

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

Background

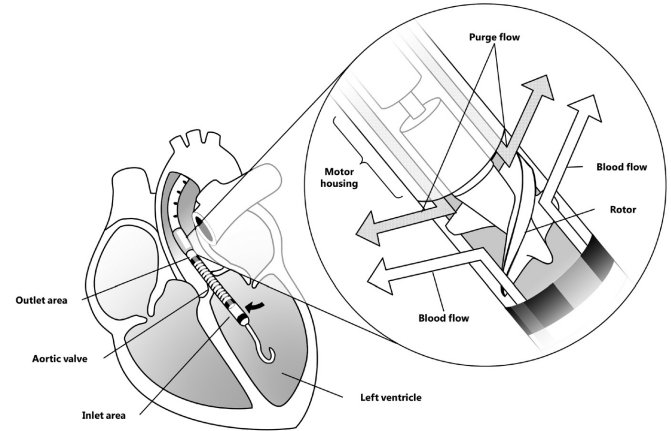
- There are many percutaneous ventricular assist devices (e.g., Intra-aortic balloon pump, Impella, TandemHeart)
- Impella devices are most widely used and are the focus of this resource
- Indications: for hemodynamic support during high-risk PCI and/or ongoing cardiogenic shock
- Mechanism: catheter-based 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"> <li>• Use UFH 25 U/mL in D5W as default purge</li> <li>• Supplement IV UFH as needed</li> <li>• Account for both sources of heparin</li> <li>• Have a standardized protocol for anticoagulation with Impella</li> </ul>	<ul style="list-style-type: none"> <li>• Use saline in purge solution</li> <li>• Use other anticoagulants (DTI, LMWH, fondaparinux) in purge</li> <li>• Use fondaparinux or DOAC for HIT in Impella patients</li> </ul>	<ul style="list-style-type: none"> <li>• Bicarbonate-based purge (25mEq per 1000 ml D5W) when UFH not feasible due to bleeding, active HIT or consistently supratherapeutic UFH levels</li> </ul>	<ul style="list-style-type: none"> <li>• D5W alone in the purge if bicarbonate not available</li> <li>• High dextrose concentrations</li> <li>• Fibrinolytic administration via the purge</li> </ul>

Outlet Area<sup>6</sup>



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	<b>BBPS*</b> <ul style="list-style-type: none"> <li>• HIT (with systemic DTI)</li> <li>• Bleeding (in absence of systemic IV UFH)</li> </ul>	<b>D5W Only</b> Only if BBPS not available

\* When using BBPS as purge solution, monitor risk of leaks forming in the yellow luer lock which may contribute to the pump stopping due to inadequate purge, particularly in use ≥ 14 days

Systemic IV UFH

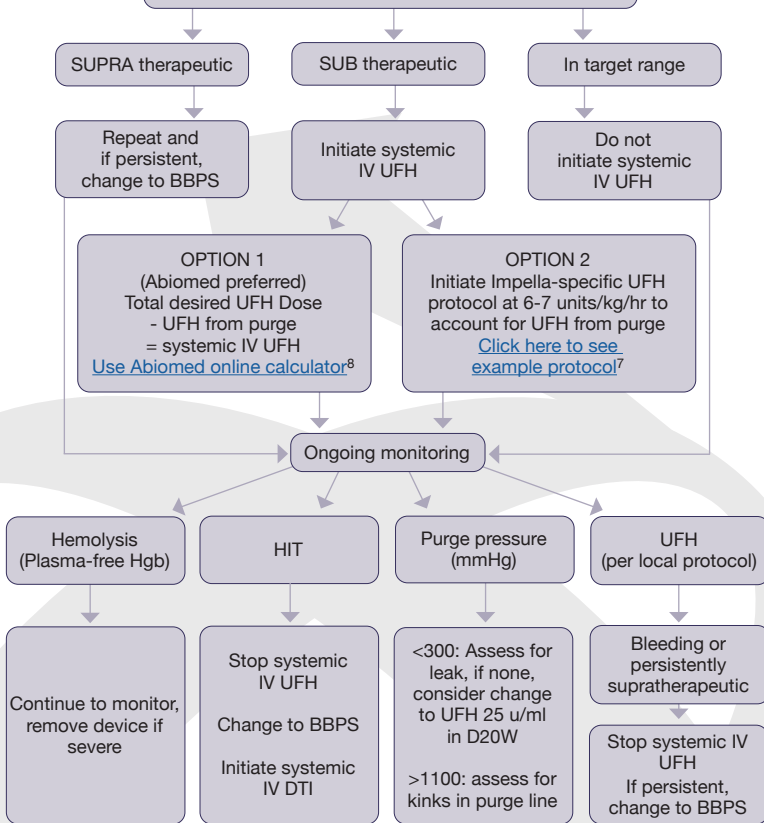
- Depending on the purge flow rate, the patient may need additional IV heparin for adequate levels of anticoagulation (see table 1)
- If IV UFH is added to existing heparin-based purge, both sources of heparin must be accounted for as both will contribute to systemic AC
- If concomitant ECMO is indicated (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
- Avoid cleaning the luer with isopropyl alcohol
- Contact the Abiomed Clinical Support Center 1-800-422-8666 if questions arise

**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<sup>®</sup> 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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