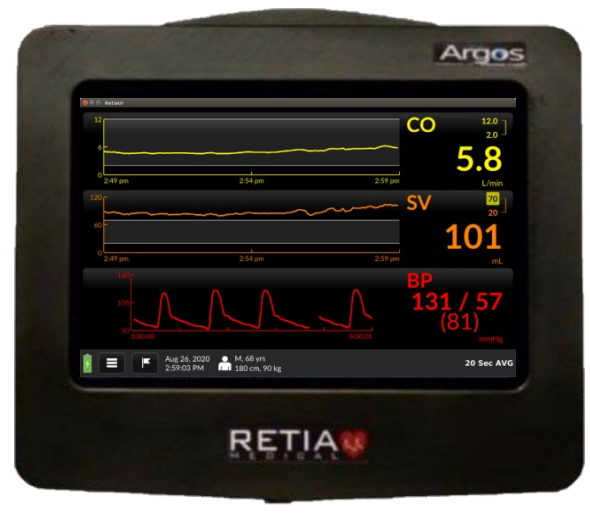
ARGOS® CARDIAC OUTPUT MONITOR: HOW IT WORKS

Retia's monitors are based on Multi-Beat Analysis (MBA™), a technology that the company developed over the past 15 years in collaboration with researchers at Michigan State University and the Massachusetts Institute of Technology. It has been rigorously tested in the most challenging patient populations.

SEE CLINICAL EVIDENCE

BACKGROUND

The algorithm has been rigorously tested and validated in the most challenging patient populations (including patients with sepsis, heart failure, major cardiac surgery, neurosurgery, major abdominal surgery, liver transplants and others). The basis for this technology is the use of the blood pressure waveform from multiple heart beats (up to 20) in conjunction with a more precise model of the circulation to determine the patient's hemodynamics while avoiding the confounding effects of **wave reflection** that cause significant inaccuracies in the readings from other pulse contour algorithms.



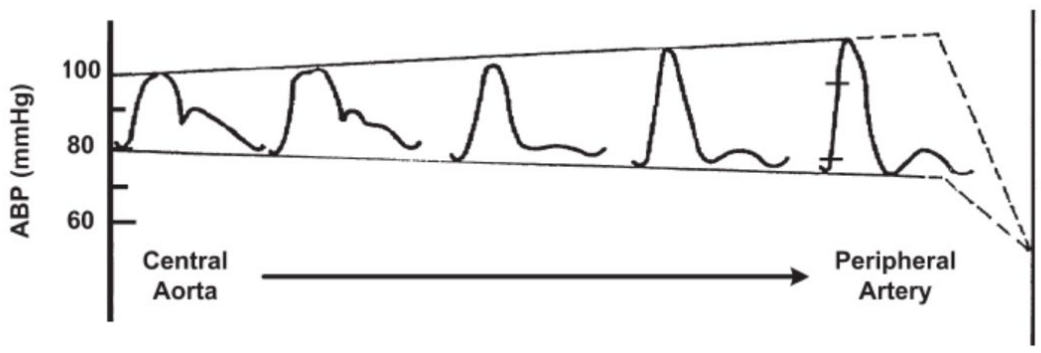
Argos® Cardiac Output Monitor

WHAT IS WAVE REFLECTION?

Ejection of blood from the heart initiates pressure and flow waves that travel through the arterial tree. Whenever these pressure and flow waves reach a site of resistance mismatch (i.e., where the arterial tree branches off into progressively smaller arteries), especially the high-resistance arteries, they are in part reflected back towards the heart. [1-4] The observed pressure (or flow) at a given arterial site is thus equal to the sum (or difference) of the forward- and backward-traveling waves at that site. [3]

As a result, the arterial blood pressure waveform becomes progressively distorted with increasing distance from the heart [1]. It is notable that the systolic blood pressure and the pulse pressure (systolic minus diastolic) become more amplified, and the exponential diastolic decay that is readily observed in the waveform at the central aorta becomes less apparent at the peripheral artery.

FIGURE 1:



The blood pressure waveform becomes progressively distorted from the central aorta to the peripheral arteries due to wave reflections in the arterial tree.[1,2]

In addition, the magnitude and timing of the wave reflections can vary, depending on the condition of the patient and any interventions that may be performed. For example, the reflected waves and the corresponding amplification of systolic pressure and pulse pressure are magnified by vasoconstriction and minimized by vasodilation. As a result, conventional circulatory models, such as the three-parameter Windkessel model and other lumped parameter models, do not accurately represent the circulation because they ignore the confounding effects of wave reflection.

WHAT IS MULTI-BEAT ANALYSIS (MBA™)?

Professor Rama Mukkamala, the inventor of the Multi-Beat Analysis (MBA™) algorithm, recognized that the confounding effects of arterial wave reflections diminish when analyzing multiple beats. As a result, analyzing a peripheral arterial blood pressure (ABP) over multiple beats offers a superior approach to determining CO more accurately.

The MBA™ algorithm uses two steps to determine a single-contraction ABP response:

1. Construction of a cardiac contraction signal based on an impulse train in which each impulse is positioned at the starting point of an ABP pulse upstroke and is then scaled by the subsequent pressure pulse.

2. Estimation of an impulse response, which is then optimally fitted to the ABP waveform segment.

Learn about the MBA™ Algorithm

WATCH VIDEO

REFERENCES

1. McDonald DA. Blood Flow in Arteries. London: Arnold 1874.
2. Noordergraaf A. Circulatory System Dynamics New York: Academic, 1978.
3. Westerhof N. et al. Forward and backward waves in the arterial system. Cardiovasc Res 6:648-656, 1972.
4. Mukkamala, R. et al, Am J Physiol Heart Circ Physiol 299:584-599, 2010.

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