DEVELOPING AN IABP PRECEPTOR STRATEGY

Datascope Clinical Support Services
DEVELOPING AN IABP PRECEPTOR STRATEGY

CONTENT DESCRIPTION

This four-hour presentation is designed for health care professionals involved in precepting staff to IABP therapy. A sound working knowledge of the theoretical and technical aspects of IABP therapy is required. The presentation will include a discussion of the patient’s cardiac performance and patient conditions, which can impact the pump’s performance. Methods for teaching the technical components of the equipment will be demonstrated with hands on time provided. Methods for maintaining clinical proficiency will be discussed.

BEHAVIORAL OBJECTIVES:

1. Discuss the hemodynamic factors that may affect maintaining and or achieving optimal diastolic augmentation pressure and possible corrective action.

2. Discuss the interaction of drug therapy and the mechanical support provided by the IABP on cardiac performance.

3. Demonstrate the set up, operation and troubleshooting of the Datascope IABP utilizing the system trainer for practice and the abbreviated operator’s guide for reference.

4. Describe two teaching strategies for maintaining competency.
## Course Schedule

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 8:00 – 8:30| Introduction  
Review Program  
Assessment of Current Practice |
| 8:30 – 9:30| Theoretical Aspects of IABP  
I. Review Physiology of Cardiac Mechanics  
II. Measurement of Cardiac Performance  
III. Theory of IABP Therapy  
IV. Indications/Contraindications  
V. Side Effects/Complications |
| 9:30 – 9:45| Break                                                                 |
| 9:45 – 10:45| Teaching Technical and Troubleshooting Components of the IABP  
I. IAB Catheter  
II. Trigger vs. Timing  
III. Review of Control Panel and Monitor  
IV. Troubleshooting |
| 10:45 – 11:15| Hands on Workshop                                                        |
| 11:15 – 11:30| Documentation Considerations                                             |
| 11:30 – 11:50| Maintaining Expertise                                                   |
| 11:50 – 12:00| Evaluation                                                             |
ASSESSMENT OF CURRENT PRACTICE

I. What is a Preceptor? Who is a Preceptee?

II. Identify Current Orientation Process for New IABP Operators

THEORETICAL ASPECTS OF IABP THERAPY

I. Review Physiology of Cardiac Mechanics

A. Arterial Pressure Curve
   1. Electrical vs. Mechanical
B. Myocardial Oxygen Supply and Demand

<table>
<thead>
<tr>
<th>Supply</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Coronary artery anatomy</td>
<td>1. Heart Rate</td>
</tr>
<tr>
<td>2. Diastolic pressure</td>
<td>2. Afterload</td>
</tr>
<tr>
<td>3. Diastolic time</td>
<td>3. Preload</td>
</tr>
<tr>
<td>4. O₂ extraction</td>
<td>4. Contractility</td>
</tr>
<tr>
<td>a. HBG</td>
<td></td>
</tr>
<tr>
<td>b. PaO₂</td>
<td></td>
</tr>
</tbody>
</table>

II. Measurement of Cardiac Performance

A. Cardiac Output = heart rate x stroke volume
   (Normal - 4-6 liters/minute)

B. Cardiac Index = \( \frac{\text{Cardiac Output}}{\text{B.S.A.}} \)
   (Normal - 2.5-3.5 l/min/m²)

C. Systemic Vascular Resistance = \( \frac{\text{MAP-Mean RA}}{\text{C.O.}} \times 80 \)
   (Normal = 900-1500 dynes/sec/cm²)

D. Ejection Fraction = \( \frac{\text{end diastolic volume-end systolic volume}}{\text{end diastolic volume}} \)
   (Normal - 60 - 75% of end diastolic volume)
E. Frank-Starling Law of Heart

F. LV Failure
III. Theory of Intra-Aortic Balloon Pump Therapy

A. Counterpulsation
   1. Balloon structure and position
   2. Increased coronary perfusion
      a. Inflation
      b. Augmentation of diastolic pressure
   3. Decreased left ventricular workload
      a. Deflation
      b. Afterload reduction
B. Effects of Intra-Aortic Balloon Pump Therapy

1. Primary
   a. Increased myocardial oxygen supply
   b. Decreased myocardial oxygen demand

2. Secondary
   a. Cardiac output/cardiac index
   b. Heart rate
   c. Pulmonary artery diastolic/pulmonary capillary wedge pressure
   d. Systemic vascular resistance

3. Systemic
   a. Neurologic
   b. Renal
   c. Vascular
   d. Respiratory

IV. Indications and Contraindications

A. Indications
   1. Refractory unstable angina
   2. Impending infarction
   3. Acute MI
   4. Refractory ventricular failure
   5. Complications of acute MI
   6. Cardiogenic Shock
   7. Support for diagnostic, percutaneous revascularization, and interventional procedures
   8. Ischemia related intractable ventricular arrhythmias
   9. Septic shock
   10. Intra-operative pulsatile flow generation
   11. Weaning from bypass
   12. Cardiac support for non-cardiac surgery
   13. Prophylactic support in preparation for cardiac surgery
   14. Post surgical myocardial dysfunction/low cardiac output syndrome
   15. Myocardial contusion
   16. Mechanical bridge to other assist devices
   17. Cardiac support following correction of anatomical defects

B. Contraindications
   1. Severe aortic insufficiency
   2. Abdominal aortic aneurysm
   3. Severe calcified aortic -iliac disease or peripheral vascular disease
   4. Sheathless insertion with severe obesity, scarring of the groin
V. Side Effects and Complications

A. Limb ischemia
B. Excessive bleeding from the insertion site
C. Thrombocytopenia
D. Immobility of balloon catheter
E. Balloon leak
F. Infection
G. Aortic dissection
H. Compartment syndrome
TEACHING TECHNICAL COMPONENTS AND TROUBLESHOOTING

I. IAB Catheter
   A. Insertion/Removal
   B. Care of the Central Lumen

II. Trigger vs. Timing
   A. Definition of trigger and timing

   **Trigger selection:**

   ![Graph of an electrocardiogram showing trigger points](image)

   **Timing:**

   ![Graph of arterial pressure showing dicrotic notch](image)

   B. Conventional vs. R-wave deflation timing

III. Review of control panel and monitor
IV. Troubleshooting Clinical Conditions

A. Factors Affecting Diastolic Augmentation
   1. Patient hemodynamics
      a. Heart rate
      b. Stroke volume
      c. Mean arterial pressure
      d. Systemic vascular resistance
   2. Intra-Aortic Balloon
      a. IAB not unfolded
      b. IAB position
      c. IAB size
      d. Kink in IAB catheter
      e. Low Helium concentrate
      f. IAB leak
   3. Intra-Aortic Balloon Pump
      a. Timing
      b. Position of the augmentation dial

B. Rhythm Disturbances
   1. Atrial fibrillation/flutter
   2. Ectopic
   3. Cardiac arrest
   4. Ventricular fibrillation
C. Timing Errors

1. **Early Inflation**
   Inflation of the IAB prior to aortic valve closure

   **Waveform Characteristics:**
   - Inflation of IAB prior to dicrotic notch
   - Diastolic augmentation encroaches onto systole (may be unable to distinguish)

   **Physiologic Effects:**
   - Potential premature closure of aortic valve
   - Potential increase in LVEDV and LVEDP or PCWP
   - Increased left ventricular wall stress or afterload
   - Aortic Regurgitation
   - Increased MVO₂ demand

2. **Late Inflation**
   Inflation of the IAB markedly after closure of the aortic valve

   **Waveform Characteristics:**
   - Inflation of the IAB after the dicrotic notch
   - Absence of sharp V
   - Sub-optimal diastolic augmentation

   **Physiologic Effects:**
   - Sub-optimal coronary artery perfusion
3. **Early Deflation**
   Premature deflation of the IAB during the diastolic phase

**Waveform Characteristics**
- Deflation of IAB is seen as a sharp drop following diastolic augmentation
- Sub-optimal diastolic augmentation
- Assisted aortic end diastolic pressure may be equal to or less than the unassisted aortic end diastolic pressure
- Assisted systolic pressure may rise

**Physiologic Effects:**
- Sub-optimal coronary perfusion
- Potential for retrograde coronary and carotid blood flow
- Angina may occur as a result of retrograde coronary blood flow
- Sub-optimal afterload reduction
- Increased MVO$_2$ demand

4. **Late Deflation**

**Waveform Characteristics:**
- Assisted aortic end-diastolic pressure may be equal to the unassisted aortic end diastolic pressure
- Rate of rise of assisted systole is prolonged
- Diastolic augmentation may appear widened

**Physiologic Effects:**
- Afterload reduction is essentially absent
- Increased MVO$_2$ consumption due to the left ventricle ejecting against a greater resistance and a prolonged isovolumetric contraction phase
- IAB may impede left ventricular ejection and increase the afterload
D. Balloon Pressure Waveform

1. Normal Balloon Pressure Waveform
2. Variations in Balloon Pressure Waveforms

Variations in balloon pressure waveforms may be due to the following conditions:

**Heart Rate**

**Bradycardia**
Increased duration of plateau due to longer diastolic phase.

**Tachycardia**
Decreased duration of plateau due to shortened diastolic phase.

**Rhythm**

Varying R-R intervals result in irregular plateau durations.

**Blood Pressure**

**Hypertension**
Increased height or amplitude of the waveform.

**Hypotension**
Decreased height or amplitude of the waveform.
**Gas Loss**

Leak in the closed system causing the balloon pressure waveform to fall *below* zero baseline. This may be due to a loose connection, a leak in the IAB catheter, H₂O condensation in the external tubing, or a patient who is tachycardiac and febrile which causes increased gas diffusion through the IAB membrane.

**Catheter Kink**

Rounded balloon pressure waveform, loss of plateau resulting from a kink or obstruction of shuttle gas. This may be caused by a kink in the catheter tubing, improper IAB catheter position, sheath not being pulled back to allow inflation of the IAB, the IAB is too large for the aorta, the IAB is not fully unwrapped, or H₂O condensation in the external tubing.

**Sustained Inflation**

Theoretical possibility if the IAB remains inflated longer than 2 seconds. System 90 Series intra-aortic balloon pump will activate the System Failure alarm and deflate the IAB.
DOCUMENTATION CONSIDERATIONS

I. Discussion of Documentation Considerations

A. Suggested Documentation
   1. Insertion
   2. During Operation
      a. Pressure changes
      b. Hemodynamic benefits
      c. Pulse checks
   3. Removal

MAINTAINING EXPERTISE

I. Recommendations for Maintaining Expertise

A. Suggested Resources
   1. Videotapes
   2. CD-ROM
   3. Case Studies
   4. Skills Lab – Hands on with performance checklist
BIBLIOGRAPHY

Quaal SJ. Comprehensive Intraaortic Balloon Counterpulsation. 2nd ed. St. Louis, MO: Mosby; 1993


| 1. Please rate the overall quality of the program | 1 Poor | 2 Fair | 3 Good | 4 Very Good | 5 Excellent |
| 2. Please rate how well this program met your personal objectives | | | | | |
| 3. How well did this program meet the following objectives? | | | | | |
| a. Discuss the hemodynamic factors that may affect maintaining and/or achieving optimal diastolic augmentation pressure and possible corrective action. | | | | | |
| b. Discuss the interaction of drug therapy and the mechanical support provided by the IABP on cardiac performance. | | | | | |
| c. Demonstrate the set up, operation and troubleshooting of theDatascope IABP utilizing the balloon pressure waveform for troubleshooting, the system trainer for practice and the abbreviated operator’s guide for reference. | | | | | |
| d. Describe two teaching strategies for maintaining competency. | | | | | |
| 4. Please Rate the Following | | | | | |
| a. Program Content: Relevance to objectives | | | | | |
| b. Speaker: Effectiveness of teaching strategies and presentation style | | | | | |
| 5. Please rate how well the program will change and/or validate your practice | | | | | |
| 6. Please rate the educational tools used during the program | | | | | |
| a. Teaching manual | | | | | |
| b. Abbreviated Operator’s Guide | | | | | |
| c. Audiovisual Materials | | | | | |
| 7. Please rate the program facilities | | | | | |
| 8. Will you develop an IABP course for your hospital? | Yes | No |

Yes

No