

Practical Management of Anticoagulation for Impella Percutaneous Mechanical Circulatory Support excellence.acforum.org

Background

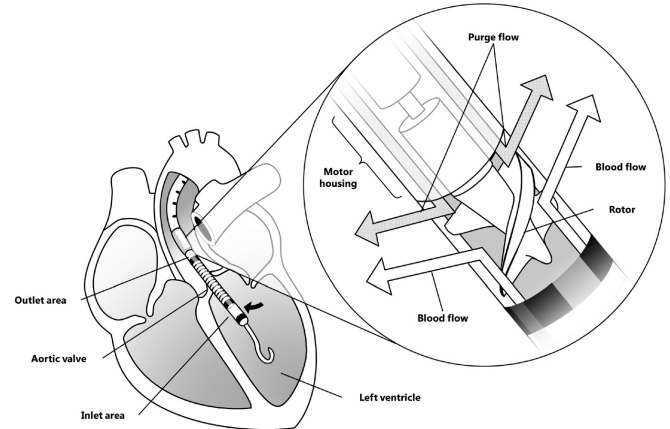
- There are many percutaneous ventricular assist devices (e.g., Intra-aortic balloon pump, Impella, TandemHeart)
- Impella devices are most widely used and are the focus of this resource
- Indications: for hemodynamic support during high-risk PCI and/or ongoing cardiogenic shock
- Mechanism: catheter-based transvalvular microaxial pump that aspirates blood from left ventricle into the aorta
- Heparin-based purge solution is essential to create a positive purge pressure, lubricate bearings, and prevent ingress of blood into the motor
- IV UFH can be supplemented to maintain adequate systemic anticoagulation needed to prevent thrombus formation

	Impella 2.5	Impella CP	Impella 5.5
Flow	2.5 L/min	4.3 L/min	6 L/min
Insertion Site	Femoral artery	Femoral artery	Axillary artery or aorta
Duration	≤4 days	≤4 days	≤14 days

BOTTOM LINE

DO	DON'T	CONSIDER	CAUTION
<ul style="list-style-type: none"> • Use UFH 25 U/mL in D5W as default purge • Supplement IV UFH as needed • Account for both sources of heparin • Have a protocol for anticoagulation with Impella 	<ul style="list-style-type: none"> • Use saline in purge solution • Use other anticoagulants (DTI, LMWH, fondaparinux) in purge • Use fondaparinux or DOAC for HIT in Impella patients 	<ul style="list-style-type: none"> • Bicarbonate-based purge (25mEq per 1000mL) when UFH not feasible due to bleeding, active HIT or consistently supratherapeutic UFH levels 	<ul style="list-style-type: none"> • D5W alone in the purge if bicarbonate not available • High dextrose concentrations • Fibrinolytic administration via the purge

Outlet Area⁶



Purge Solution

- Device controller automatically adjusts purge flow rate to target purge pressure 300-1100 mmHg. Flow rate ranges from 2-30 mL/hour
- Heparin is the default purge solution due to unique ionic charge that prevents deposition of denatured proteins and thrombi in the purge gaps
- The default concentration is 25 units/mL. Lower concentrations may not adequately protect the motor and higher ones may lead to over-anticoagulation
- For patients requiring biventricular support with Impella RP and 2.5, CP or 5.0, the same purge solution should be utilized for both devices

Standard	Non-standard	
UFH 25 units/mL in 500-1000 ml D5W	BBPS <ul style="list-style-type: none"> • HIT (with systemic DTI) • Bleeding (in absence of systemic IV UFH) 	D5W Only Only if BBPS not available

Systemic IV UFH

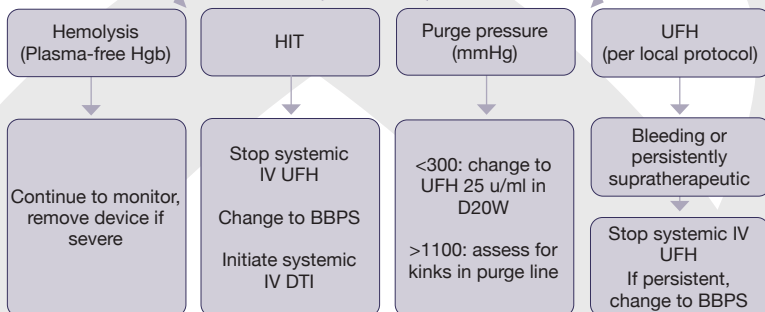
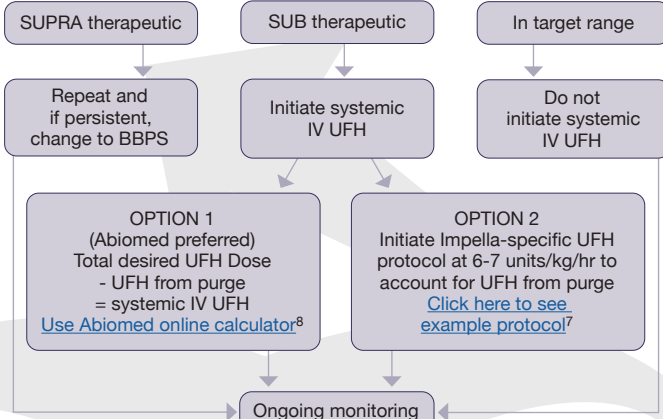
- Depending on the purge flow rate, the patient may need additional IV heparin for adequate levels of anticoagulation (see table 1)
- If IV UFH is added to existing heparin-based purge, both sources of heparin must be accounted for as both will contribute to systemic AC
- If concomitant ECMO is indicated (Ecpella), UFH cannulation bolus should be reduced to account for UFH in purge solution

TABLE 1 – Monitoring of UFH

• Not based on high-quality data • No assay has been shown to be superior

ASSAY	FREQUENCY	TARGET RANGE
ACT	Baseline, then q4h after each assessment or dose change until at target x 2, then q 6h	161-180 sec
aPTT (Lab Specific)	Baseline then q6h after each assessment or dose change until at target x 2 then qAM	Aim for low intensity equivalent to anti-Xa of 0.2-0.4 (e.g., 40-60 seconds)
Anti-FXa	Baseline then q6h after each assessment or dose change until at target x 2 then qAM	0.2-0.4 IU/ml

Initiate purge and check heparin assay in 4 hours



Best practices for Impella anticoagulation

- Use only programmable pumps with pump library
- Ensure use of institutional Impella-specific anticoagulation protocol
- Use standardized, evidence-based reversal and peri-procedural protocols when needed in Impella patients
- Use premixed commercial heparin infusion bags whenever possible to avoid errors
- Utilize multidisciplinary approach to Impella management
- Require tracking and reporting of adverse events associated with Impella
- Review and update local Impella protocols at least annually to ensure contemporary, optimized care

EXAMPLE: using 80 kg patient

Total desired UFH dose = 12 units/kg/hr (typical low-intensity ACS heparin protocol)
12 units X 80 kg= 960 units/hr UFH
Calculator will round to nearest 100 units (in this case, 1000 units/hr)

Anticoagulation Therapy with Impella[®] Heparin Infusion

Total Heparin Delivered to Patient (Rate)

Recommended by hospital protocol or pharmacy

1000.00 U/Hr

Determine heparin from purge solution

Purge concentration in units/ml X purge flow rate in ml/hour= purge UFH in ml/hr

Calculate Impella Delivered Heparin Rate

Heparin Concentration in Purge from AIC*

25.00 U/ml

Input purge UFH concentration

Purge Flow Rate from AIC*

*Taken from Automated Impella Controller™

15.00 mL/Hr

Impella Delivered Heparin Rate

375.00 U/Hr

Amount of UFH from purge

Total desired UFH- purge delivered UFH= systemic IV UFH rate

1000 u/hr – 375 units/hr= 625 units/hr

Results

Systemic IV Heparin Rate

625.00 U/Hr

Most UFH pump libraries are in units/kg/hr

If your institution uses units/kg/hr in their pump library, be sure to divide systemic IV UFH rate by patient weight to get units/kg/hr

625/80= 7.8 units/kg/hr

Abbreviations:

UFH—unfractionated heparin
IV—intravenous
DTI—direct thrombin inhibitor
LMWH—low-molecular weight heparin
DOAC—direct acting oral anticoagulant
HIT—heparin-induced thrombocytopenia
mEq—milliequivalent

mL—milliliter
D5W—dextrose 5% water
PCI—percutaneous coronary intervention
L—liter
CP—cardiac power
mmHG—millimeters mercury
BBPS—bicarbonate-based purge solution
ECMO—extracorporeal membrane oxygenation

Ecpella—ECMO with Impella
ACT—activated clotting time
aPTT—activated partial thromboplastin time
IU—international units
qAM—every morning
HgB—hemoglobin
kg—kilogram

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