TO INITIATE MONITORING, YOU NEED: **STARLING** MONITOR AND SENSORS

**DOES MY PATIENT HAVE A LOW BLOOD PRESSURE/MAP OR PERFUSION PROBLEM (I.E., LOW UOP/HIGH LACTATE)?**

**DO I NEED TO GIVE FLUID?**

(only ~50% of hemodynamically unstable patients are fluid responsive!)

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**DYNAMIC ASSESSMENT**

**PLR**
- 3 min baseline
- 3 min challenge

* Turn off SCDs for set up and duration of PLR.

**BOLUS**
- 3 min baseline
- Challenge

- 250 ml in <5 min
- OR 500 ml in <10 min

**RESULTS**: ±10% ΔSVI patient is likely fluid responsive

<10% ΔSVI (including negative numbers) patient is not likely fluid responsive

**Wloul you like to start immediately from the challenge stage?**” means “Can I use the last 3 minutes of SVI data as my baseline?” (i.e, no nursing interventions)

**Baseline shows unstable results** means the last 3 SVI readings have changed more than 10%. Consider repeating baseline.

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**CALIBRATION VS. BASELINE:**

**Calibration** = signal optimization occurs during initial pt. set-up.

**Baseline** = initial SVI readings of a dynamic assessment

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**SENSORS:**

- “Box in” the heart
- Red dashes indicate right/left and upper/lower
- White tabs point to toes
- Can be on front or back in any combination

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**NEED TO RECALIBRATE:**

(Session Controls > Recalibrate)

- If any or all sensors are moved or replaced
- Once a shift

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**Baxter**

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FLUID MANAGEMENT MONITORING SYSTEM
## Clinical Shock States

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Normal Adult Range</th>
<th>Cardiogenic Shock</th>
<th>Septic Shock</th>
<th>Hypovolemic Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP (MAP)</td>
<td>&gt; 65</td>
<td>↑</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Heart Rate (HR)</td>
<td>60–100</td>
<td>↑ early</td>
<td>↑ late</td>
<td>↓ late</td>
</tr>
<tr>
<td>Cardiac Index (CI)</td>
<td>2.5–4.0 L/min/m²</td>
<td>↓</td>
<td>↑ 10%</td>
<td>↑ 10%</td>
</tr>
<tr>
<td>Total Peripheral Resistance Index (TPRI)</td>
<td>1970–2390 dynes • sec/cm²/m²</td>
<td>↑</td>
<td>↓ late</td>
<td>↓ late</td>
</tr>
</tbody>
</table>

### Changes in Stroke Volume Index (ΔSVI) to Dynamic Assessment
- ΔSVI <10%: Unlikely to be Fluid Responsive
- ΔSVI ≥10%: Likely to be Fluid Responsive

### Hemodynamic Parameters

#### Shock States
- **Septic Shock**: Mean Arterial Pressure (MAP) ≥70–105 mmHg; Cardiac Index (CI) ≥60 mL/beat/m²
- **Hypovolemic Shock**: Mean Arterial Pressure (MAP) ≥80 mmHg; Cardiac Index (CI) ≥60 mL/beat/m²

#### Hypovolemic Shock
- Mean Arterial Pressure (MAP) ≥80 mmHg; Cardiac Index (CI) ≥60 mL/beat/m²

#### Cardiogenic Shock
- Cardiac Index (CI) ≥4.0 L/min/m²

### Dynamic Assessments Directly Challenge the Heart with Volume to Measure its Response:

#### Passive Leg Raise (PLR) Maneuver
- Translocation of 250-300cc of blood from lower extremities into the heart

#### Fluid Bolus Challenge (FB)
- Rapid Infusion of 250cc of fluid over 3-5 minutes

### Normal Hemodynamic Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Equation</th>
<th>Normal adult range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke Volume (SV)</td>
<td>CO/HR x 1000</td>
<td>60 – 100 mL/beat</td>
</tr>
<tr>
<td>Stroke Volume Index (SVI)</td>
<td>SV/BSA</td>
<td>33 – 47 mL/beat/m²</td>
</tr>
<tr>
<td>Δ Stroke Volume Index (ΔSVI)</td>
<td>Change in SV after Dynamic Assessment</td>
<td>≥10% Likely to be Fluid Responsive</td>
</tr>
<tr>
<td>Cardiac Output (CO)</td>
<td>HR x SV/1000</td>
<td>4.0 – 8.0 L/min</td>
</tr>
<tr>
<td>Cardiac Index (CI)</td>
<td>CO/BSA</td>
<td>2.5 – 4.0 L/min/m²</td>
</tr>
<tr>
<td>Mean Arterial Pressure (MAP)</td>
<td>(SBP + (2 x DBP))/3</td>
<td>70 – 105 mmHg</td>
</tr>
<tr>
<td>Total Peripheral Resistance (TPR)</td>
<td>80 x (MAP/CO)</td>
<td>800 – 1200 dynes • sec/cm²</td>
</tr>
<tr>
<td>Total Peripheral Resistance Index (TPRI)</td>
<td>80 x (MAP/CI)</td>
<td>1970 – 2390 dynes • sec/cm²/m²</td>
</tr>
</tbody>
</table>

### Changes in Stroke Volume Index (ΔSVI) to Dynamic Assessment
- ΔSVI ≥10% Predictive of 15% increase in CO with 500cc

### Systemic Hemodynamics and Hemodynamic Management


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**Patient Selection Tool**

- **Shock States/Low Blood Pressure**: Sepsis, Low Vascular Tone, Low Cardiac Output, Hypovolemia, Neurogenic Shock
- **Patients treated with Inotropes, Vasopressors or Vasodilators**
- **Surgical Patients**: Perioperative Volume Management, Goal Directed Therapy, Enhanced Recovery After Surgery (ERAS)
- **Emergency/Trauma Patients**
- **Other Critical Care Conditions**: Acute Respiratory Distress (ARDS), Sub-Arachnoid Hemorrhage (SAH), Acute Kidney Injury (AKI), Congestive Heart Failure (CHF)
- **Patients undergoing Continuous Renal Replacement Therapy (CRRT) or patients undergoing hemodialysis**

**Only ~50% of hemodynamically unstable patients will respond to fluid by increasing cardiac output and perfusion.**