Advanced IABP troubleshooting strategies

NTI 2019

Class Code: EXED268
At the conclusion of this program, the participants will be able to:

- Identify three interventions to utilize in troubleshooting fiberoptic catheter alarms
- Identify three interventions to utilize in troubleshooting gas loss/gas gain alarms
Historical perspective
Historical perspective
Evolution of intra aortic balloon catheter

• The IABP device was pioneered at Grace Sinai Hospital in Detroit during the early 1960s by Dr. Adrian Kantrowitz and his team\(^1\)

• First clinical implant was performed at Maimonides Medical Center, Brooklyn, N.Y. Oct., 1967. 48-year-old woman was in cardiogenic shock and unresponsive to traditional therapy. An IABP was inserted by cut down on the left femoral\(^1\)

• Size of the original balloon was 15 French\(^6\) — now, 7 to 8 French balloons are used\(^2,3\)

• Since 1979 the placement of the balloon has been modified using the Seldinger technique\(^2,3\)

1. Intra Aortic Balloon Pump (IABP) Counterpulsation mirror with better quality by P. J Overwalder, M.D., Department of Surgery, Division of Cardiac Surgery, University Hospital Graz. The Internet Journal of Thoracic and Cardiovascular Surgery. 1999. Volume 2 Number 2.
Fluid-filled (conventional) signal transmission

Continuous invasive BP monitors display the information both numerically and graphically. The basic principle is to provide a solid column of liquid connecting arterial blood to a pressure transducer (hydraulic coupling) and requires the following components:

- Intra-arterial cannula
- Tubing (incorporating an infusion system)
- Transducer
- Microprocessor and display screen
- Mechanism for zeroing and calibration
Fluid-filled (conventional) signal transmission

Tubing (incorporating an infusion system)
- Delivers constant infusion delivered at a rate of 2-4 mls
- The infusion fluid is kept pressurized to ensure a constant flow
- Tubing should be stiff and not contain any bubbles in order to minimize resonance and damping

Transducer
- Liquid in tubing is in contact with a diaphragm that moves in response to transmitted pressure waveform
- Movement is converted to an electrical signal by a transducer

Mechanism for zeroing and calibration
- Transducer needs to be kept horizontally level with the right atrium
- Raising or lowering the transducer relative to the patient will alter the reading (10 cm change in height will alter the pressure reading by 7.5 mmHg)
- Zeroing is still important and is performed by opening the transducer to atmospheric pressure and electronically zeroing the system

Blood Pressure Measurement
A fiber-optic pressure sensor is a very small manometer located in the tip of the Sensation IAB catheter that transmits the signal by light through a fiber-optic strand to the Getinge IABP.
Fiber-optic technology

What makes it different?
• Automatic in vivo calibration: automatically calibrates IAB upon start-up and every 2 hours
• Crisp, clean arterial pressure waveform
• No zeroing of pump
• Instantaneous signal transmission

What does this mean for you?
• Faster and easier process to provide hemodynamic support to patient
• Ongoing consistency and accuracy of arterial blood pressure waveform
• Less work

What does this mean for your patient
• Faster time to therapy
Case studies
Case study 1

Situation

You hear the IABP alarm but it is continuing to pump. You go into the room to investigate. You see this message on the pump:

Fiber-Optic Sensor Calibration Postponed
**Probable cause**

Fiber-optic sensor calibration postponed

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A non-scheduled calibration update has been intentionally postponed because either patient’s mean arterial pressure may be too low to pause assist.</td>
<td>Assess patient to determine if a brief pause in assist would be tolerated, and if so, press CALIBRATE PRESSURE key for 2 seconds while IABP is assisting.</td>
</tr>
<tr>
<td>Less than 15 minutes have elapsed since last calibration.</td>
<td>Resume pumping, then press CALIBRATE PRESSURE key for 2 seconds to initiate a calibration.</td>
</tr>
<tr>
<td>A non-scheduled calibration has been postponed because the IABP is in STANDBY.</td>
<td></td>
</tr>
</tbody>
</table>
Case study 2

Situation

Your patient had a left ventricular assist device implanted. Upon returning to the unit the IABP is alarming.
### Probable cause
Unable to calibrate fiber-optic sensor

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient’s pulse pressure is inadequate for calibration.</td>
<td>When patient’s pulse pressure improves, press CALIBRATE PRESSURE key for 2 seconds while IABP is assisting.</td>
</tr>
<tr>
<td></td>
<td>Provide alternate A.P. source (i.e. radial).</td>
</tr>
<tr>
<td>There is a restriction in the IAB catheter or tubing.</td>
<td>Relieve restriction.</td>
</tr>
<tr>
<td></td>
<td>Attempt calibration by pressing CALIBRATE PRESSURE key for 2 seconds while IABP is assisting.</td>
</tr>
</tbody>
</table>
Case study 3

Situation

Your patient has been restless throughout your shift. He sits up in bed then lies back down. The IABP begins to alarm.
Probable cause

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is a failure in communication of the fiber-optic sensor signal with the IABP.</td>
<td>Firmly grasp the Fiber-Optic Sensor Connector using the raised grips. Remove it from the Fiber-Optic Sensor Input and reinsert until it clicks. Check for visible kinks in the orange Fiber-Optic cable, if found relieve the kink. If problem persists, disconnect Fiber-Optic Sensor Connector and provide alternate A.P. source (i.e. radial).</td>
</tr>
</tbody>
</table>
Case study 4

Situation

You were using the transport pole to hang your arterial flush solution and the spike was inadvertently pulled out. The flush solution ran down the back of the IABP and it started to alarm...
### Probable cause

**Fiber-optic sensor module failure**

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>There has been a failure of the internal Fiber-Optic Sensor Module in the IABP.</td>
<td>If a Getinge fiber-optic IAB is NOT in use, continue normal IAB use.</td>
</tr>
<tr>
<td></td>
<td>If a Getinge fiber-optic IAB is in use, replace IABP with another Getinge IABP that supports the fiber-optic IAB.</td>
</tr>
<tr>
<td></td>
<td>If a replacement IABP is NOT available, provide alternate A.P. source (i.e. radial).</td>
</tr>
<tr>
<td></td>
<td>Contact Getinge Service for Fiber-Optic Sensor Module repair.</td>
</tr>
</tbody>
</table>
Case study 5

Situation

You hear the IABP high priority alarm tone and the pump is in standby. You go into the room to investigate. You see this message on the pump:
## Probable cause

Gas Loss in IAB Circuit

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Helium loss has been detected due to a leak or high rate of diffusion in the IAB Circuit.</td>
<td>Check for evidence of blood in the tubing. If found, stop pumping and notify physician. Refer to IAB manufacturer's instructions for IAB removal. If blood is NOT detected, ensure that the IAB extender tubing is tightly connected to the IAB and the IABP. If appropriate, perform an Autofill by pressing and holding the IAB FILL key for 2 seconds, then press the START key to resume pumping. If the patient is febrile or tachycardic, consider increasing the frequency of Autofills by initiating an Autofill prior to the regularly scheduled 2-hour Autofill.</td>
</tr>
<tr>
<td>• Cumulative shuttle gas loss exceeds a nominal 5 cc/hr. dynamic limit</td>
<td></td>
</tr>
</tbody>
</table>
Case study 6

Situation

You hear the IABP high priority alarm tone and the pump is in standby. You go into the room to investigate. You see this message on the pump:
**Probable cause**

Gas gain in IAB circuit

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A gas gain has been detected in the IAB circuit.</td>
<td>Verify all connections are leak free.</td>
</tr>
<tr>
<td>• Cumulative shuttle gas gain exceeds 5 cc, relative to the last autofill volume</td>
<td>Press the START key to Autofill and resume pumping.</td>
</tr>
<tr>
<td></td>
<td>If alarm persists, contact Getinge Service.</td>
</tr>
</tbody>
</table>
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