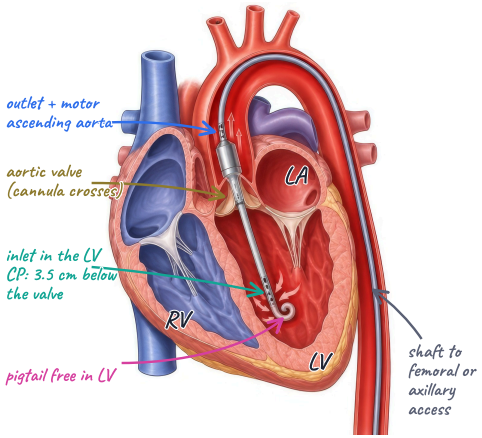
ER BASICS · ONE-PAGER

Impella Heart Pump

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

15 sources + more detail
erbasics.com/sheets/impella.html
checked Oct 2026

HOW IT WORKS Across the aortic valve



1 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

2 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.

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.

4 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.

5 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.

6 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.

MORE Hemodynamics in depth

The Impella is a continuous-flow axial pump in series with the LV: the inlet draws blood from the cavity and the impeller ejects it just above the aortic valve. Speed is fixed by the P-level, with no ECG or pressure trigger, so it pumps through VT, VF and asystole as long as the LV fills. An IABP adds about 0.5–1 L/min by displacement; a CP adds 3.5–4 L/min and a 5.5 up to 5.5 L/min of forward flow.

For education and exam preparation only. Not medical advice; follow current guidelines and your institution's protocols. ER Basics is an independent study aid not affiliated with any certifying body.