterior/posterior (prefered) or ant/lat
2. Set **pacing mode** (often demand) and **rate** (commonly ~60–80 bpm or as ordered).
3. Increase **output (mA)** until you see **electrical capture**:
    - Each pacer spike followed by a wide QRS on the monitor.
4. Confirm **mechanical capture**:
    - Palpable pulse with each paced beat or HR on pulse ox matching paced rate.

Safety points:

- It's **painful** – if the patient is conscious and time allows, advocate for **analgesia/sedation**. *No one has ever died from pain!*
- Make sure the **monitor ECG leads (3 LEAD)** are on and giving a clean signal (pads don't show a good ECG by themselves).
- Continuous monitoring: watch for loss of capture, changes in rhythm, skin burns, or breakdown under pads.
- Reassess Vitals Regularly - Blood Pressure may need additional assistance.

(You won't usually be fiddling with sensitivity here – the defib handles it.)

B. Temporary Transvenous Pacer (TVP + Box)

Typical knobs on the box:

- **Mode** – e.g., VVI, AAI, DDD (ventricular pacing only, atrial only, dual-chamber)
- **Rate (bpm)** – ~ 60–80, but you **always** follow the order.
- **Output (mA)** – strength of impulse
- **Sensitivity (mV)** – how big a signal the pacer needs to "see" a native beat

1. Output & Capture

- **Output (mA)** = current delivered to the myocardium.
- **Capture threshold** = **lowest mA** that still consistently causes a beat after each spike.

How it's usually set (conceptually):

1. Set a rate above native so the pacer is doing the work.
2. Start with a **higher mA** and slowly **turn it down** until capture is lost.
3. Note that minimum mA = **capture threshold**.
4. Then set the output to about **2× the capture threshold** to give a safety margin (or per protocol, often "threshold + 2–3 mA" or "+10%").

2. Sensitivity (mV)

- **Sensitivity** = how well the device "sees" intrinsic beats.
- It's measured in **millivolts (mV)**; a **lower number = more sensitive** (picks up smaller signals).

Problems to recognize:

- **Under-sensing** (pacer isn't seeing native beats):
    - Pacing spikes show up **on top of** QRS/T waves (dangerous).
- **Over-sensing** (pacer thinks noise = beats):
    - Pacer doesn't fire even though the patient is brady/asystolic.

C. Nursing Safety Checklist for External Pacers

Pulled and simplified from multiple pacing protocols.

General:

- **Never** assume the box is set correctly – **check settings at the start of every shift**:
    - Mode, rate, output, sensitivity, battery status, alarms.
- Ensure the **control panel is locked** if your device has that feature, to prevent accidental knob bumps.
- Secure all connections (wires at skin, cable into box) – label clearly ("**Temporary pacer – DO NOT TURN OFF**").
- Make sure to wear gloves while touching exposed ends of the pacing wires.

Battery & power:

- Know **how to change the battery** and whether your policy requires **two RNs at bedside** for a change.
- Never disconnect external power without checking battery strength.

Insertion site & movement:

- **Jugular/subclavian/antecubital sites**:
    - Limit arm movement on the affected side; excessive stretching can dislodge the wire.
    - HOB often limited (e.g., ≤ 45°) depending on protocol.
- **Femoral site**:
    - Keep the leg mostly straight and limit hip flexion to avoid wire displacement.

Ongoing assessment:

- Continuous **telemetry** – watch for:
    - Consistent **capture** (spike followed by appropriate P/QRS)
    - HR that matches the **set rate** (or demand behavior)
- Frequent **pacer checks** after:
    - Patient repositioning
    - Bed transfers, transport, procedures
    - Big electrolyte shifts (especially K^+, Mg^{2+}, acid–base) – can alter thresholds.

If things go south:

- Loss of capture or pacer failure + symptomatic patient = **emergency**:
    - Check patient first (pulse, responsiveness).
    - Check connections and quickly turn output up if trained/allowed.
    - Call for help (charge, provider, RRT, code) while someone manages ABCs.