# Impella Heart Pump

Microaxial pumps for shock and high-risk PCI: signals, purge, alarms, care

**Medic Basics**
medicbasics.com · checked Oct 2026

## HOW IT WORKS

A catheter-mounted microaxial pump crosses the aortic valve, moving blood from the LV into the aorta. Flow is continuous, with no ECG or pressure trigger (unlike the IABP).

- Unloads the LV: lower LVEDP and PAOP, less work
- Adds forward flow: higher MAP, cardiac output, coronary perfusion
- Preload dependent: needs LV filling and a working RV
- If VA-ECMO starts, may stay in to unload the LV

| PUMP | ACCESS | FLOW | LABELED USE |
|---|---|---|---|
| **CP** | Femoral or axillary artery | 3.3–3.7 L/min (peaks 4.3) | HRPCI ≤6 h; shock ≤4 days |
| **5.5** | Surgical axillary graft or aorta | Up to 5.5 L/min | Shock ≤14 days; can walk |
| **RP Flex** | IJ or femoral vein to PA | About 4 L/min | RV failure after LVAD, MI, transplant or surgery; ≤14 days |

## WHO GETS ONE

Indications: shock from isolated LV failure <48 h after MI or heart surgery, or from cardiomyopathy (including peripartum) or myocarditis, despite fluids, pressors and inotropes. Also high-risk PCI in stable patients (heart team decision).

Contraindications (left-sided pumps):

- LV mural thrombus
- Mechanical aortic valve or heart constrictive device
- Aortic stenosis or calcification, valve area ≤0.6 cm²
- Moderate to severe aortic regurgitation
- Severe PAD blocking access
- ASD or VSD, including post-MI VSD
- Shock only: RV failure, LV rupture, tamponade, heart-lung failure

DanGer Shock (2024): in STEMI shock, Impella CP lowered 180-day mortality (46% vs 59%) but raised bleeding, limb ischemia and dialysis. 2025 ACC/AHA ACS guideline: microaxial pump class 2a in selected STEMI with severe or refractory shock; routine IABP class 3.

## READING THE CONTROLLER

P-levels (P-0 to P-9) set motor speed.

| SIGNAL | CORRECT | MALPOSITIONED |
|---|---|---|
| **Placement signal (outlet sensor)** | Aortic waveform | Ventricular: outlet in LV, too deep |
| **Motor current** | Pulsatile: inlet in LV, outlet in aorta | Flat: whole pump in LV or in aorta |
| **Echo (CP)** | Inlet 3.5 cm below the valve | Over 4 cm deep, or inlet in aorta |

**EXAM TIP** Exams pair the signals: aortic placement signal plus pulsatile motor current = correct. Flat motor current in a beating heart = both ends on one side of the valve. A very weak LV dampens the signals ("Position Unknown").

**SAFETY** At P-0 (possibly P-1), blood flows backward through the pump into the LV. Keep P-2 or higher while it crosses the valve.

## PURGE SYSTEM

Pressurized purge fluid keeps blood out of the motor.

- Base: dextrose in water (D5W recommended; 5–20% allowed). Never saline.
- Add heparin 25 or 50 units/mL, or bicarbonate 25 or 50 mEq/L if heparin is contraindicated. Never both; no other anticoagulant.
- Purge pressure 300–1100 mmHg; flow 2–30 mL/h
- Purge heparin counts toward the total heparin dose
- Cassette change: finish within 90 s of luer disconnection

**EXAM TIP** HIT: stop all heparin, purge included. Use a bicarbonate-dextrose purge and IV argatroban or bivalirudin, per your institution's or agency's protocols.

## ALARMS AND FIRST MOVES

| ALARM | LIKELY CAUSE | FIRST MOVES |
|---|---|---|
| **Suction** | Underfilled LV (volume, RV failure) or inlet on wall | Lower P-level; check volume, RV, position |
| **Position in ventricle or in aorta** | Whole pump on one side of valve | P-2; provider repositions with imaging |
| **Placement signal low** | Outlet at valve, too deep; motor current pulsatile | Assess LV function; imaging; provider repositions |
| **Purge pressure low (<300)** | Leak or dextrose too dilute | Find leak; raise dextrose; new cassette |
| **Purge pressure high (≥1100) or blocked** | Kink or dextrose too strong | Unkink; switch to D5W; watch motor current |
| **Impella stopped** | Backflow into LV | Restart, or withdraw pump from LV |

**EXAM TIP** Suction is a filling problem: lower the P-level and fix volume or the RV. Raising it worsens suction.

## COMPLICATIONS AND NURSING CARE

*Hemolysis causes: malposition, suction, underfilling, high P-level. First moves: confirm position by echo, fix filling, lowest P-level that supports the patient.*

| COMPLICATION | WATCH FOR |
|---|---|
| **Hemolysis** | Dark, red or pink urine; falling Hgb; plasma free Hgb >40 mg/dL |
| **Limb ischemia** | Cool, pale, pulseless leg; may need an antegrade perfusion sheath |
| **Bleeding** | Site hematoma; retroperitoneal flank pain, hypotension |
| **Also** | AKI, stroke, valve or vessel injury, low platelets |

- Femoral: leg straight (knee immobilizer), HOB ≤30°; turn with care (pump can shift)
- Pulses, color, warmth, site; hourly urine output and color
- Heparin per protocol (IFU ACT 160–180 s; aPTT or anti-Xa common)
- RV failure: rising CVP, low flows, suction
- Weaning: down 2 P-levels at a time; ≥P-2 until pulled from LV; sheath out at ACT <150 s
- Transport: battery ≥60 min; no commercial flights; air transport needs grounding and Flight Mode

**SAFETY** MRI unsafe. Arrest: CPR with lower pump flow; defibrillate without touching the pump, cable or controller; recheck position by echo.

**Sources** (15) are listed with links at medicbasics.com/sheets/impella.html. For education and exam preparation only. Not medical advice; follow current guidelines and your institution's protocols. Medic Basics is an independent study aid not affiliated with any certifying body.