Nursing Management on Impella

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What is Impella?

Set up and insertion

Device and patient monitoring

Weaning and explant
01 Introduction
What is Impella?

Catheter diameter: 9Fr
Flow rate: up to 2.5 L/min

Blood Inlet Area

Blood Outlet Area

12FR Pump Motor

Impella 2.5

Automated Impella® Controller
The primary user control interface for the Impella platform
Family of Mechanical Support Device

Continuous Flow Pumps

- Pulsatile
  - IABP
  - Intracorporeal

- Axia-Flow
  - Impella CP

- Centrifugal Flow
  - PHP*
  - TandemHeart
  - Extracorporeal
  - VA-ECMO

IABP = intra-aortic balloon pump; PHP = percutaneous heart pump; VA-ECMO = veno-arterial extracorporeal membrane oxygenation
**Left side devices**
- Impella 2.5
- Impella CP/SmartAssist
- Impella 5.0/LD
- Impella 5.5 with SmartAssist

**Right side devices**
- Impella RP
Indications

High-risk PCI (≤ 6 hours)
- Single surviving vessel, severe LM Dx, TVD
- Surgical turndown

Cardiogenic Shock (≤ 4 days)
- Ongoing cardiogenic shock that occurs immediately (< 48 hours)
Impella®
World’s Smallest Heart Pump
Physiological Results of Impella Support
- Automated Impella® Controller controls how fast the impeller rotates
- Rotation speed is proportional to flow: **Faster rotation = Higher flow**
Components of the Purge System

**Purge Fluid**

D5 with 25-50U/mL of heparin
5 – 40% dextrose in water
(5% dextrose recommended)
Concentration proportional to viscosity

**Purge Cassette**

Delivers purge fluid to Impella® device
Purge System Animation

**PURPOSE**
Prevents blood from entering the motor

**MECHANISM**
Creates pressure barrier from purge fluid

Purge Pressure must always be > 300mHg
02 Implantation
Patient assessment prior to implantation

**LV thrombus**
- may cause the Impella motor to stop

**Mechanical aortic valve**
- contraindicated to impella use

**Aortic stenosis/ calcification**
- may inhibit motor to pass the AV

**Tortuous iliac artery**
- cause difficulty in insertion
Steps of insertion

Access the femoral artery

Support the shaft of the introducer while advancing into the artery.

A. Access the femoral artery
B. Pre-dilate and place peel away introducer
C. Achieve ACT of 250 seconds or higher
D. Remove the dilator
Steps of insertion

2 Insert 4-5 Fr pigtail into left ventricle

Alternative guidewires are listed in the IFU.

A. Insert a 4-5 Fr pigtail with or without side holes or a 6 Fr AL1 or MP without side holes into the left ventricle over a 0.035” diagnostic guidewire
B. Exchange the 0.035” guidewire for the 0.018” placement guidewire
C. Remove the diagnostic catheter
Steps of insertion

3 Backload using EasyGuide lumen

A. Insert the guidewire into the red EasyGuide lumen at the tip of the pigtail
B. Advance the guidewire until it exits the red lumen near the label
C. Remove the EasyGuide lumen by gently pulling the label while holding the Impella pump

Wire will align with straight black line.
Steps of insertion

4. Advance the Impella pump

If you feel any resistance as the Impella Catheter passes the tip of the introducer, pull back about 1 cm, advance the Impella, and reposition the introducer.

A. Advance Impella through peel away sheath
B. Follow and confirm position with fluoroscopy
1. Verify proper placement with fluoroscopy

2. Monitor AIC Placement Screen
   - Aortic placement signal
   - Pulsatile motor current

3. Reposition if needed and remove excess slack
1. Press the **START IMPELLA** soft button to turn on the Impella® device
2. Press **BACK** to edit Purge Fluid Information
3. Confirm that the guidewire has been removed and pump should be started by pressing the **YES** soft button
03 Management
Management

A. Device Monitoring
   - Normal Function
   - Purge system monitoring
   - Normal Position

B. Patient Monitoring
   - Hemodynamic
   - Wound management

C. Complications/ Trouble shooting
   - Suction
   - Obstruction
   - HIT
   - CPR/ Defibrillation
Device monitoring

Placement Screen

Home Screen

Infusion history Screen

Purge Screen
Purge system monitoring

- Current flow rate
- Max / Min display
- Catheter operation icon

- Purge system marquee
- Purge flow
- Purge Pressure

Battery status
- Full-partial green: >50% charged
- Partial yellow: 16% to <50% charged
- Partial red: <15% charged
- Moving gray: charging

AC plug indicator
- Green: running on AC power
- Gray with red X: on Battery

<table>
<thead>
<tr>
<th>Impella Flow</th>
<th>Purge System</th>
<th>System Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0 Max 3.0 Min</td>
<td>Purge Flow: 7.0 ml/hr</td>
<td>100%</td>
</tr>
<tr>
<td>L/min</td>
<td>Purge Pressure: 600 mmHg</td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Incorrect position: Impella Position in Ventricle
Incorrect position: Impella Position in Aorta
Normal Function

- Aortic
- Power Pressure Port
- Outlet
- Inlet

Impella Flow: 3.5 L/min
Purge System:
  - Purge Flow: 7.0 ml/hr
  - Purge Pressure: 600 mmHg
System Power: 100%
Repositioning

1. Reduce P-level to P-2

2. Reposition via Echo
   - The inlet should be 3.5 cm below the aortic valve annulus
   - Use a parasternal long axis view (TTE) or long axis view (TEE) to make the measurement
   - Ensure the device is free from the anterior leaflet of the MV and the subannular structures
   - Remove all slack by pulling back on the Impella catheter until you see it just start to move backwards

3. Lock Down the Tuohy

4. Resume Previous P-level Setting
# Patient Hemodynamic

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Goal (with Impella®)</th>
<th>Relation to Patient Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVP</td>
<td>≥ 10 mmHg</td>
<td>• Goal of ≥ 10 mmHg indicate that volume is adequate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lower suggests that additional volume may be required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Consider adding volume with CVP or PCWP &lt; 10 mmHg and symptoms of suction or hemolysis</td>
</tr>
<tr>
<td>PCWP</td>
<td>≥ 10-12 mmHg</td>
<td></td>
</tr>
<tr>
<td>MAP</td>
<td>≥ 60-90 mmHg</td>
<td>• Goal indicates adequate support</td>
</tr>
<tr>
<td>CI</td>
<td>≥ 2.2 L/min/m²</td>
<td>• Lower suggests that support may be inadequate</td>
</tr>
<tr>
<td>UOP</td>
<td>≥ 30 mL/h</td>
<td>• Escalation of therapy may be considered if measures are beneath the goal</td>
</tr>
<tr>
<td>SvO₂</td>
<td>≥ 60%</td>
<td></td>
</tr>
</tbody>
</table>
How hemodynamics effect the Impella® device

The Impella device is preload dependent; low CVP could precipitate a suction alarm

Rapid infusion of IV fluids may help resolve a suction alarm if low CVP is the cause

Swan Ganz Cardiac Output = Impella device flow + native heart ejection

Native heart will compete with Impella device for volume

The Impella device is afterload sensitive; high SVR can decrease flows from the device
Bleeding Troubleshooting

- ACT should be maintained between 160-180
- Peel-away sheaths should be removed in Cath Lab
- Minimize unnecessary movement
- Use leg immobilizer to reduce trauma to access site
- Check for forward suturing of repositioning unit butterfly

If butterfly is flat against skin, use 4x4s to angle match and reduce lift on vessel
• Impella is designed to be operated with heparin in the purge solution to protect the Impella motor

• HIT should be verified by:
  – 50% drop in platelets since the administration of Heparin
  – positive ELISA test
  – positive serotonin release test (SRA)
  – presence of megakaryocytes on a peripheral smear

• If Heparin must be removed:
  – Any systemic DTI may be used to keep the ACT between 160-180 seconds
  – Clinicians can request DTI protocol for use in purge solution by contacting medical affairs (medicalaffairs@abiomed.com)

*for use of Angiomax or Argatroban in purge solution by visiting http://www.abiomed.us/npi-search
What causes suction?

- Inadequate LV filling
- Incorrect position in LV
- RV failure

What are the effects of suction?

- Lower than expected Impella flow
- Patient may not fully benefit from Impella
- Risk of hemolysis

What to look for?

- Alarm: “Suction”
- Lower than expected flows before a suction alarm
- Lower patient blood pressure
- Reduced mean motor current (5-minute display)
**Possibilities for Interference with Device Operation**

**Inflow Obstruction**
- If ventricular structures obstruct inflow windows, blood will travel faster to enter through unobstructed windows.
- Higher speed against cannula wall and other structures causes higher shear and hemolysis.

**Cannula Obstruction**
- Obstruction within pump (clot, fiber, etc) creates narrowing of cannula and small passages for blood to pass through, creating high shear and hemolysis.

**Outflow Obstruction**
- If the aortic valve or wall of the aorta obstruct outflow windows, blood will exit pump at higher speeds from unobstructed windows and will make violent contact with obstructing structures causing hemolysis.
### High Purge Pressure

**Measurement:** Purge Flow ≤ 2 mL/hr and Purge Pressure > 1100 mmHg

<table>
<thead>
<tr>
<th>Where to look</th>
<th>What to look for</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Are there any kinks in the purge tubing, the clear sidearm, or anywhere along the catheter?</td>
<td>Straighten the tubing, clear the sidearm, or catheter</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Is the purge fluid concentration too high?</td>
<td>Reduce the purge fluid (dextrose) concentration</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Motor Current If unable to resolve high purge pressure, monitor for increases in motor current which can indicate impending pump failure</td>
<td>May need to replace pump</td>
</tr>
</tbody>
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**Low Purge Pressure**

*Measurement:* Purge Pressure < 300 mmHg and Purge Flow 30 mL/hr

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<tr>
<td>1</td>
<td>Are there any leaks in the purge cassette, Y connector, or luer connections to the catheter?</td>
<td>Tighten any loose connections</td>
</tr>
<tr>
<td>2</td>
<td>Is the dextrose (purge fluid) concentration too low?</td>
<td>Increase the dextrose (purge fluid) concentration</td>
</tr>
<tr>
<td>3</td>
<td>Is the leak coming from the purge cassette?</td>
<td>Replace the purge cassette</td>
</tr>
<tr>
<td>4</td>
<td>Motor Current</td>
<td>If unable to resolve low purge pressure, monitor for increases in motor current which can indicate impending pump failure</td>
</tr>
<tr>
<td>Condition</td>
<td>Alarm</td>
<td>Placement Signal</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Low native heart pulsatility</td>
<td>White advisory alarm: “Impella® position unknown due to low pulsatility, assess cardiac function”</td>
<td>Placement signal pulse pressure narrowed to &lt; 20mmHg</td>
</tr>
</tbody>
</table>

**Diagram:**

- **Impella Position Unknown**
- **Impella Catheter position unknown due to low pulsatility. Assess cardiac function.**
- **Placement Signal**
- **Motor Current**
Placement signal lumen clotted off due to:

1. Closed or partially closed roller clamp on saline bag
2. Pressure bag not inflated > 300 mmHg
Emergency situations

CPR – What to do?

1. Initiate CPR per hospital protocol
2. Reduce Impella flow rate to P-2
3. When cardiac function has been restored:
   - Assess motor current
   - If pulsatile, return to previous setting
4. Check positioning using echo when possible

Defibrillation – What to do?

→ Initiate defibrillation per hospital protocol

NOTE: It is not necessary to reduce P-level
04 Weaning & Explant
To initiate weaning a patient from Impella® support...

1. Press **FLOW CONTROL** and decrease flow rate by 2 level increments as cardiac function allows
2. Maintain support at P-2 until hemodynamics are stable
3. Reduce to P-1 and pull catheter into the aorta
4. Reduce flow to P-0 (0.0 L/min) and remove the Impella device
5. When ACT < 150 seconds, apply manual compression per hospital protocol

**Do not reduce flow below P-2 until just before removing the catheter from the ventricle.**
Thank you