Impella Heart Pump

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

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 icubasics.com/sheets/impella.html. For education and exam preparation only. Not medical advice; follow current guidelines and your institution's protocols. ICU Basics is an independent study aid not affiliated with any certifying body.