ClearSight System Technology Overview

How does it work?

Volume clamp method
- The essence is to dynamically provide equal pressures on either side of the wall of the artery by clamping the artery to a certain constant volume
- 1000 times each second the cuff pressure is adjusted to keep the diameter of the finger arteries constant
- Continuous recording of the cuff pressure results in a real-time finger pressure waveform

The Physiocal method – Physiological Calibration
- The Physiocal method is the real-time expert system that determines the proper arterial ‘unloaded’ volume, i.e. no pressure gradient across the arterial wall
- Automatic, periodic adjustments are essential to track the unloaded volume clamp setpoint when smooth muscle tone changes (e.g. during vasoconstriction)
- Calibration interval starts at 10 beats, but it increases to every 70 beats as stability increases
- Physiocal interval >30 beats is considered reliable

Brachial pressure reconstruction
- Clinical standard for noninvasive BP is brachial level
- The ClearSight system reconstructs the brachial arterial pressure waveform from the finger arterial pressure waveform
- The reconstruction algorithm is based on a vast clinical database

Cardiac output calculation
- Stroke volume is calculated by an algorithm based on an improved pulse contour method using:
  - The area under systolic portion of blood pressure curve (Systolic Pressure-time Integral - SPI)
  - A physiological model to calculate afterload individualized by age, gender, height and weight
- Cardiac output results from stroke volume times heart rate and is updated every beat

References
**Validation of monitoring blood pressure and cardiac output with non-invasive finger cuff technology versus traditional methods**

### Blood pressure validation studies

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<thead>
<tr>
<th>Vs. Noninvasive upper arm cuff</th>
<th>Bias ± SD</th>
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<tr>
<td>Akkermans et al. – Hypertension in Pregnancy 2009&lt;sup&gt;6&lt;/sup&gt;</td>
<td>33 pregnant patients</td>
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<td>Eeftinck Schattenkerk et al. – Am J Hypertension 2009&lt;sup&gt;7&lt;/sup&gt;</td>
<td>104 volunteers</td>
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### Cardiac output validation studies

Measurement of relative changes in CO performs comparably with invasive measurements

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<thead>
<tr>
<th>Vs. Noninvasive upper arm cuff</th>
<th>Percentage error</th>
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<tr>
<td>Bubene-Turconi et al – Anesthesiology-Analgesia 2013&lt;sup&gt;12&lt;/sup&gt;</td>
<td>28 cardiac surgery patients</td>
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<tr>
<td>Bogert et al – Anaesthesia 2010&lt;sup&gt;13&lt;/sup&gt;</td>
<td>25 post CABG patients</td>
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<tr>
<td>Stover et al – BMC Anesthesiology 2009&lt;sup&gt;14&lt;/sup&gt;</td>
<td>10 severely ill ICU patients</td>
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### References (continued)