



note the degree of pulsatility. Pulse has been seen to “mean out” with high levels of Impella® support; however, the mean blood pressure should be adequate and in the 60–75 mmHg range. Myocardial depression and/or severe hypovolemia will exacerbate this phenomenon. With this knowledge, one should be prepared and aware that the Impella® alarm of “Impella® Position Unknown” will be displayed if the arterial pulse pressure is <20 mmHg at which point pulse oximetry monitors may simultaneously indicate falling or potentially unknown oxygen saturation condition.

It should be noted that although the blood pressure may be flat and non-pulsatile, the patient is still displaying an acceptable blood pressure mean. Acceptable systemic oxygenation can be validated by a normal or unchanged exam (skin color) or by arterial blood gas analysis.

Pulsatility can be returned by reduction of Impella® support level (if the patient can tolerate such a reduction) or by increasing the available blood volume for the native heart and the Impella® to pump. This can be accomplished through IV fluid administration. A more rapid option is through the use of a vasoconstrictor allowing a relatively

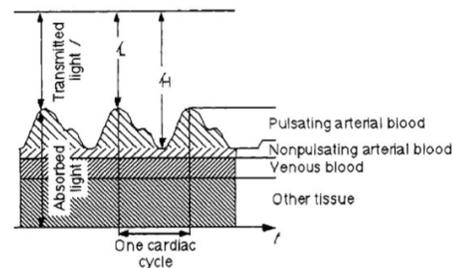
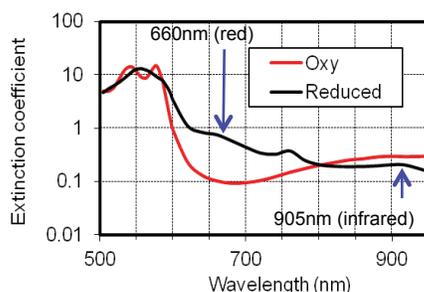
large volume of blood to be made available to the systemic circulation by the selective vasoconstriction of the abdominal venous capacitance vessels. Small doses of ephedrine or phenylephrine may rapidly increase available intracardiac volume so that Impella® flow remains high and the left ventricle has volume to pump, thus restoring native pulsatility.

## SUMMARY

While on Impella® support, a patient’s blood flow inherently loses its pulsatile nature, which may cause a patient’s pulsatility to drop or disappear completely. Clinicians may see a drastic drop or a “zero” value calculated for SpO<sub>2</sub>, regardless of the true arterial oxygen saturation. However, the mean blood pressure should be adequate and in the 60–75 mmHg range and skin color and/or arterial blood gas analysis should reveal acceptable systemic oxygenation. Reducing Impella® support, if the patient can tolerate the reduction, or administering IV fluids to increase blood volume can return pulsatility. Pulsatility may also be restored by administering small doses of ephedrine or phenylephrine to rapidly increase left ventricular volume and keep Impella® flow high.

**Figure 1: Basis of Standard Pulse Oximetry and the Implications of Non-Pulsatile Flow (1,2)**

- Transilluminate a fingertip with at least 2 wavelengths, e.g., 660nm (red) and 905nm (infrared).
- Determine absorbance of each wavelength by pulsing arterial blood (and not other components of the fingertip) by measuring changing transmission during pulses
- Convert to absorbance (really attenuation).
- Calculate ratio of attenuation of red to attenuation of infrared



From Weiben 1997



### Without a discernable pulse, standard pulse oximetry fails

1. Aldrich, Thomas K, MD. *Pulseless Oximetry*. Health & Bio Technology Summit. Bronx: Albert Einstein College of Medicine and Montefiore Medical Center, 2014. Print.
2. Wieben O, *Light absorbance in pulse oximetry*, in *Design of pulsoximetry*, J.G. Webster, Editor. 1997, Institute of Physics Publishing, Dirac House, Temple Back, Bristol BS1 6BE, UK: Bristol. p. 40-55.
3. Slaughter, Mark S, et al. *Clinical management of continuous-flow left ventricular assist devices in advanced heart failure*. *J Heart Lung Transplant* 2010;29:51–539.