

Cardiac Index

Clinical Education

CI Physiology

Cardiac Output (CO) is an important hemodynamic parameter that explains the volume of blood being pumped out of the heart per minute. Fick's Principle, states that the volume of the oxygen consumed per unit of time (VO_2) is proportional to the difference in oxygen content between arterial (C_a) and venous (C_v) blood. Cardiac Output has the units of L/min.

$$CO = VO_2 / C_a - C_v$$

CO = Cardiac Output

VO₂ = Oxygen Consumption, mL of gas per minute

C_a = concentration of arterial (oxygenated) blood

C_v = concentration of venous (deoxygenated) blood

Cardiac Index (CI) is a hemodynamic parameter that expresses the volume of blood pumped by the heart in a minute (CO) divided by the body surface area (BSA). It is used to evaluate the performance of the heart to the size of the individual. Cardiac Index has the units of L/min/m².

$$CI = CO / BSA$$

CI = Cardiac Index

CO = Cardiac Output

BSA = Body Surface Area

Current Method

Currently there are numerous methods to measure cardiac output, both invasive and non-invasive, but none are considered the "gold standard". Invasive methods are more commonly accepted but evidence has proven that they are not necessarily effective in managing therapy, therefore there is a growing need for the development of non-invasive methods.

The Mespere Cardiac Index system is a non-invasive and continuous solutions that can help healthcare professionals make an easy and reliable cardiac index assessment.

Interpreting a Change in CI Measurement

Normal range of CI is between 2.6-4.2 L/min/m². A CI reading outside of this range should be monitored, and appropriate measures should be taken to get the CI back into the normal range.

Mespere LifeSciences Solution for CI

Based upon assumed Fick determination, the Mespere Cardiac Index (CI) system is able to non-invasively assess cardiac index. Because it is very difficult to monitor and measure gas concentrations a common value for VO₂ consumption at rest is used, 125mL O₂ per minute per meter of body surface area. It is also a known fact that each gram of hemoglobin can carry 1.34 mL of O₂ and that there is a hemoglobin concentration of 150 grams of hemoglobin per liter of blood. Using these assumptions, the oxygen content can then be calculated with the following formula:

$$\text{Oxygen Content of Blood} = [15] \left(\frac{\text{g of Hb}}{\text{dl}} \right) \times 1.34 \left(\frac{\text{mL of O}_2}{\text{g of Hb}} \right) \times O_2^{\text{saturation fraction}}$$

Clinical Applications of Non-Invasive CI

The Mespere Cardiac Index (CI) system is indicated for healthcare professional to measure trending changes in the patient's body to allow physicians to better understand cardiovascular health. The Mespere Cardiac Index (CI) system should be used by health care professionals as a non-invasive, spot checking and/or continuous assessment tool for physical assessment of cardiac index (CI) of an individual. This is done via an adhesive neck sensor placed over the external jugular vein and a pulse oximeter placed on the patient's finger. This device is intended for use in hospital and clinical environments.

Mespere Cardiac Index (CI) System

