

## PWA Glossary

- 1) **Pulse Wave Analysis (PWA):** PWA means the appliance of algorithms from the field of bio-mathematics, in order to transfer the shape of the peripheral pulse wave into the pulse wave form of the aortic arch. These mathematical calculations are summarized within the term 'Generalized Transfer Function'. Calculations from the fields of wave harmonics, higher derivative Windkessel equations and other complex bio-mathematical areas are included in the analysis. The pulse wave analysis enables the provision of different and independent parameters for the assessment of cardiovascular risk (biomarkers).
- 2) **Pulse Wave:** The pulse wave is a pressure wave that -initialized on each heart beat-propagates through the arterial vascular system. Due to the uniqueness of the arterial vascular system of every human being, the pulse wave itself is as unique as a fingerprint. Its shape is composed of the result of two components, the inflection- and the reflection wave.
- 3) **Inflection wave:** With each heartbeat, a pulse wave is generated which extends from the left ventricle of the heart into the entire arterial tree. This wave is called ejection wave or also inflection wave.
- 4) **Reflection Wave:** On its way through the arterial tree, the inflection wave encounters vessel branches (bifurcations), vasoconstrictions or vascular damage (endothelial dysfunction, deposits of plaques, etc.). This partly healthy (physiological), partly pathologically induced properties of the peripheral vascular system cause the inflection wave to be reflected in many places. Thus, many smaller (running in reverse) waves are created. The summation of these pulse waves running counter wise to the ejection wave is called the reflection wave.
- 5) **Peripheral (brachial) pulse wave:** During the pulse wave recording, the pulse wave is captured in the periphery of the arterial tree. This is called a peripheral pulse wave or depending on the recording position also brachial or radial pulse wave.
- 6) **Central (aortic) pulse wave:** A result of the pulse wave analysis is the shape of the central pulse wave. This is often referred to in literature as aortic pulse wave. The shape of this calculated pulse wave corresponds exactly to the same shape as that of the pulse wave, which can be recorded by the invasive insertion of a pressure sensor in the aortic arch (catheterization).
- 7) **Amplitude of Reflection Wave (Pb):** The concept of Wave Separation Analysis allows for the display of the reflection wave shape. Consequently, the maximum amplitude of the reflection wave shape is defined as "Amplitude of the backward running wave" (Pb) - The maximum amplitude of the reflection wave has been shown to be an independent predictor for cardio vascular events.
- 8) **Amplitude of Ejection Wave (Pf):** Please refer to "Amplitude of the forward running wave" (Pf) in analogy to the backward running wave amplitude.
- 9) **Cardiac Output:** Cardiac Output is the volume of blood being pumped by the heart in the time interval of one minute

- 10) **Stroke Volume:** Stroke Volume is the volume of blood being pumped by the heart in each heartbeat.
- 11) **Peripheral Resistance:** Peripheral Resistance sets into relation the cardiac output and the mean arterial pressure. It thereby indicates on the ability of the heart to sufficiently perfuse the organs with oxygen – given a certain pressure level in the periphery of the metabolic system.
- 12) **Cardiac Index:** Cardiac Index relates the Cardiac Output to body surface; similar to the widely used SVI (Stroke Volume Index).
- 13) **Augmentation Pressure:** Pressure influence of reflection wave to ejection wave. Augmentation pressure is defined as the amount of pressure difference between P2 and P1 (see attached graphs for visualization). Nota bene: Augmentation pressure can be negative, in case the reflection wave impulse is imposed to the ejection wave in diastolic heart cycle.
- 14) **Reflection Coefficient:** Reflection coefficient describes the ratio between reflection wave amplitude (Pb) and ejection wave amplitude (Pf). It is calculated by following formula: Pb divided by Pf – also refer to attached graph for visualization and to the definitions for Amplitude of Reflection Wave and Amplitude of Ejection Wave.
- 15) **Augmentation Index:** Augmentation Index by definition is calculated by following formula: Augmentation Pressure divided by central Pulse Pressure multiplied by 100. Taking augmentation pressure into relation to the pulse pressure allows for a more precise statement on the impact of the impulse of the reflection wave (see attached graphs for visualization). Nota bene: Augmentation Index can be negative; also refer to remark in Augmentation Pressure.
- 16) **Alx@75:** Augmentation Index @ 75 corrects the augmentation index for heart rate and standardizes the results to a normative heart rate of 75 beats per minute. This correction allows for the ability to compare Alx values between two different subjects, or the result of the measurement to a norm cohort.
- 17) **Pulse Wave Velocity:** Pulse wave velocity (PWV) describes the speed of the pulse wave travelling within the aorta. PWV is considered the gold standard in arterial stiffness evaluation and the respective unit of results is meter per second (m/s).
- 18) **Pulse pressure amplification:** Pulse pressure amplification sets into relation the brachial pulse pressure and the central (aortic) pulse pressure. As the pressure in an elastic artery amplifies from proximal to distal, the pulse pressure amplification enables to assess the quality of the arteries in not only the large arteries, but also including the peripheral arteries.

