Vigileo Monitor Simulation
Instructors Guide for v2.0

October 2011
Welcome to the Edwards Lifesciences Vigileo Monitor Simulation
The Vigileo monitor simulation integrates the Vigileo monitor with the Laerdal SimMan platform for simulation training. The program includes three preprogrammed patient scenarios. This toolkit includes all the direction an instructor needs to proctor the Vigileo monitor simulator program to healthcare providers.

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Overview of the Vigileo Monitor Simulator Program

The Vigileo monitor allows for monitoring the balance of oxygen delivery and consumption by displaying continuous central venous oxygen saturation (ScvO₂) when used with the PreSep catheter. Additionally, the Vigileo monitor also displays key flow parameters such as continuous cardiac output (CCO/CCI), stroke volume (SV), stroke volume variation (SVV), and systemic vascular resistance (SVR) when used with the FloTrac sensor.

**Vigileo Monitor** - Expands the options for monitoring high-risk patients:
- Guiding fluid optimization
- Assessing real-time changes in vascular tone
- Guiding inotropic therapy in real time
- Optimizing the effects of HR and SV
- Managing precise titration of cardiovascular medications

**FloTrac Sensor** - Provides continuous cardiac output (CCO), stroke volume (SV), stroke volume variation (SVV), and systemic vascular resistance (SVR) through an existing arterial line. The FloTrac sensor connects to an existing arterial catheter:
- Performs continuous self-calibration through its automatic vascular tone adjustment
- Calculates key flow parameters **every 20 seconds**
- Continuously monitors changes in patient’s vascular tone (compliance and resistance)
- Validated against the clinical gold-standard Swan-Ganz pulmonary artery catheter

**PreSep Oximetry Catheter (ScvO₂)** - Central venous oximetry as measure in the superior vena cava by a central venous catheter with integrated fiberoptic strands which is connected to an Edwards oximetry computer (EV1000, Vigileo, Vigilance II).
Installation

System Requirements

- Processor: Minimum Pentium M 1.8 GHz or better
- Hard drive: 60 GB minimum
- RAM: 512 MB minimum
- System: Windows XP and Windows 7
- CD-ROM drive

Recommended Software

- Laerdal SimMan with software version 3.5
Installation Steps

1. Remove all previously loaded Vigileo, Vigilance II, and EV1000 programs as well as the previously loaded SimSuite monitor interface.

2. Close all open applications.

3. Insert the installation disk in the CD drive. The installation will begin automatically after the disk is inserted.

4. Follow the steps on the installer using the ‘Next’ and ‘Back’ buttons.

5. Click the ‘Close’ button when the setup wizard has completed the installation.
6. Multiple installers will launch automatically. Continue to use the ‘Next’ and ‘Back’ buttons to complete the installation process.

7. Restart the computer.

8. Open the ‘Edwards Lifesciences Scenarios’ shortcut on your desktop.

9. Right click on the ‘Edwards Lifesciences’ folder and select ‘Copy’.

10. Start SimMan.

11. Select ‘File’ from the list of menus as the top of the SimMan window.

12. Select ‘Start Scenario’.

13. Right click in the new window and select ‘Paste’. If asked if you want to merge and/or copy any files, select ‘Yes’.
Displays and Equations

In order for each of the parameters to change in sync with each other from a physiologic perspective values are based upon well established equations. The following are parameters, the equations that affect the values, and how they are displayed on the Vigileo monitor simulation.

Cardiac Output or Cardiac Index (CO/CI)
Cardiac output or cardiac index values displayed on the Vigileo monitor simulation are double the value on the instructors screen of the SimMan program. This was to allow the simulation of high output or hypderdynamic states. Cardiac index is calculated by CO/BSA, with BSA calculated using the Dubios scale.

Stroke Volume or Stroke Volume Index (SV/SVI)
Stroke volume or stroke volume index on the Vigileo monitor simulation are calculated by dividing the CO or CI displayed on the Vigileo monitor by the heart rate displayed next to the ECG (CO/HR or CI/HR).

Systemic Vascular Resistance (SVR/SVRI)
Systemic vascular resistance or systemic vascular resistance index is calculated and displayed on the Vigileo monitor simulation based upon the standard equation SVR = MAP-CVP/CO x 80 or SVRI = MAPCVP/CI x 80.
Instructors Guide for Operating the Vigileo Monitor Simulation

Simulation Scenarios

2. Vigileo Hypovolemic Shock (Hypovolemic Shock due to Lower GI Bleed).
3. Vigileo Septic Shock (Septic Shock due to Pneumonia).

Starting the Scenario

1. Click ‘Start Scenario’.
2. Select ‘Edwards Lifesciences’.
3. Select ‘Vigileo’.
4. Select desired scenario.

Patient History

• Review the patient history handout prior to starting the scenario to add context to the case
• A participant copy of the patient histories can be found in the “Participant Materials” section

Instructions

The objective of the simulation scenario is to evaluate hemodynamic data from the Vigileo monitor and the patient bedside monitor to most appropriately treat a patient in a shock state. Therapeutic options include fluid resuscitation, blood products, vasopressors, inotropes, and diuretic administration. Continue to manage your patient until end points of resuscitation are met.
Medications

Selecting Medications During a Scenario

- Select the desired medication from the list of interventions in the medication event menu
  - Selecting the same medication more than once simulates giving multiple doses of fluid or upward titration of a medication
- Interventions listed under ‘Decrease or Discontinue Medications’ on the medication event menu allow the instructor to discontinue a previous intervention
  - If an intervention is selected more than once, interventions listed under ‘Decrease or Discontinue Medications’ allow the instructor to downward titration of the medication
- Intervention peak effect occurs in 1 minute after being selected
- **Avoid selecting multiple interventions in rapid succession.** Rapid selection of interventions may not trigger the intended effect in the simulation scenario although it may appear as if it was selected
### Drug Interactions

<table>
<thead>
<tr>
<th>Drug Type</th>
<th>Initial Vital Signs</th>
<th>HR</th>
<th>SBP</th>
<th>DBP</th>
<th>CVP</th>
<th>SVV</th>
<th>ScvO2</th>
<th>CO</th>
<th>HGB</th>
<th>PARAMETER</th>
</tr>
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<tbody>
<tr>
<td>Crystalloid 500 ml</td>
<td>Independent</td>
<td>-5</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>-3</td>
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<td>0.3</td>
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<td>Crystalloid 1000 ml</td>
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<td>0</td>
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<td>-3</td>
<td>-0.2</td>
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</tr>
<tr>
<td></td>
<td>SVV &lt; 15</td>
<td>5</td>
<td>-10</td>
<td>-7</td>
<td>-2</td>
<td>0</td>
<td>-2</td>
<td>0.2</td>
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<td>2</td>
<td>0.2</td>
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<td>-3</td>
<td>-0.2</td>
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<tr>
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<td>SVV &lt; 15</td>
<td>3</td>
<td>-10</td>
<td>-7</td>
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<td>2</td>
<td>0.2</td>
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<td>-0.4</td>
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<tr>
<td></td>
<td>SVV&lt;15,SBP&gt;140</td>
<td>2</td>
<td>-4</td>
<td>-2</td>
<td>-1</td>
<td>1</td>
<td>2</td>
<td>0.3</td>
<td>1</td>
<td></td>
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<tr>
<td></td>
<td>SVV&lt;15,SBP&lt;140</td>
<td>2</td>
<td>-4</td>
<td>-2</td>
<td>-1</td>
<td>2</td>
<td>0</td>
<td>-0.2</td>
<td>1</td>
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</tr>
<tr>
<td>PLR/Fluid Challenge</td>
<td>Positive Response</td>
<td>-10</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>-6</td>
<td>4</td>
<td>0.8</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Negative Response</td>
<td>-5</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>-3</td>
<td>2</td>
<td>0.2</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

*(Drug Interactions: A list of interventions and their effect on each parameter based upon the SVV at that time)*
Miscellaneous

Selecting Decompensation ON/OFF

‘Decompensation ON’ sets the simulators parameters to decompensate 2 minutes after an intervention has had its full affect. ‘Decompensation OFF’ sets the simulators parameters to maintain at the level achieved after an intervention has had its full affect.
Selecting Labs or X-ray During a Scenario

- Labs can be displayed on the patient monitor by selecting 'Labs' under the 'Diagnostics' folder from the 'Miscellaneous' event menu.
- A chest x-ray can be displayed on the patient monitor by selecting 'CXR' under the 'Diagnostics' folder from the 'Miscellaneous' event menu.

### CHEMISTRY

<table>
<thead>
<tr>
<th></th>
<th>PATIENT VALUES</th>
<th>REF. VALUES</th>
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</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>136</td>
<td>135 – 145 mmol/L</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.1</td>
<td>3.5 – 5.0 mmol/L</td>
</tr>
<tr>
<td>Chloride</td>
<td>100</td>
<td>98 – 108 mmol/L</td>
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<tr>
<td>CO₂</td>
<td>20</td>
<td>21 – 30 mmol/L</td>
</tr>
<tr>
<td>Glucose</td>
<td>187</td>
<td>70 – 140 mmol/L</td>
</tr>
<tr>
<td>BUN</td>
<td>25</td>
<td>7 – 20 mg/dL</td>
</tr>
<tr>
<td>Creatinine</td>
<td>1.4</td>
<td>0.5 – 1.1 mg/dL</td>
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</table>

### CBC

<table>
<thead>
<tr>
<th></th>
<th>PATIENT VALUES</th>
<th>REF. VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBG</td>
<td>10</td>
<td>12.0 – 17.3 g/dL</td>
</tr>
<tr>
<td>HCT</td>
<td>31.4</td>
<td>35 – 40%</td>
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<tr>
<td>PLT</td>
<td>215</td>
<td>150 – 450 thousand/mm</td>
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<tr>
<td>WBC</td>
<td>11.8</td>
<td>3.2 – 12 thousand/mm</td>
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### COAGULATION

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<th>REF. VALUES</th>
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</thead>
<tbody>
<tr>
<td>INR</td>
<td>1</td>
<td>0.9 – 1.1</td>
</tr>
<tr>
<td>PTT</td>
<td>35</td>
<td>26.4 – 35.5 sec</td>
</tr>
</tbody>
</table>
Heart Rhythm

The rhythm of the ECG can be changed to include sinus, sinus with occasionally arrhythmias, sinus with frequent arrhythmias and atrial fibrillation. The "Yellow Heart" icon will appear when atrial fibrillation is selected indicating that SVV should not be used to evaluate fluid responsiveness.

Selecting Atrial Fibrillation

Demonstrates the display of the yellow heart icon and the inability to use SVV as an indication of preload responsiveness.
Selecting Passive Leg Raise (PLR)/Fluid Challenge During a Scenario

Select the desired result from the list of interventions under the “Passive Leg Raise” folder from the miscellaneous event menu. Options for passive leg raise include:
- Positive response
- Negative response

<table>
<thead>
<tr>
<th>Passive Leg Raise / Fluid Challenge</th>
<th>HR</th>
<th>SBP</th>
<th>DBP</th>
<th>CVP</th>
<th>SVV</th>
<th>ScvO₂</th>
<th>CO</th>
<th>HGB</th>
<th>SpO₂</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Response</td>
<td>0</td>
<td>-5</td>
<td>-5</td>
<td>1</td>
<td>2</td>
<td>-3</td>
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<td>Negative Response</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td></td>
</tr>
</tbody>
</table>

Selecting PEEP During a Scenario

Effects of PEEP on hemodynamics can be simulated by selecting “Increase PEEP 2.5 cm” or “Decrease PEEP 2.5 cm” found in the “PEEP” folder under the ABC event menu.

<table>
<thead>
<tr>
<th>PEEP 2.5 cm H₂O</th>
<th>HR</th>
<th>SBP</th>
<th>DBP</th>
<th>CVP</th>
<th>SVV</th>
<th>ScvO₂</th>
<th>CO</th>
<th>HGB</th>
<th>SpO₂</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVV &gt;15</td>
<td>0</td>
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<td>1</td>
<td>2</td>
<td>-3</td>
<td>-0.3</td>
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<td></td>
</tr>
<tr>
<td>SVV &lt;15</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td></td>
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</table>
Instructors Guide for Operating the Vigileo Monitor Façade

The Vigileo monitor façade simulates the actual Vigileo monitor and is integrated with Laedal SimMan scenario programming. The façade replicates what the participant might commonly see displayed while using the Vigileo monitor in actual patient care. The façade does not contain all of the customization functionality of the actual Vigileo monitor.

Turn Monitor On or Off

• Press the ‘On/Off’ button to turn the façade monitor on or off. A chime will sound when the monitor is turned on. The monitor can be turned on and off during a simulation scenario without losing data.

Switching Between Numerical and Trend Views

• Press the ‘Multipurpose Frame Switch’ button to switch between the numerical and trend views.
Changing Display Options

- The façade display can be customized by pressing anywhere on the display screen

- ‘Return’ will close the option menu and restore the display
- ‘Swap CI and CO’ swaps cardiac index and cardiac output. The variables will be swapped on the numerical view. The trend view will also switch between CI and CO
- ‘Hide CO’ hides the cardiac output in addition to all the derived parameters on the numerical view. CO (or CI) will be hidden on the trend view
- ‘Hide ScvO2’ hides the ScvO2 on the numerical view. ScvO2 will be hidden on the trend view
- ‘Refresh every 20 seconds’ will update the numerical parameters every 20 seconds rather than the default 2 seconds
End Points of Simulation Scenario

- The objective of the scenario is to resuscitate the simulated patient with a combination of multiple interventions. A predefined end point for the scenarios has not been stipulated. Participants may continue to treat the patient until satisfied with the results
- General resuscitation goals:
  - ScvO₂ ≥ 70%
  - Cardiac Index ≥ 2.5 L/min/m²
  - SVV ≤ 10%

Scenario Debriefing

- Scenario debriefing allows the instructor and participants to review what occurred during the simulation scenario. Debriefing details can be saved for later review

1. Click ‘Debrief’.
2. Select ‘Yes’ on Do you really want to go to debriefing?
3. Adjust ‘Level of Detail’ to display the amount of detail desired for your debriefing session.
Other Important Features

- Additional features are available to the instructor by right clicking on the ‘Edwards E’ icon in the icon tray.

- ‘Patient Info’ displays the patient’s information in a separate window in real time. The patient Information window can be used in situations where the instructor or controller does not have visibility to the Vigileo monitor facade. The information includes some additional calculated values (DO$_2$ and VO$_2$) as well as the current hemoglobin.
Instructor Monitor Configuration

In order to configure the default screens for your instructors:

Click on ‘Edit’ on the top menu.
Select ‘Edit Monitor Setup’.
   a. Select ‘5 Waveform Layout’, and then setup the monitor according to these instructions.

1. Click on the ‘Waveform 2’ box: select ‘Secondary ECG Lead’ on the available parameters box to the right. Then click ‘Select Parameter.’

2. Click on the ‘Waveform 3’ box: select ‘Arterial BP’ on the available parameters box to the right. Then click ‘Select Parameter.’

3. Click on the ‘Waveform 4’ box: select ‘CVP’ on the available parameters box to the right. Then click ‘Select Parameter.’

4. Click on the ‘Waveform 5’ box: select ‘Pleth (SpO2)’ on the available parameters box on the right. Then click ‘Select Parameter.’

5. Click on the ‘Numeric 6’ box: select ‘AGT’ on the available parameters box on the right. Then click ‘Select Parameter.’

6. Click on the ‘Numeric 7’ box: select ‘N2O’ on the available parameters box on the right. Then click ‘Select Parameter.’

7. Click on the ‘Numeric 8’ box: select ‘ICP’ on the available parameters box on the right. Then click ‘Select Parameter.’

8. Click on the ‘Numeric 5’ box: select ‘NONE’ on the available parameters box on the right. Then click ‘Select Parameter.’

9. Click on the ‘Numeric 4’ box: select ‘NONE’ on the available parameters box on the right. Then click ‘Select Parameter.’

10. Click on the ‘Numeric 3’ box: select ‘C.O.’ on the available parameters box on the right. Then click ‘Select Parameter.’

11. Click on the ‘Numeric 2’ box: select ‘Tblood’ on the available parameters box on the right. Then click ‘Select Parameter.’

12. Click on the ‘Numeric 1’ box: select ‘Pulse’ on the available parameters box on the right. Then click ‘Select Parameter.’

13. Rename layout name at the top to whatever you want.

14. Click on the ‘Save Setup’ box. The image below will pop-up.

Click on ‘Save’. 
To make this the default monitor:

15. Go to edit on your top menu bar.

16. Select ‘Configuration’.

17. Select ‘Patient Monitor’.

Click on instructor's monitor setup click on drop down arrow select desired setup click ‘OK’.

18. A message will appear, select ‘Yes’.
19. Changes will take effect next time the scenario is started.

20. The instructor monitor will now appear as below.

21. The instructor monitor and patient monitor should not look the same. If they do…

22. Click on ‘View’ located on the top menu bar.

23. If there is a √ in front of “instructor’s monitor = patient monitor”, uncheck it.
FloTrac Sensor/PreSep Catheter Simulation Scenario’s

Case 1 “Cardiogenic Shock Scenario”

This scenario reflects the application of advanced monitoring with a patient in cardiogenic shock.

Objectives

Objectives of scenario are to achieve the end points of resuscitation and maintain the patient within the end points until the termination of the simulation by using fluids combined with inotropic agents.

End Points

<table>
<thead>
<tr>
<th>Traditional Vital Signs</th>
<th>Advanced Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR &gt; 60 &lt; 101 bpm</td>
<td>ScvO₂ &gt; 70%</td>
</tr>
<tr>
<td>MAP 65 – 95 mmHg</td>
<td>CI &gt; 2.5 l/ml/m</td>
</tr>
<tr>
<td>SpO₂ &gt; 94%</td>
<td>SVV &lt; 10-15%</td>
</tr>
</tbody>
</table>

Teaching Points

1. SVV is still a useful indicator of fluid responsiveness in a patient with pump failure.
2. Careful use of volume infusion (small volumes at slow infusion rates) guided by SVV can increase cardiac output and oxygen delivery in the pump failure patient.
3. Inotropic support can increase pump function and cardiac output increasing oxygen delivery.
4. Timing of volume with Inotropic support allows for mitigation volume overload and pulmonary edema.
5. ScvO₂ is a helpful indicator in determining the adequacy of oxygen delivery against consumption.

Potential Teaching Points

1. Volume resuscitation with a low SVV will produce little increases in cardiac output.
2. Vasopressors used in the presence of hypovolemia may actually decrease cardiac output and oxygen delivery.
3. Inotropes used in the presence of hypovolemia may result in small increases in cardiac output with high increases in HR.
4. Resuscitation to acceptable traditional vital signs (HR, BP, SpO₂, RR) levels may be reached without reaching end points of advanced monitoring parameters (ScvO₂, CI, SVV) placing the patient at risk for inadequate oxygen delivery.

Ideal Pathway

Volume 500 ml followed by or in conjunction with Inotrope followed by volume 500 ml, followed by more Inotrope.
Chief Complaint

Chest pain and shortness of breath times 5 days.

HPI

45 y.o. female with chest pain and shortness of breath times 5 days. The patient reports intermittent chest pain that lasted a couple of minutes that would resolve spontaneously until today. Today the pain has become much worse occurring at rest every hour lasting up to 10 minutes. Associated symptoms include shortness of breath and nausea but no vomiting. Patient denies radiation of pain, fever, cough, abdominal pain, or leg pain.

PMH

• Hypertension

Family History

• Hypertension
• Mother with AMI @ 50

Medications

• NONE

Exam (presentation to emergency department)

• Vital Signs
  - Temp 37.6°C
  - HR 90
  - BP 123/79
  - RR 20
  - SpO₂ 95% on 2L NC

• Physical Exam
  - Alert and oriented. Diaphoretic
  - Regular rate and rhythm, no murmur/rub
  - Lungs clear to auscultation
  - Abdomen round soft, nontender, active bowel sounds
  - No reproducible pain with palpation of chest
Labs

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<tr>
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<tr>
<td>Cr</td>
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<td></td>
<td></td>
<td>BNP</td>
</tr>
<tr>
<td>Gluc</td>
<td>120</td>
<td></td>
<td></td>
<td>D-dimer</td>
</tr>
</tbody>
</table>

Studies

- Chest X-ray (PA/Lat): significant for enlarged heart shadow
- ECG: sinus rhythm with inverted T waves in anterior leads, no ST elevations

Hospital Course

After presentation to the emergency department, the patient received ASA, metoprolol PO, and started on heparin drip. The patient was seen by cardiology and medical management was chosen over cardiac catheterization. The patient was then transferred to the CCU for closer observation. After transfer to the CCU, the patient decompensated becoming hypotensive (80/40), tachypneic (RR 30), hypoxic (SpO₂ 89%) despite increased O₂. The patient was intubated and a PreSep catheter with ScvO₂ monitoring capability and an arterial line with a FloTrac sensor capable of continuous cardiac output monitoring were inserted. A repeat CXR post-intubation revealed pulmonary edema.

Instructions

The objective of the Adult Shock Patient Management scenario is to evaluate hemodynamic data from the Vigileo monitor and the patient bedside monitor to most appropriately treat a patient in a shock state. Therapeutic options include fluid resuscitation, blood products, vasopressors, inotropes, and diuretic administration. No laboratory, diagnostic studies, or interventional procedures are available during the scenario. Continue to manage your patient until satisfied with the available hemodynamic data.
Case 2 “Hypovolemic Shock Scenario”

This scenario reflects the application of advanced monitoring with a patient in hypovolemic shock.

Objectives

Objectives of scenario are to achieve the end points of resuscitation and maintain the patient within the end points until the termination of the simulation by using fluids, vasoactive and inotropic agents.

End Points

<table>
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<tr>
<th>Traditional Vital Signs</th>
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</tr>
<tr>
<td>MAP 65 – 95 mmHg</td>
<td>CI &gt; 2.5 l/ml/m</td>
</tr>
<tr>
<td>SpO₂ &gt; 94%</td>
<td>SVV &lt; 10-15%</td>
</tr>
</tbody>
</table>

Teaching Points

1. Volume infusion guided by SVV can increase cardiac output and oxygen delivery in the hypovolemic patient.
2. Inotropic support can increase pump function and cardiac output increasing oxygen delivery.
3. Blood transfusion increases oxygen carrying capacity as well as increases preload, both can result in increased oxygen delivery.
4. ScvO₂ is a helpful indicator in determining the adequacy of oxygen delivery against consumption and the prevention of tissue hypoxia.

Potential Teaching Points

1. Volume resuscitation with a low SVV will produce little increases in cardiac output.
2. Vasopressors used in the presence of hypovolemia may actually decrease cardiac output and oxygen delivery.
3. Inotropes used in the presence of hypovolemia may result in small increases in cardiac output with high increases in HR.
4. Resuscitation to acceptable traditional vital signs (HR, BP, SpO₂, RR) levels may be reached without reaching end points of advanced monitoring parameters (ScvO₂, CI, SVV) placing the patient at risk for inadequate oxygen delivery.

Ideal Pathway

2 liters of volume, through crystalloids, colloids, and blood followed by or in conjunction with inotropic support.
Chief Complaint:

Bright red blood per rectum.

HPI

67 y.o. male with complaint of bright red blood per rectum times 1 day. Patient reports multiple episodes over the past day with a small amount of blood each time. Associated symptoms include lower abdominal pain and mild lightheadedness when changing positions. Patient denies fever, nausea or vomiting, loss of consciousness, chest pain, SOB, or dysuria.

PMH

- Mitral valve replacement
- Diabetes mellitus
- Hypertension
- COPD
- h/o UTI 5 days ago treated with TMP-SMX

Medications

- Warfarin 5mg PO daily
- Lisinopril 10mg PO daily
- Insulin glargine 20 units SC daily
- TMP-SMX DS 1 tablet PO BID x 5 days (finished course yesterday)

Exam (presentation to emergency department)

- Vital Signs
  - Temp 37.8°C
  - HR 110
  - BP 115/70
  - RR 18
  - SpO₂ 95%

- Physical Exam
  - Awake but lethargic. Pale
  - Tachycardic, regular rhythm, no murmur/rub, positive click
  - Lungs clear to auscultation
  - Abdomen round soft, mild tenderness to palpation, no rebound tenderness, active bowel sounds
  - Weak pulses x4, capillary refill >4 seconds
Labs

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<tr>
<td>Gluc</td>
<td>187</td>
<td></td>
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</tr>
</tbody>
</table>

Studies

- CT Abdomen/Pelvis: significant for multiple diverticuli

Hospital Course

After presentation to the emergency department, the patient rapidly decompensated becoming more tachycardic, hypotensive, and decreased LOC. The patient was intubated and received 2 units PRBC, 2 units FFP, and 1L NS. A PreSep catheter with ScvO₂ monitoring capability and an arterial line with a FloTrac sensor capable of continuous cardiac output monitoring were inserted. The patient was then transferred to the MICU. Currently, the patient is 100% mechanically ventilated without any spontaneous breaths.

Instructions

The objective of the Adult Shock Patient Management scenario is to evaluate hemodynamic data from the FloTrac sensor/PreSep catheter and the patient bedside monitor to most appropriately treat a patient in a shock state. Therapeutic options include fluid resuscitation, blood products, vasopressors, inotropes, and diuretic administration. No laboratory, diagnostic studies, or interventional procedures are available during the scenario. Continue to manage your patient until satisfied with the available hemodynamic data.
Case 3 “Septic Shock Scenario”

This scenario reflects the application of advanced monitoring with a patient in septic shock.

Objectives

Objectives of scenario are to achieve the end points of resuscitation and maintain the patient within the end points until the termination of the simulation by using fluids combined with inotropic agents.

End Points

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<td>CI &gt; 2.5 l/ml/m</td>
</tr>
<tr>
<td>SpO₂ &gt; 94%</td>
<td>SVV &lt; 10-15%</td>
</tr>
</tbody>
</table>

Teaching Points

1. SVV is still a useful indicator of fluid responsiveness in a patient with septic shock.
2. Volume infusion guided by SVV can increase cardiac output and oxygen delivery in the septic patient.
3. Inotropic support can increase pump function and cardiac output increasing oxygen delivery.
4. Blood transfusion increases oxygen carrying capacity as well as increases preload both can result in increased oxygen delivery.
5. ScvO₂ is a helpful indicator in determining the adequacy of oxygen delivery against consumption and the prevention of tissue hypoxic.

Potential Teaching Points

1. Volume resuscitation with a low SVV will produce little increases in cardiac output.
2. Vasopressors used in the presence of hypovolemia may actually decrease cardiac output and oxygen delivery.
3. Inotropes used in the presence of hypovolemia may result in small increases in cardiac output with high increases in HR.
4. Resuscitation to acceptable traditional vital signs (HR, BP, SpO₂, RR) levels may be reached without reaching end points of advanced monitoring parameters (ScvO₂, CI, SVV) placing the patient at risk for inadequate oxygen delivery.

Ideal Pathway

3 liters of volume, through crystalloids, colloids, or blood.
Chief Complaint

Shortness of breath and productive cough times 3 days

HPI

55 y.o. male with shortness of breath and productive cough times 3 days. The patient reports thick tan sputum production that has progressively become worse. Associated symptoms include fever, chest tightness, and decreased PO intake. Patient denies headache, abdominal pain, nausea/vomiting/diarrhea, dysuria, or leg pain.

PMH

• Hypertension
• Diabetes mellitus
• COPD

Medications

• Albuterol 2 puffs Q4 hours
• Amlodipine 5mg PO daily
• Insulin glargine 25 units SC daily

Exam (presentation to emergency department)

• Vital Signs
  - Temp 38.5°C
  - HR 120
  - BP 115/70
  - RR 24
  - SpO2 85%

• Physical Exam
  - Alert and oriented
  - Tachycardic, regular rhythm, no murmur/rub
  - Crackles right lower lobe
  - Abdomen round soft, nontender, active bowel sounds
  - No edema. Pulses intact
Labs

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<tbody>
<tr>
<td>Na</td>
<td>132</td>
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<td>CO2</td>
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<td>BUN</td>
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<tr>
<td>Cr</td>
<td>2.0</td>
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<tr>
<td>Gluc</td>
<td>200</td>
<td></td>
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</tbody>
</table>

INR | 1.3 |
PTT | 32  |
D-dimer | 3 |
BNP | 100 |

Studies

- Chest X-ray (PA/Lat): significant consolidation RLL consistent with pneumonia
- ECG: sinus tachycardia otherwise normal

Hospital Course

After presentation to the emergency department, the patient was started on a sepsis protocol, given 1L NS, cultures were drawn, and started on IV antibiotics. After 30 minutes the patient decompensated becoming more tachypneic (RR 40) and hypoxic (SpO2 80%) despite increased O2. The patient was intubated and a PreSep catheter with ScvO2 monitoring capability was inserted.

Instructions

The objective of the Adult Shock Patient Management scenario is to evaluate hemodynamic data from the FloTrac sensor/PreSep sensor and the patient bedside monitor to most appropriately treat a patient in a shock state. Therapeutic options include fluid resuscitation, blood products, vasopressors, inotropes, and diuretic administration. No laboratory, diagnostic studies, or interventional procedures are available during the scenario. Continue to manage your patient until satisfied with the available hemodynamic data.