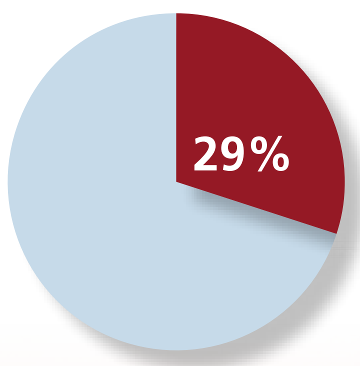
Innovation and Accuracy in CardioVascular Disease prevention

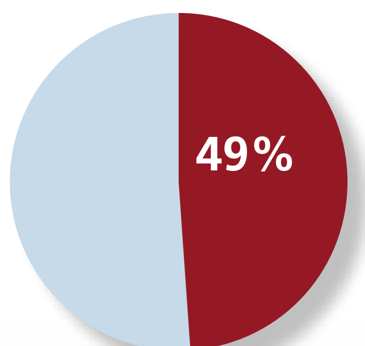
QIMT-QAS

Introduction

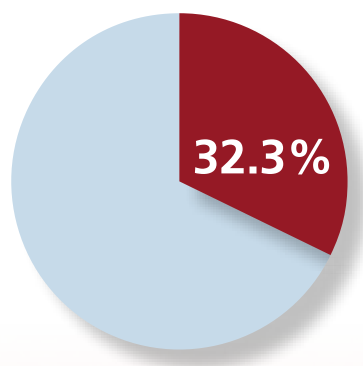
- CardioVascular Disease is the number one cause of death and disability *(World Health Report 2004, WHO)*
- According to World Health Organization (WHO) estimates, in 2003, 16.7 million people around the globe die of CVD each year. This is over 29 percent of all deaths globally.*(www.who.int)*
- Each year CVD causes over 4.35 million deaths in Europe and over 1.9 million deaths in the EU. CVD causes nearly half of all deaths in Europe (49 percent) and in the EU (42 percent). *(European Cardiovascular Disease Statistics. 2005 Edition, British Heart Foundation Health Promotion Research Group)*
- In US, nearly 2300 Americans die of CVD each day, an average of 1 death every 38 seconds *(AHA Statistical Update Heart Disease and Stroke Statistics - 2010 Update. A report from the American Heart Association)*



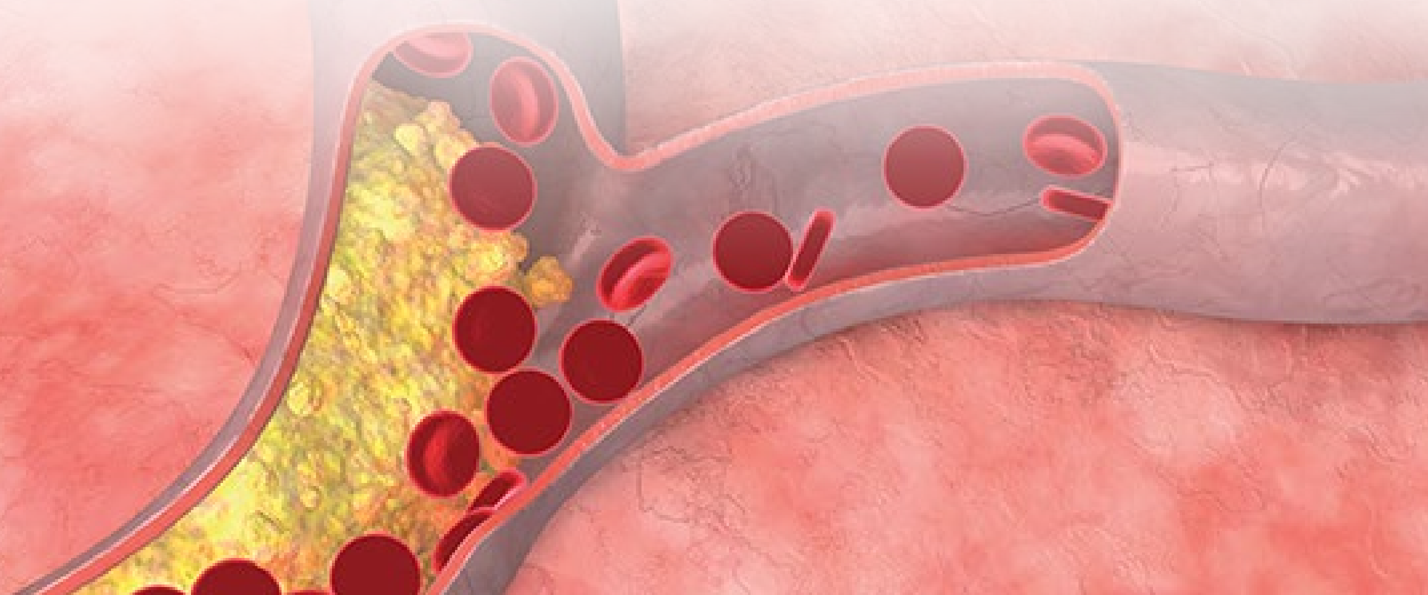
CVD deaths
around the **globe**



CVD deaths
in **Europe**



CVD deaths
in **U.S.**



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Why is prevention of CVD needed?

Because CVD is an important cause of:

- Premature mortality and morbidity
- Years of life lost (YLL) and Disability adjusted lifeyears (DALY's)
- Increasing health care costs

Objectives of CVD prevention

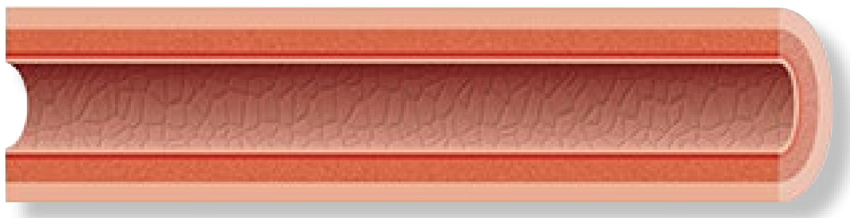
Early detection reduces the risk of major Cardiovascular events resulting in reduced premature morbidity and mortality, prolongs good health and improves quality of life. QIMT and QAS can help assess the need for lifestyle changes, management of cardiovascular risk factors and the prophylactic use of certain drugs.

Guidelines on CVD Prevention

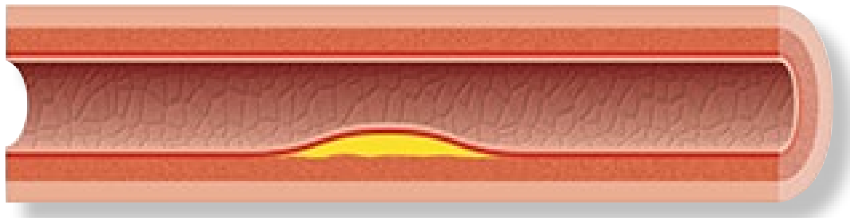
The 2012 European Guidelines on CVD Prevention in Clinical Practice is a new shorter and more practical format around the 5 key questions of prevention:

- What is it?
- Why is it needed?
- For whom?
- By whom?
- How can be provided?

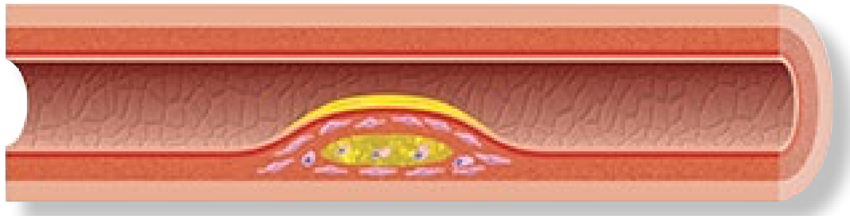
The European Guidelines state that vascular ultrasound screening is reasonable for risk assessment in asymptomatic individuals at moderate risk, i.e. for primary prevention.



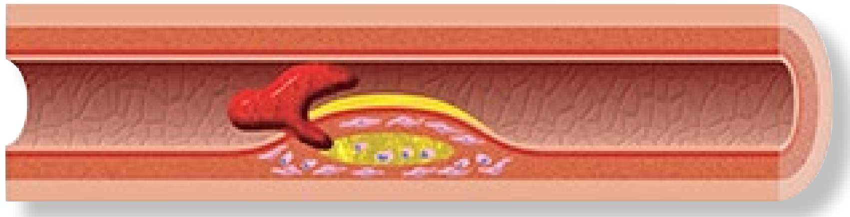
1 Normal artery



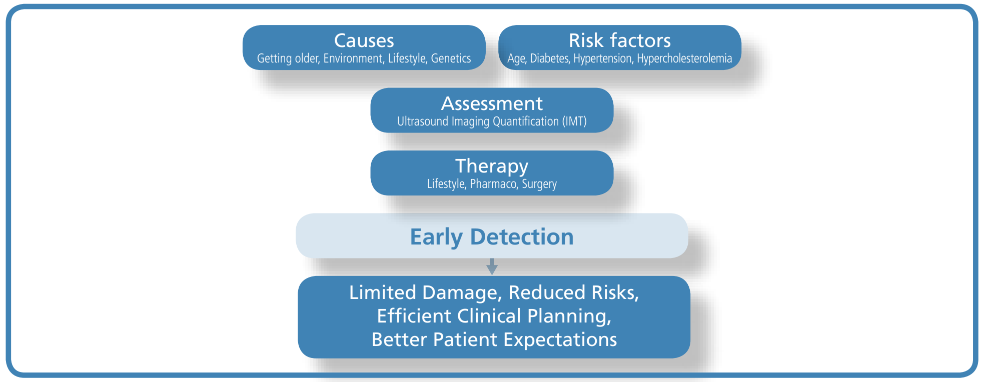
2 Fatty streak



3 Mature plaque



4 Ruptured plaque
with thrombus formation



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Causes
Getting older, Environment, Lifestyle, Genetics

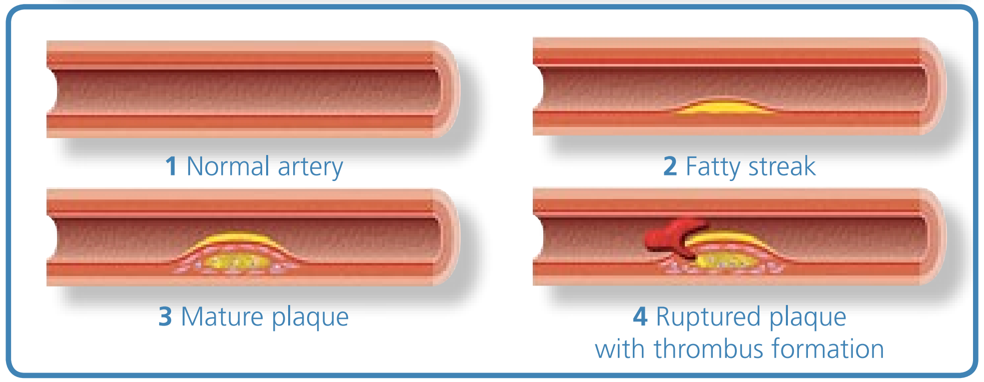
Risk factors
Age, Diabetes, Hypertension, Hypercholesterolemia

Assessment
Ultrasound Imaging Quantification (IMT)

Therapy
Lifestyle, Pharmaco, Surgery

Early Detection

Limited Damage, Reduced Risks, Efficient Clinical Planning, Better Patient Expectations



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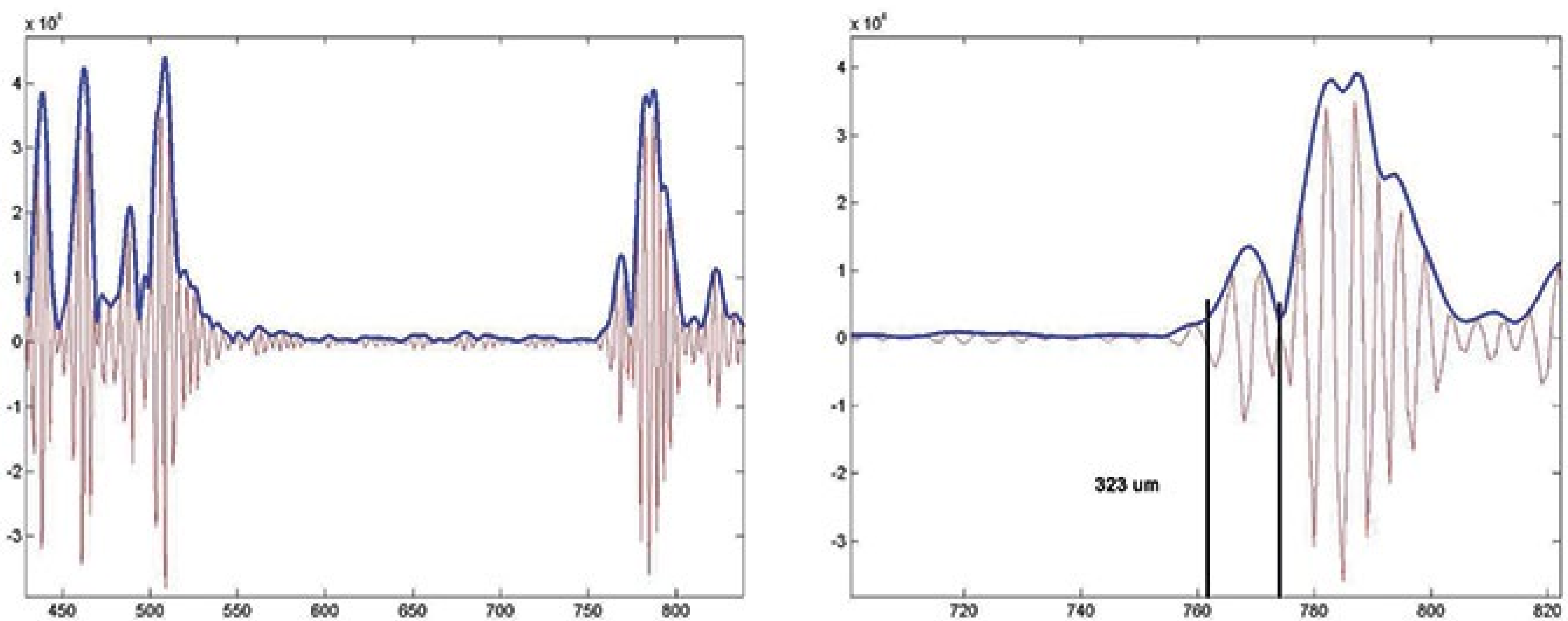
RF-technology

The RadioFrequency (RF) is received unfiltered from the ultrasound transducer; it is raw data and contains 100% of the reflected signal.

The Esaote Quality Arterial Stiffness (RFQAS) and Quality Intima media Thickness (RFQIMT) are based on RF-data technology. This allows an accurate assessment of arterial stiffness and vessel wall thickness.

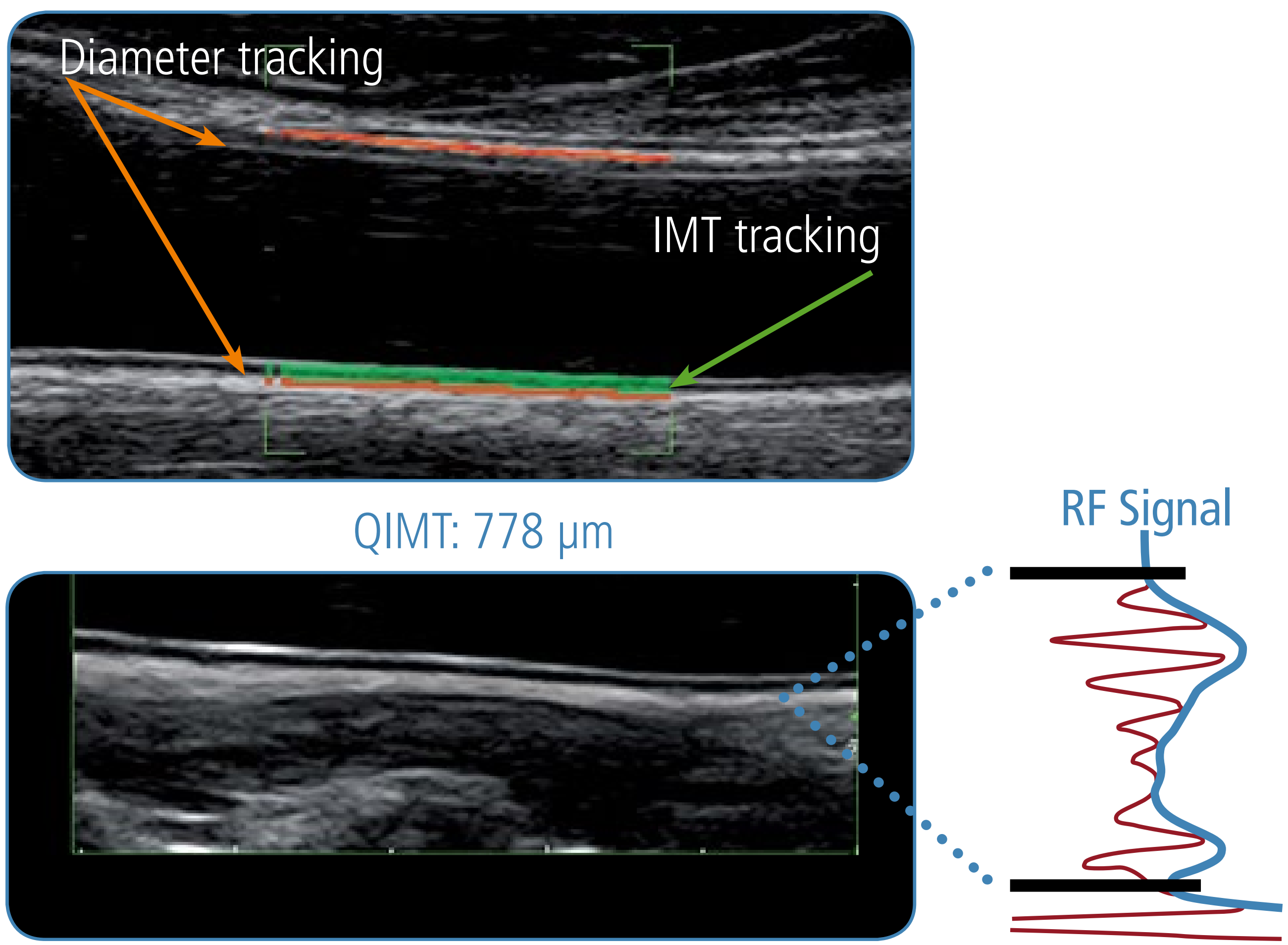


While traveling through the body, ultrasonic waves react uniquely to different tissue types; the RF preserves all information content.

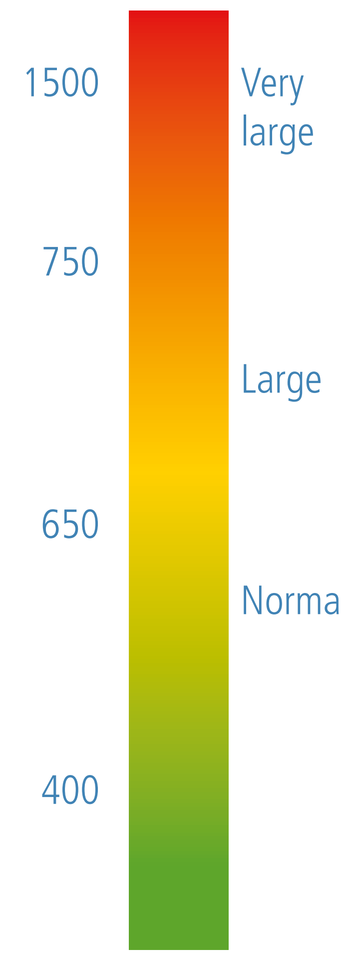
RF-technology versus video-based methods

The RF based technology provides several advantages over the old video-based method:

- The information available with radiofrequency contains more than double the information contained in the video signal
- The real-time character of the functional information has also an inherent measurement quality feedback by means of a B-mode overlay
- Due to the real-time feedback the operator is able to optimize probe position to achieve the best possible scan plane.



Assessment of Blood Vessel Wall Properties by means of ultrasound



Quality Intima Media

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Highlights and advantages

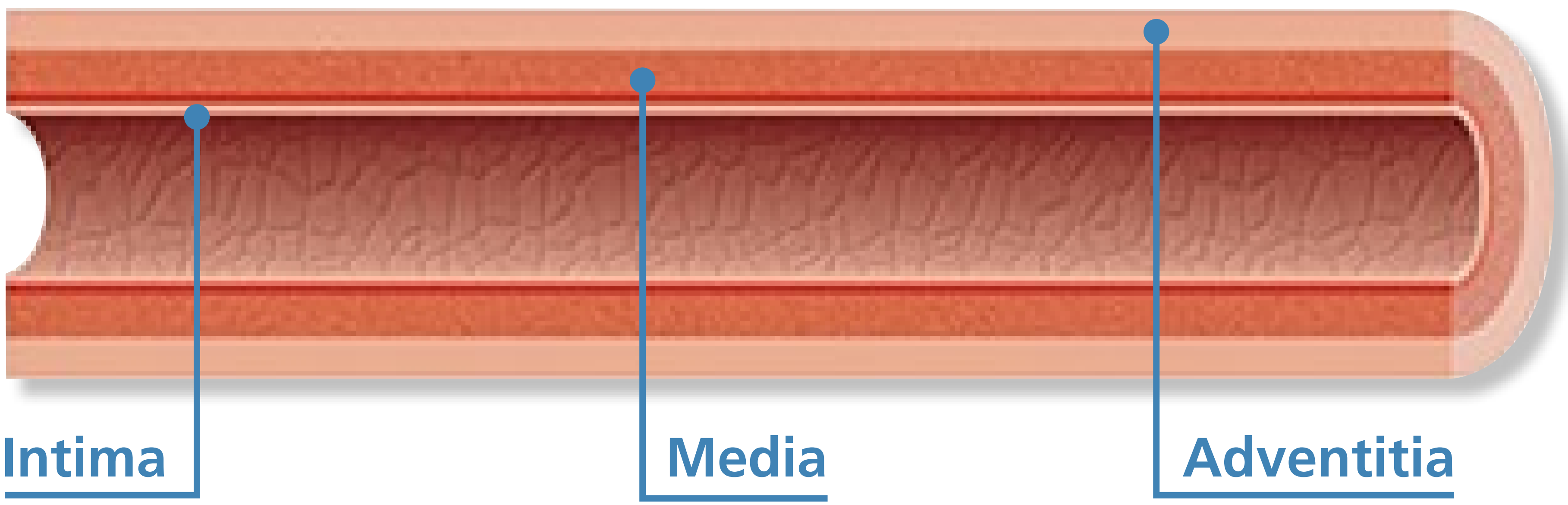
- Accuracy
- Quality feedback control
- Ease of use
- Decreased operator variability
- Real-time

Quality Intima Media Thickness

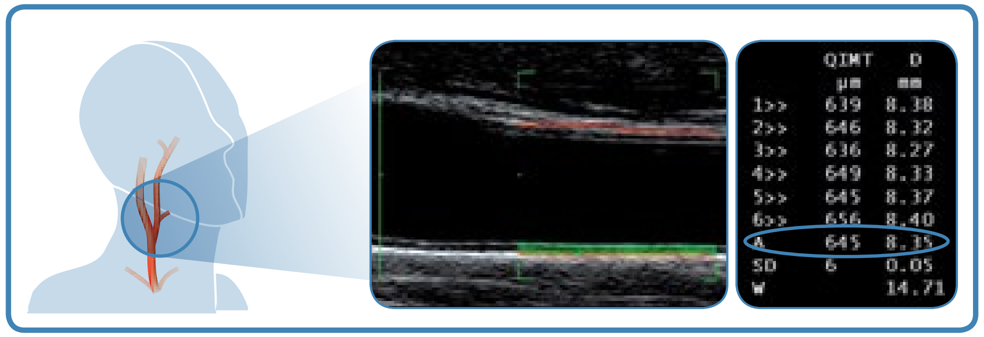
Intima-media thickness (IMT) of the inner arterial wall has been shown to correlate with the degree of atherosclerosis measured by autopsy that, in turn, has been found to correlate with atherosclerotic burden in other arterial beds[1].

Consequently, carotid IMT is considered a surrogate marker of subclinical atherosclerosis. Increased carotid IMT is associated with CV risk factors, prevalent CVD and coronary artery atherosclerosis. Additionally, it has been shown to predict future CV events and death, independently of CV risk factors[2-3].

Structural and functional ultrasound imaging such as arterial stiffness (QAS) and blood vessel wall thickness (QIMT) are emerging as the most representative of arteriosclerosis and atherosclerosis, and are widely validated for monitoring CVD patients and as independent markers of cardiovascular risk[4-8].



Atherosclerosis is a condition in which plaque builds up on the inner lining of arteries.



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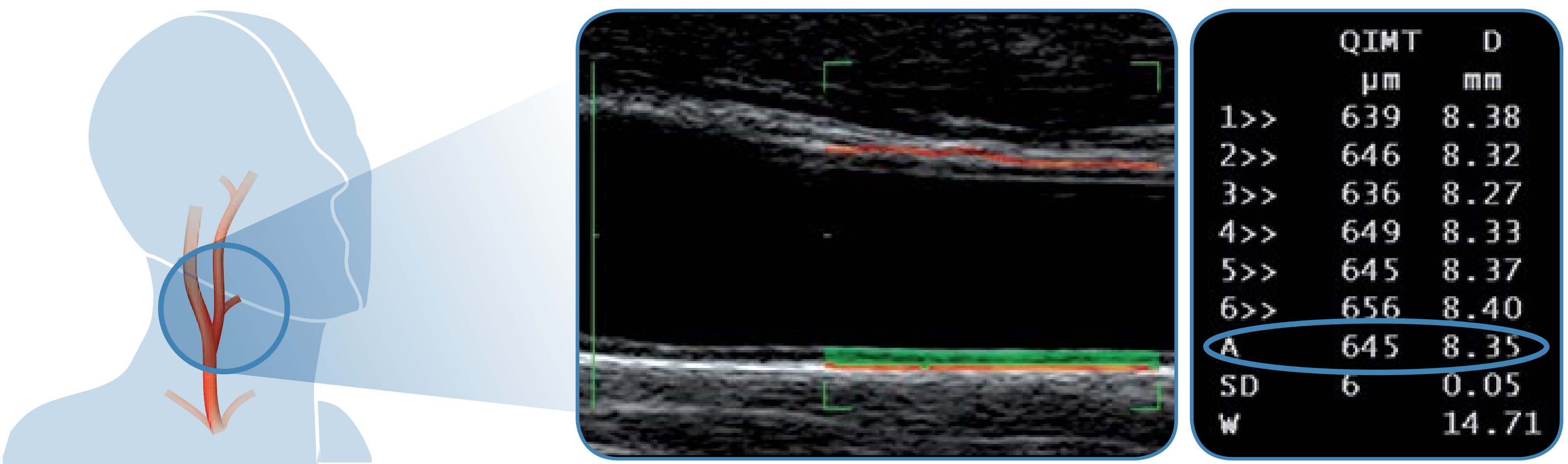

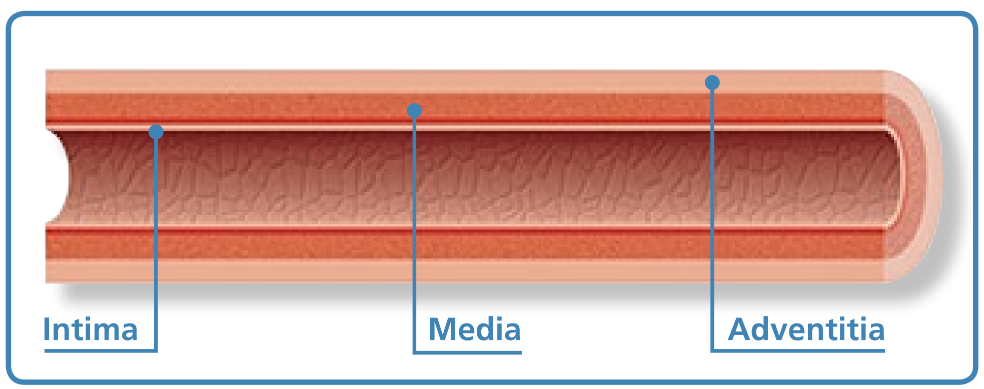

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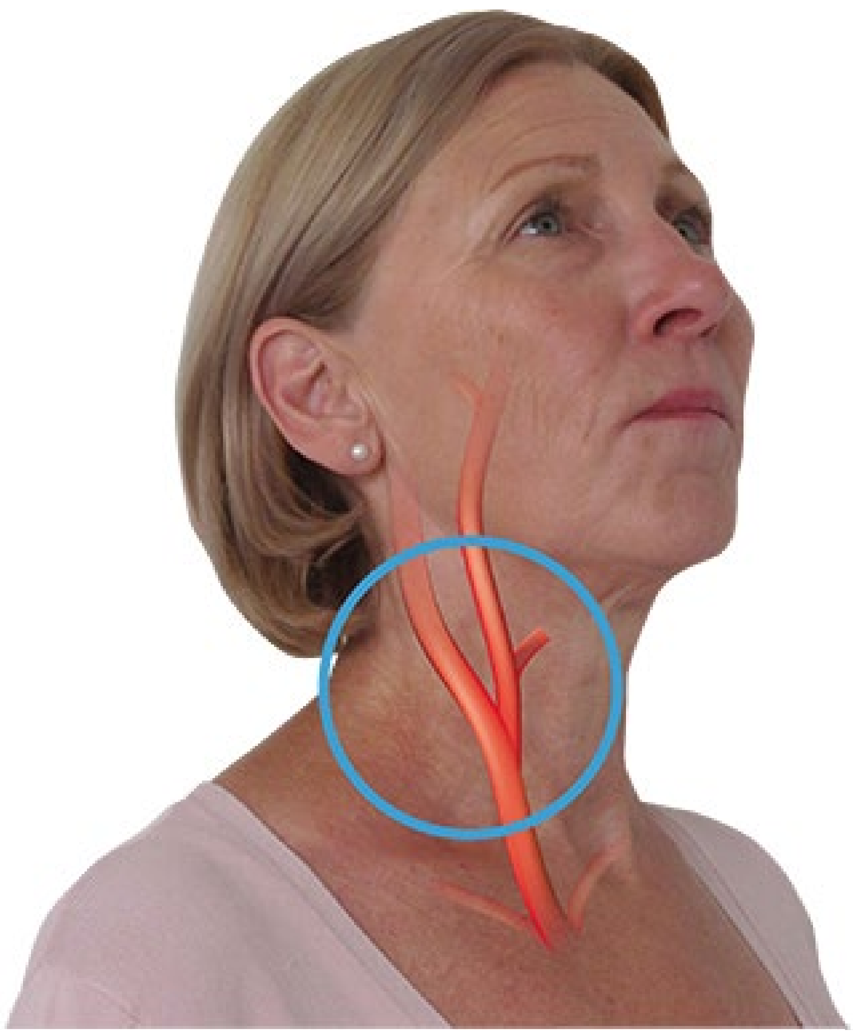
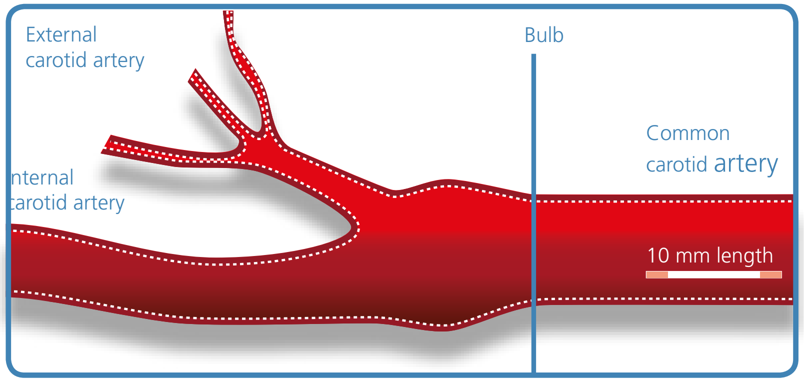
Measurement of the ^{RF}QIMT

The ^{RF}QAS and ^{RF}QIMT measurements are performed at the Common Carotid Artery.

Mannheim consensus suggestes measuring IMT and stiffness on the common carotid artery, where the accuracy and reproducibility of the measurements are superior.





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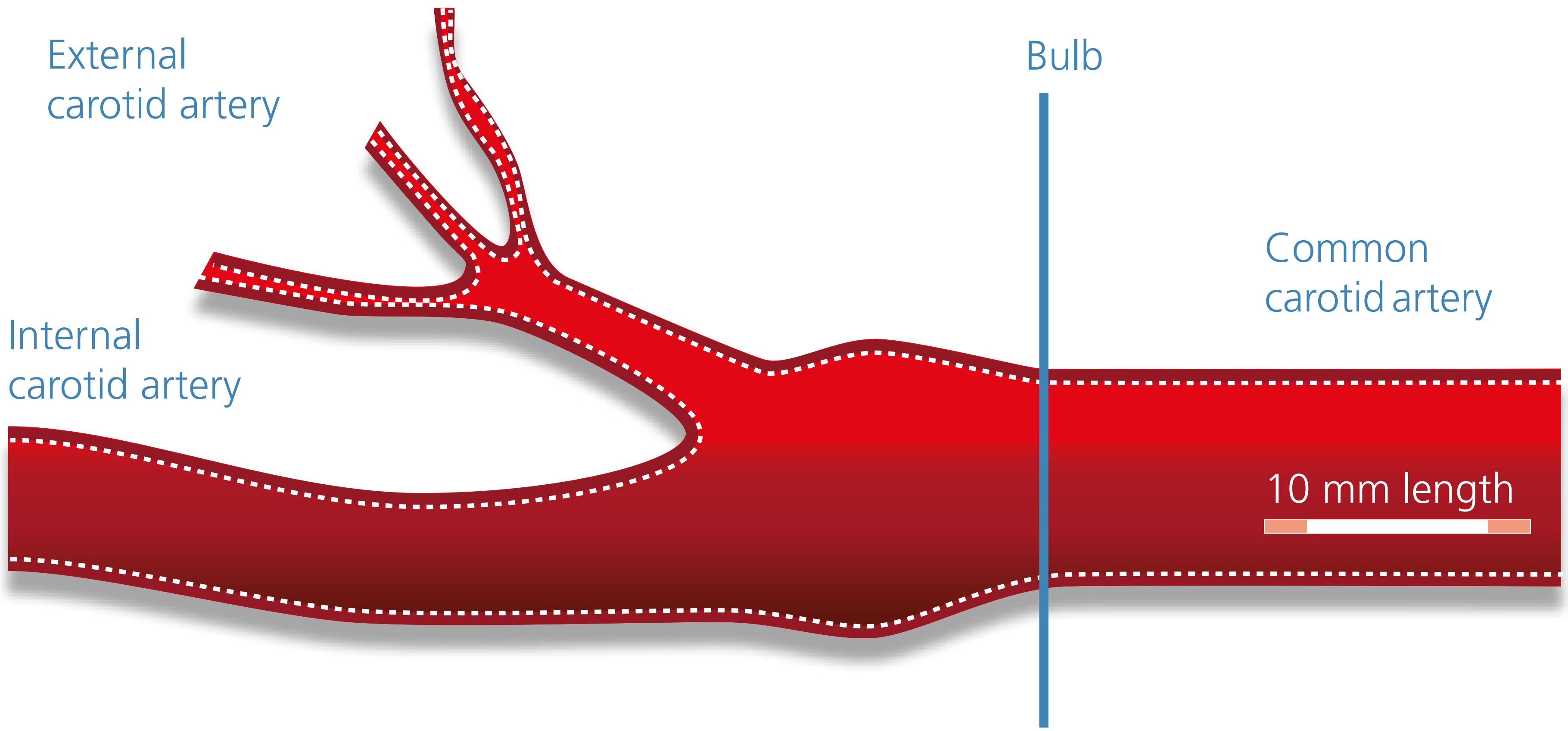

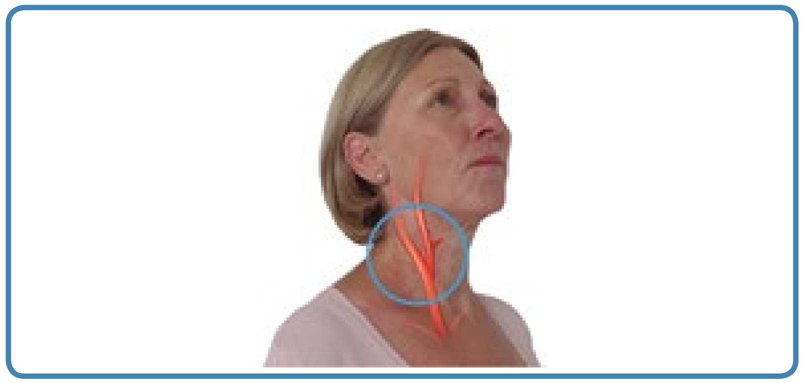

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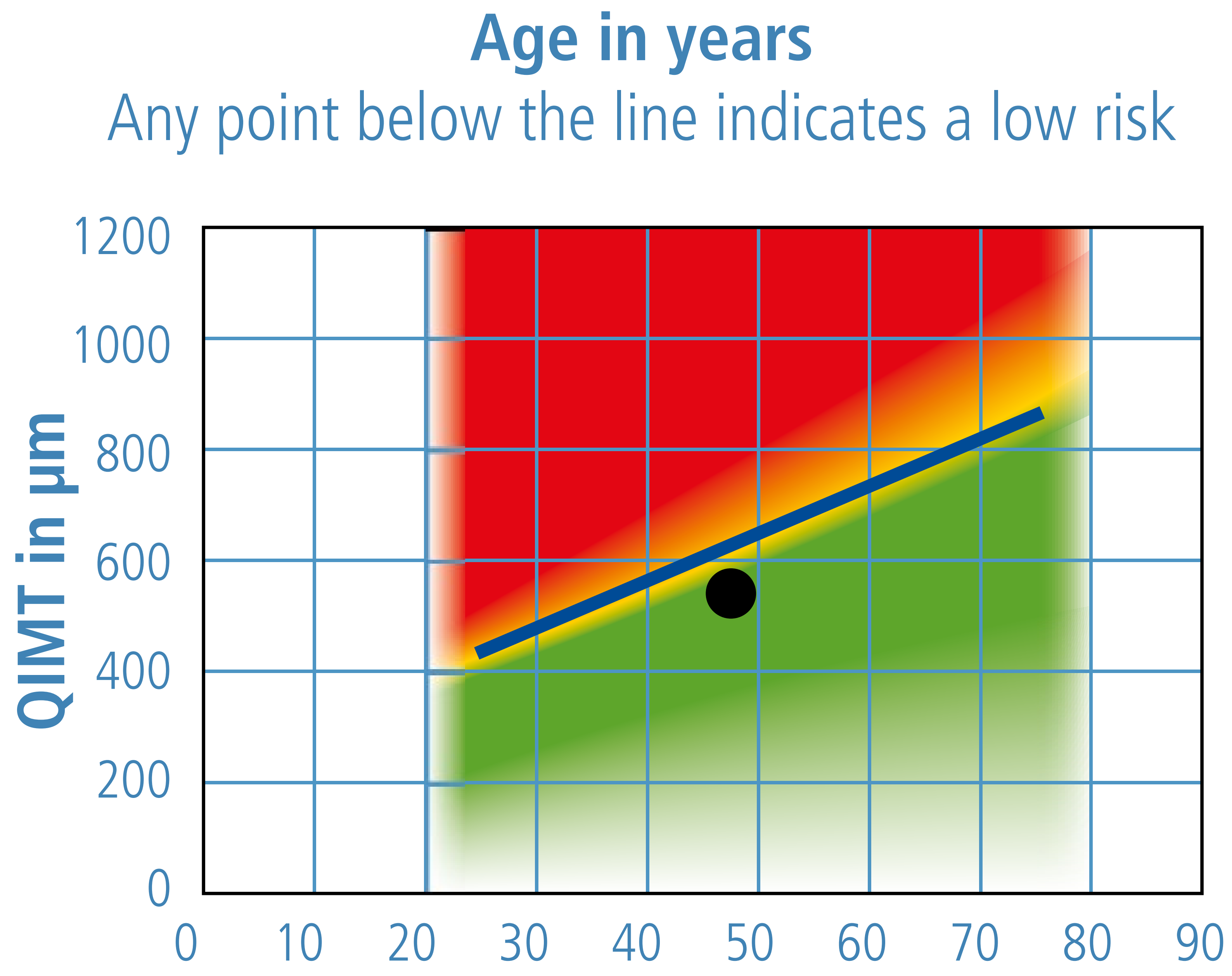
RFQIMT graph

QIMT is based on the Howard or MESA tables.

The Howard table represents the QIMT values in micrometers taken from the ARIC study over age.

The MESA table represents the QIMT values taken from the MultiEthnic Study of Atherosclerosis (MESA).

The measured value is displayed in the QIMT graph and enables the doctor and patient to compare that value with the normal values obtained in one of the two studies cited.



RFQIMT report

CARDIOVASCULAR REPORT

Date : 21-Jan-2013

Gender : Female

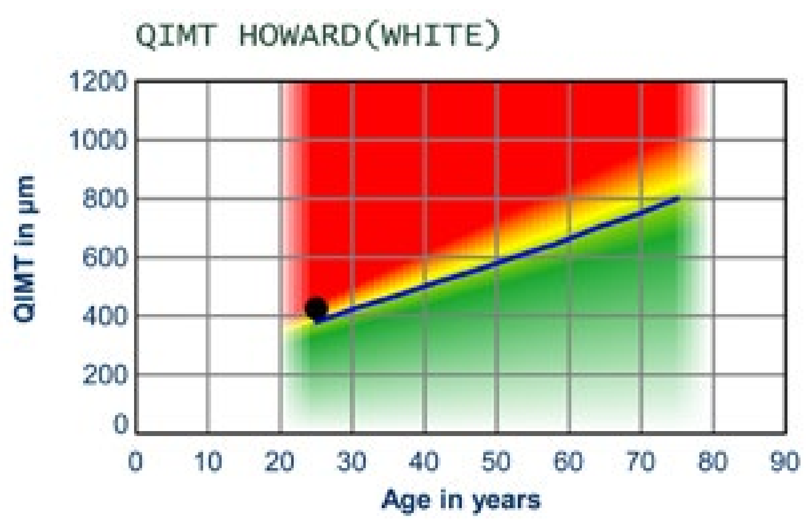
Age : 25 Years
Systolic BP : 120 mmHg
Diastolic BP : 80 mmHg

QUALITY INTIMA MEDIA THICKNESS

RIGHT

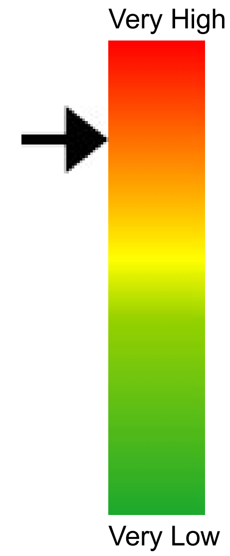
QIMT	:	425 µm	**Diameter**	:	6.36 mm
QIMT SD	:	9 µm	**Diameter SD**	:	0.03 mm

CALCULATIONS



Any point below the line indicates a low risk

Normal QIMT	:	380 µm
Maximum QIMT (right)		425 µm
Expected Age	:	32 Y
Risk of CVD based on highest QIMT	:	High



QUALITY ARTERIAL STIFFNESS

RIGHT

Distension	:	622 µm	**Brachial Psys**	:	120 mmHg
Distension SD	:	24 µm	**Brachial Pdia**	:	80 mmHg
Diameter	:	6.57 mm			
Diameter SD	:	0.07 mm			

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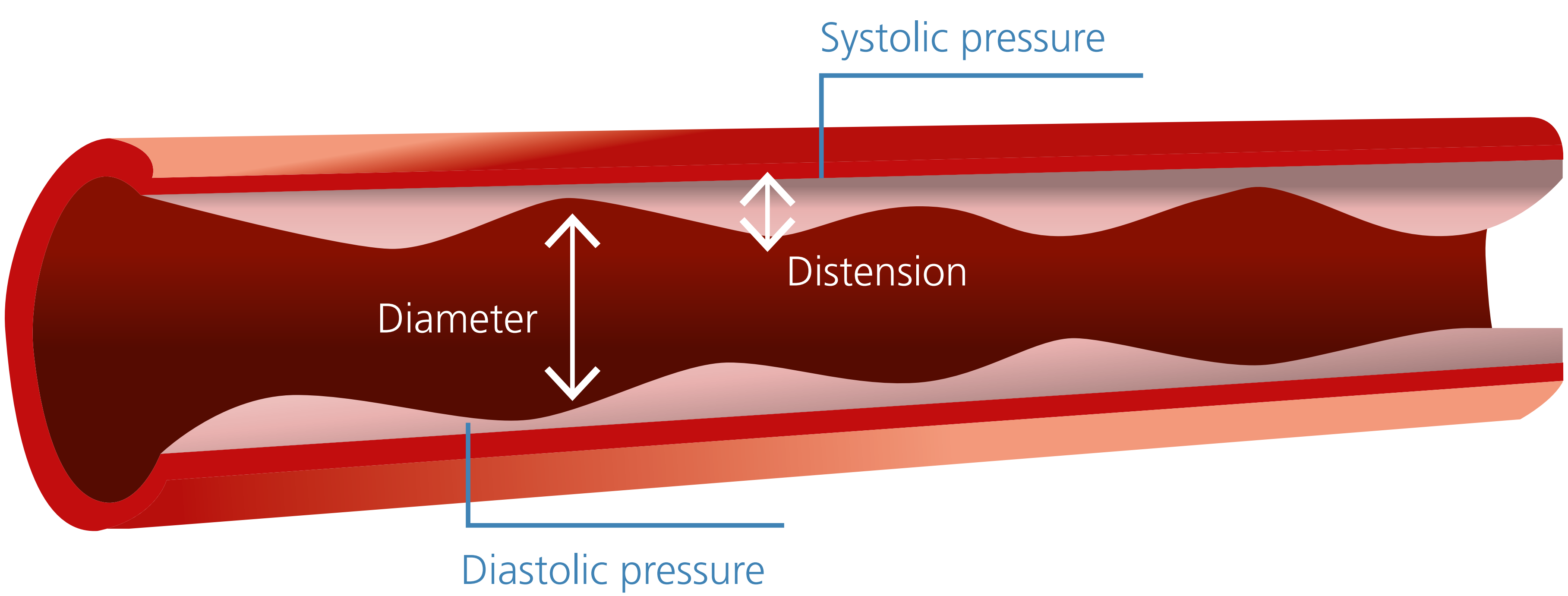
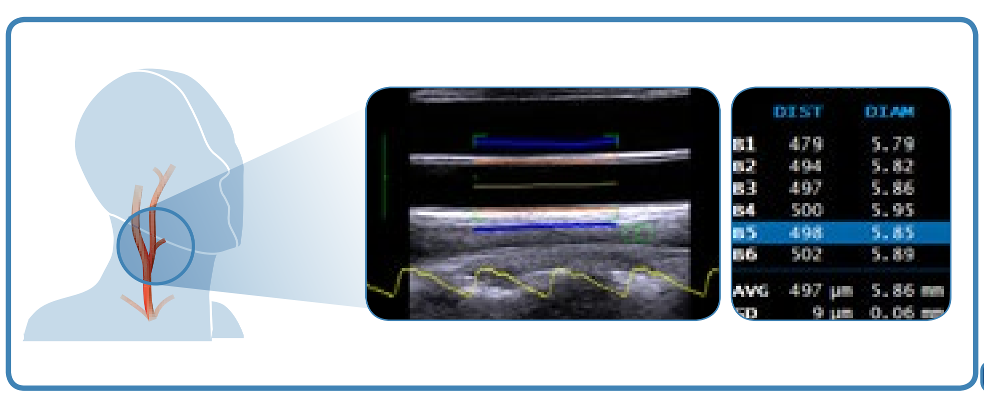
Quality Arterial Stiffness

The stiffening of arteries is the most important cause of increasing both systolic and pulse pressure as well as decreasing diastolic pressure in people of 40 years and above.

This leads to cardiovascular complications, such as left ventricular hypertrophy, aneurysm formation and rupture[9].

Hence a noninvasive determination of arterial stiffness during a routine ultrasound examination of the carotid arteries is a powerful clinical tool in CVD prevention.





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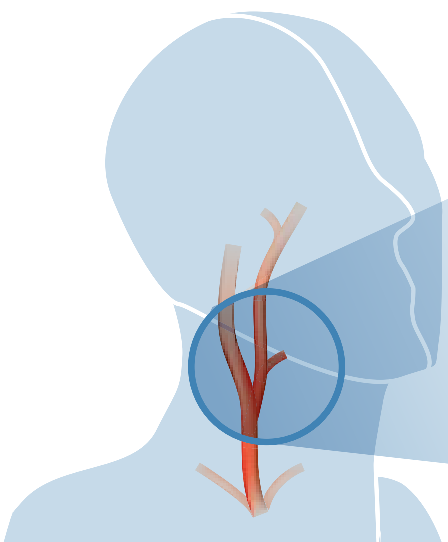
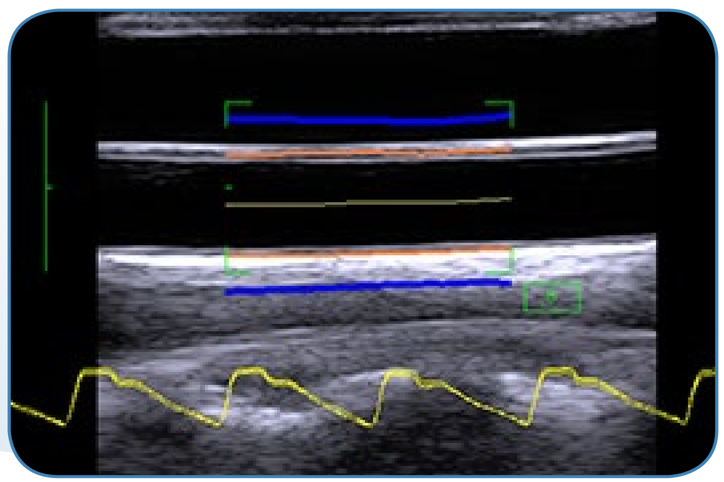
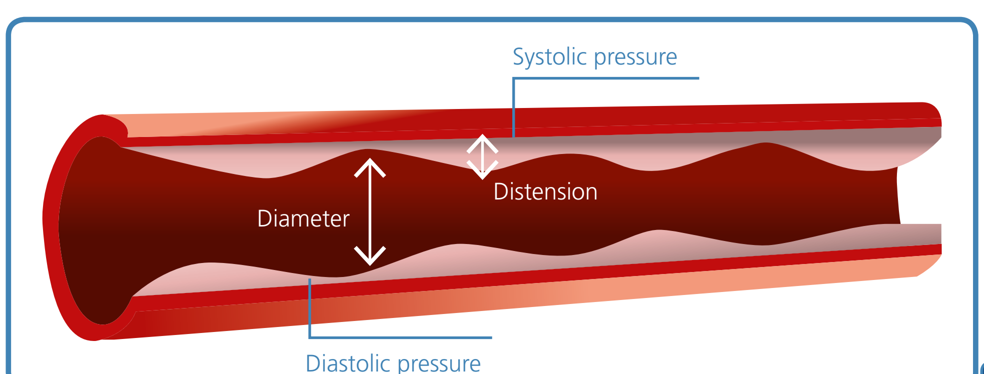




	DIST	DIAM
B1	479	5.79
B2	494	5.82
B3	497	5.86
B4	500	5.95
B5	498	5.85
B6	502	5.89
AVG	497 µm	5.86 mm
SD	9 µm	0.06 mm



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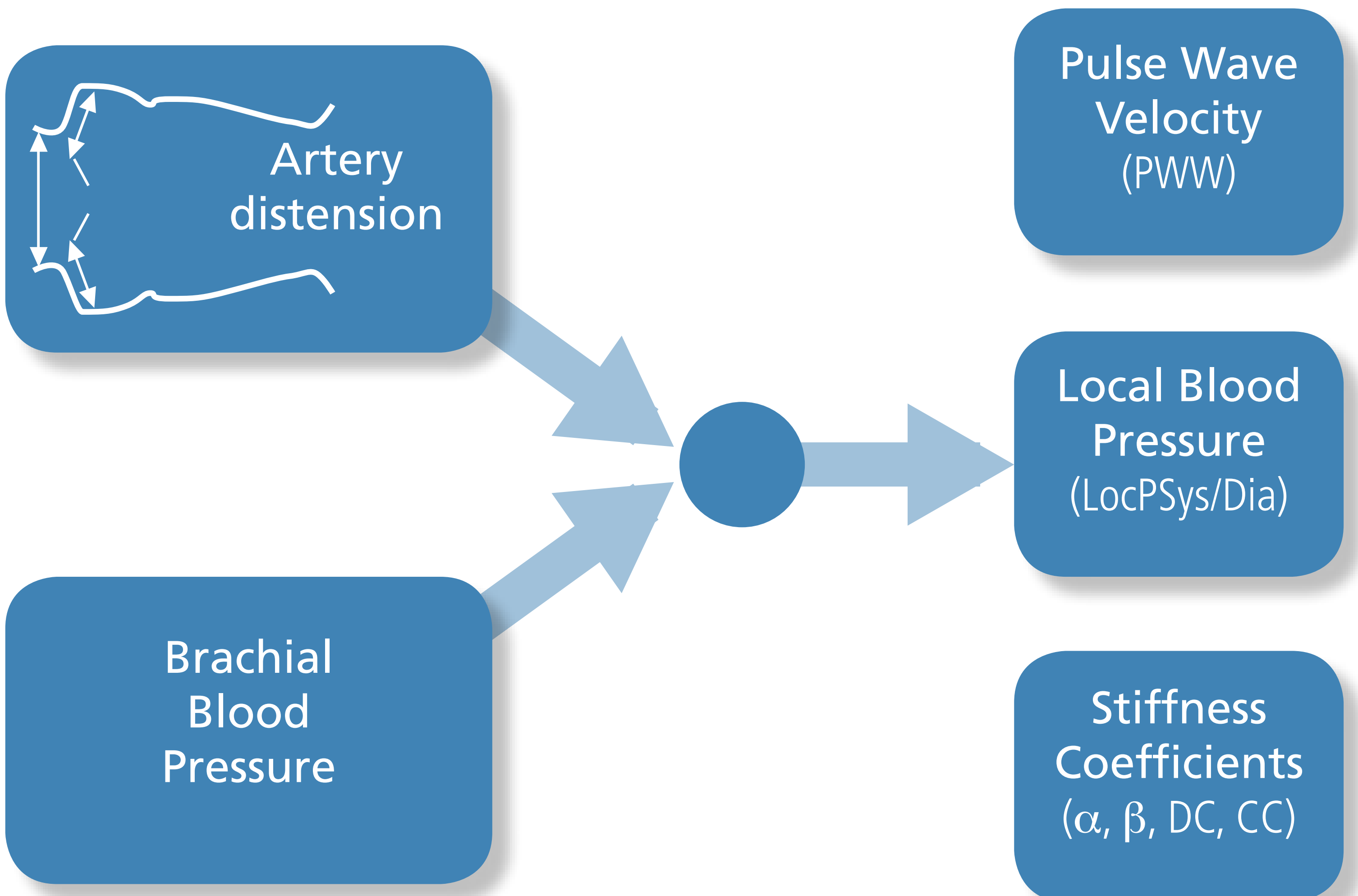
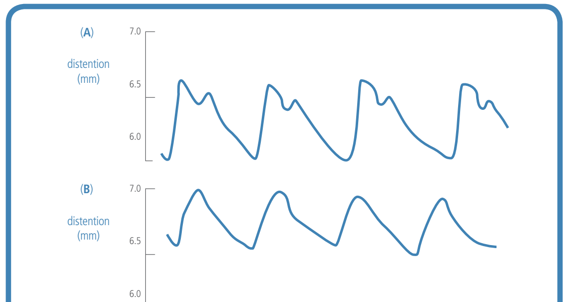
Measurement of the ^{RF}QAS

QAS provides a list of standard parameters calculated combining the measured values (Distension, Distension Waveform and Diameter) with the Brachial Blood Pressure measured externally by using an automated system or standard cuff.





Healthy 23-year-old subject (**A**) – Healthy 65-year-old subject (**B**)
The 2nd peak due to wave reflection is more evident in the younger subject.

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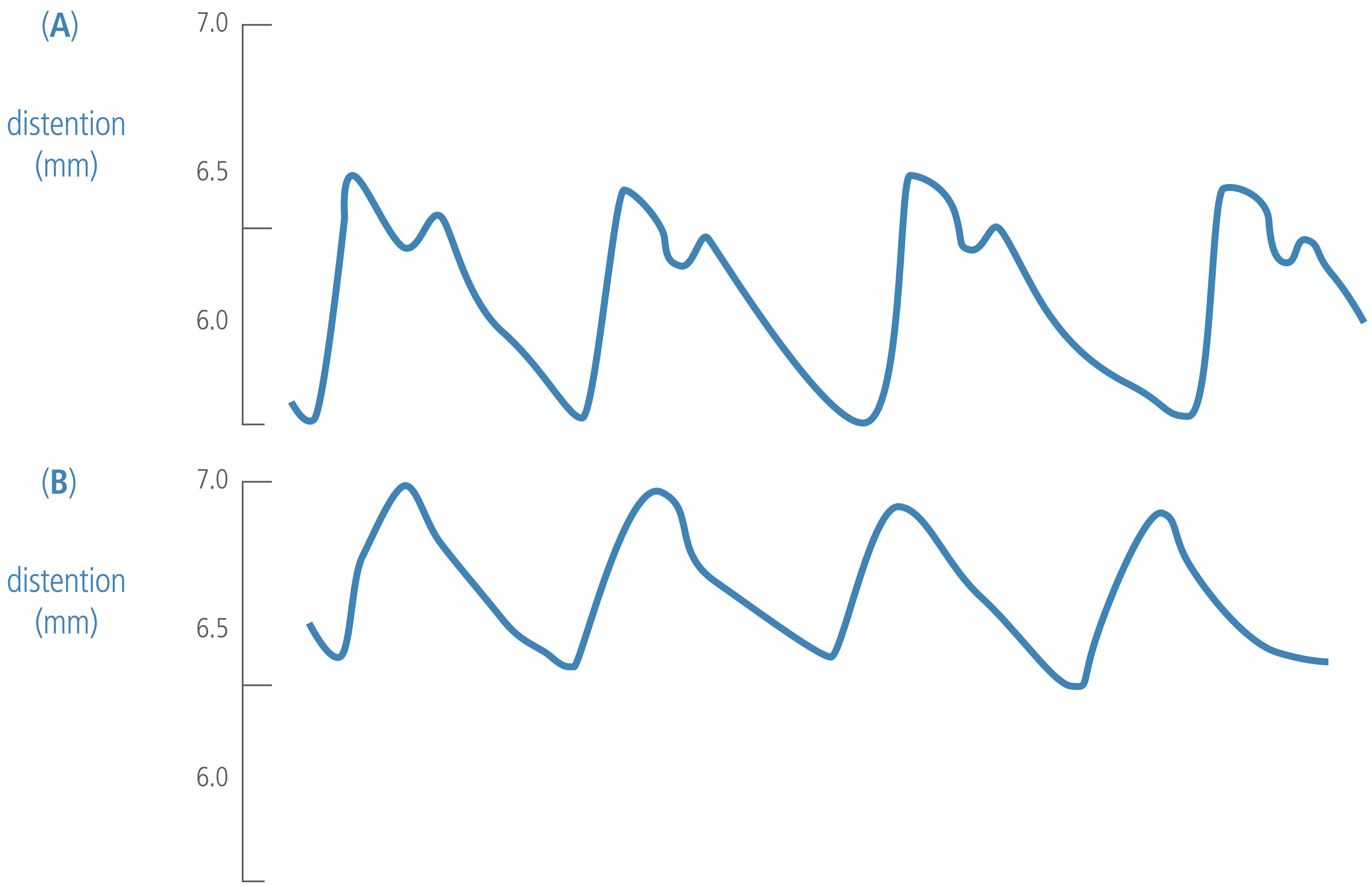

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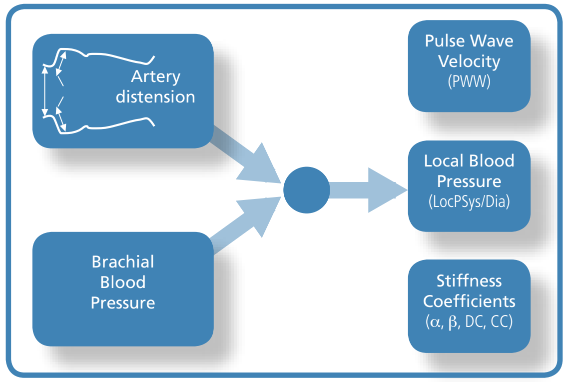

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^{RF}QAS report

PWV: When the heart contracts it generates a pulse or energy wave that travels through the circulation.

The speed of travel of this pulse wave (Pulse Wave Velocity or PWV) is related to the arterial stiffness of the arteries.

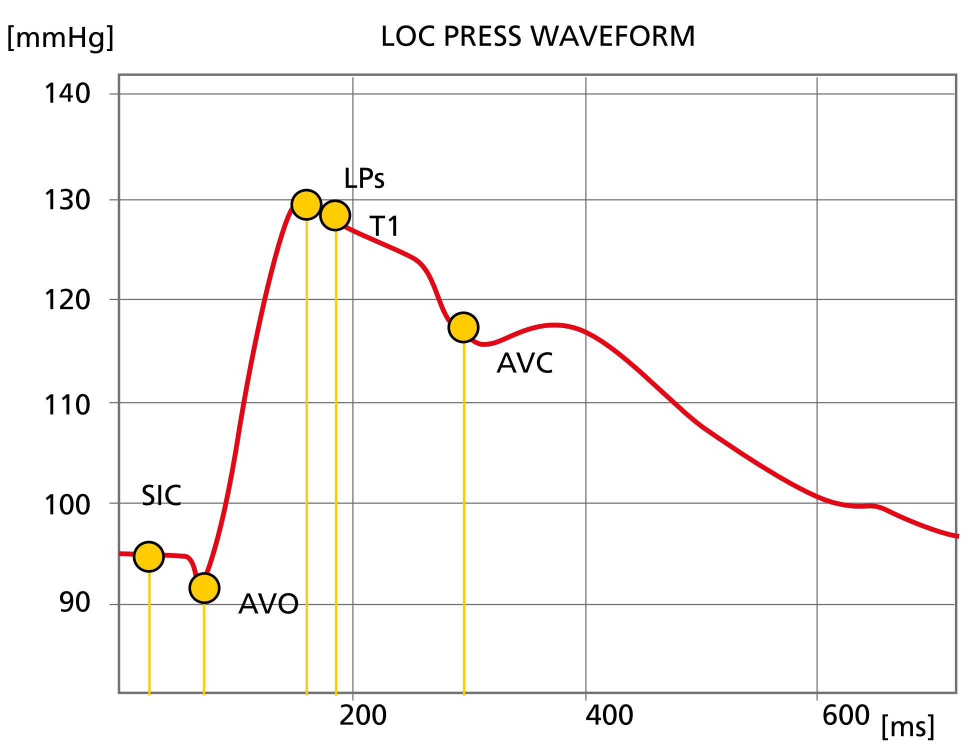
The stiffer the artery is, the higher the PWV will be.

The final report shows:

- Distension values
- Stiffness values
- Local pressure values

RIGHT CCA QAS		
DISTENSION:	413	µm
SD:	12	µm
DIAMETER:	7.14	mm
SD:	0.28	mm
BrP sys:	130.0	mmHg
BrP dia:	80.0	mmHg

STIFFNESS		
DC:	0.02	1/kPa
CC:	0.78	mm^3/kPa
α	3.80	
β	7.82	
PWV	6.97	m/s



LOCAL PRESSURE		
LOC Psys:	125.7	mmHg
LOC Pdia:	80.0	mmHg
P(T1):	123.4	mmHg
AP:	2.8	mmHg
AIx:	-2.25	%
ICP:	39	mm
ED:	244	mm

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