

Open debates in Cardiology
Naples April 2010
AROUND THE HEART SEMINARS

**THICKENING AND STIFFENING OF THE
BLOOD VESSEL WALL**

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2007 ESH/ESC Hypertension Guidelines

Guidelines

2007 Guidelines for the Management of Arterial Hypertension

The Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC)

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Journal of Hypertension 2007, 25:1105–1187

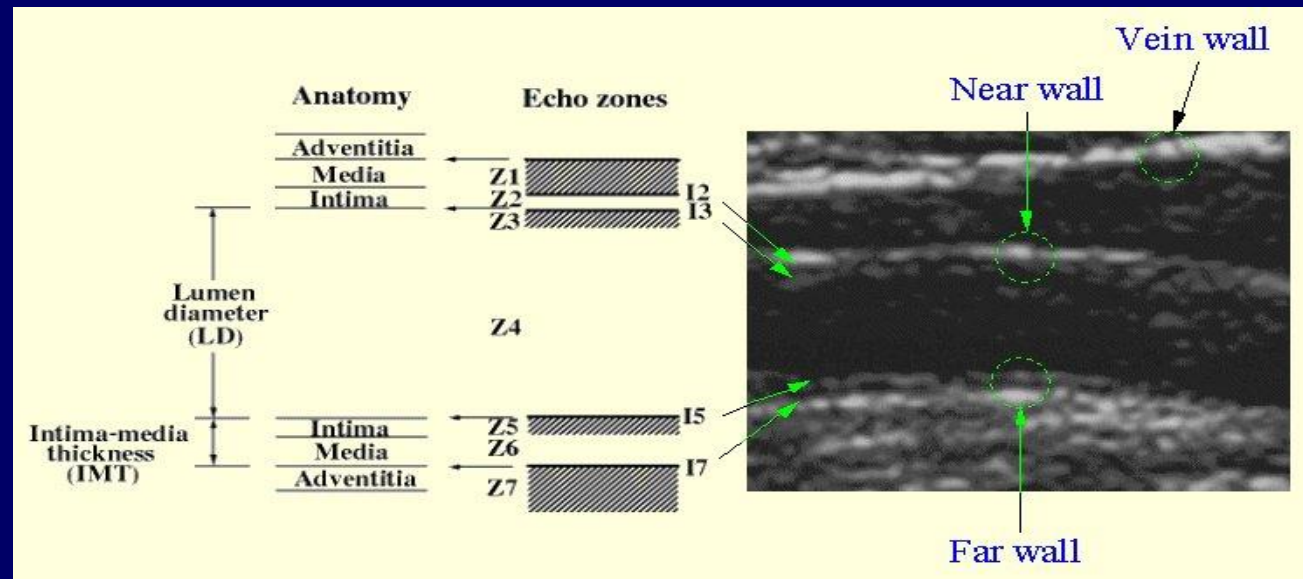
2007 ESH/ESC Hypertension Guidelines for the Management of Arterial Hypertension

Factors that influence the prognosis

Sub-clinical organ damage

- Electro-cardiographic evidence of IVS (Sokolow-Lyon > 38 mm; Cornell > 2440 mm*ms) or:
 - Electro-cardiographic evidence of IVS (IMVS M ≥ 125 g/m², F ≥ 110 g/m²)
- Thickening of the carotid part (IMT $> 0,9$ mm) or Atheromatous plaques
- **Carotid/femoral pulse wave velocity > 12 m/s**
- **Pressure index lower limbs/upper limbs $< 0,9$**
- Slight increases in plasmatic creatinine:
 - M: 115-133 μ mol/l (1,3-1,5 mg/dl)
 - F: 107-124 μ mol/l (1,2-1,4 mg/dl)
- Reduction in glomerular filtrate (< 60 ml/min/1,73 m²) or creatinine clearance (< 60 ml/min)
- Microalbuminuria 30-300 mg/24h or albumin/creatinine ratio: ≥ 22 (M) or ≥ 31 (F) mg/g of creatinine

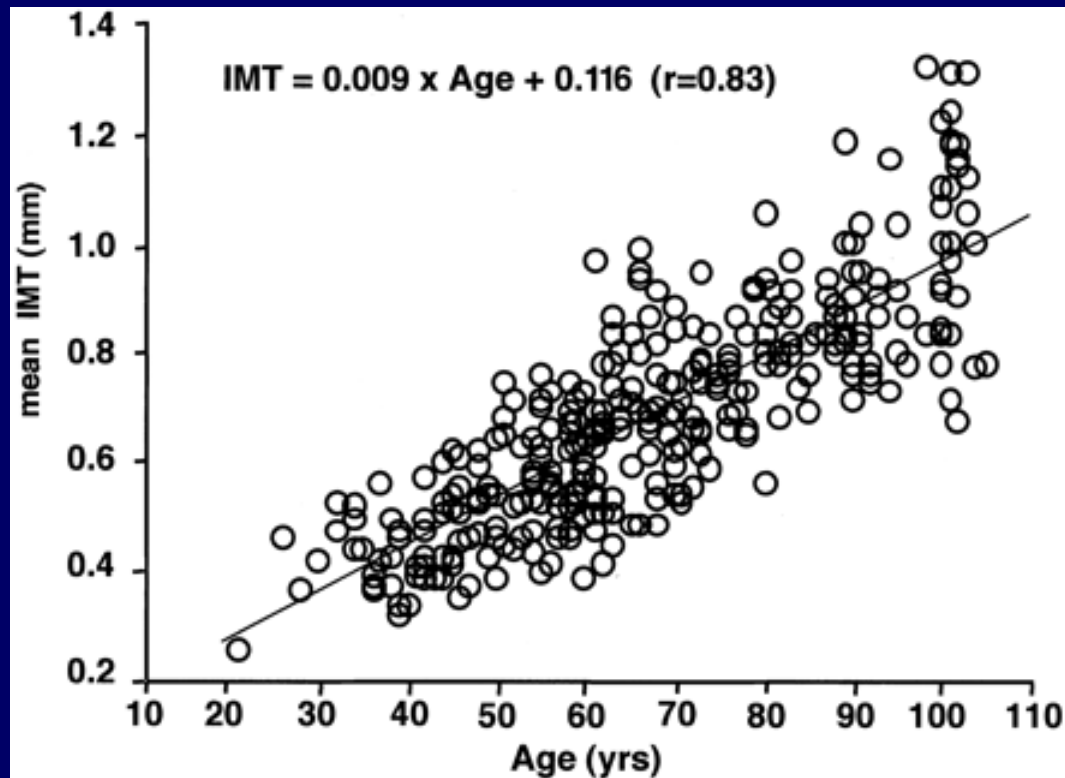
Intima plus media thickness of the arterial wall



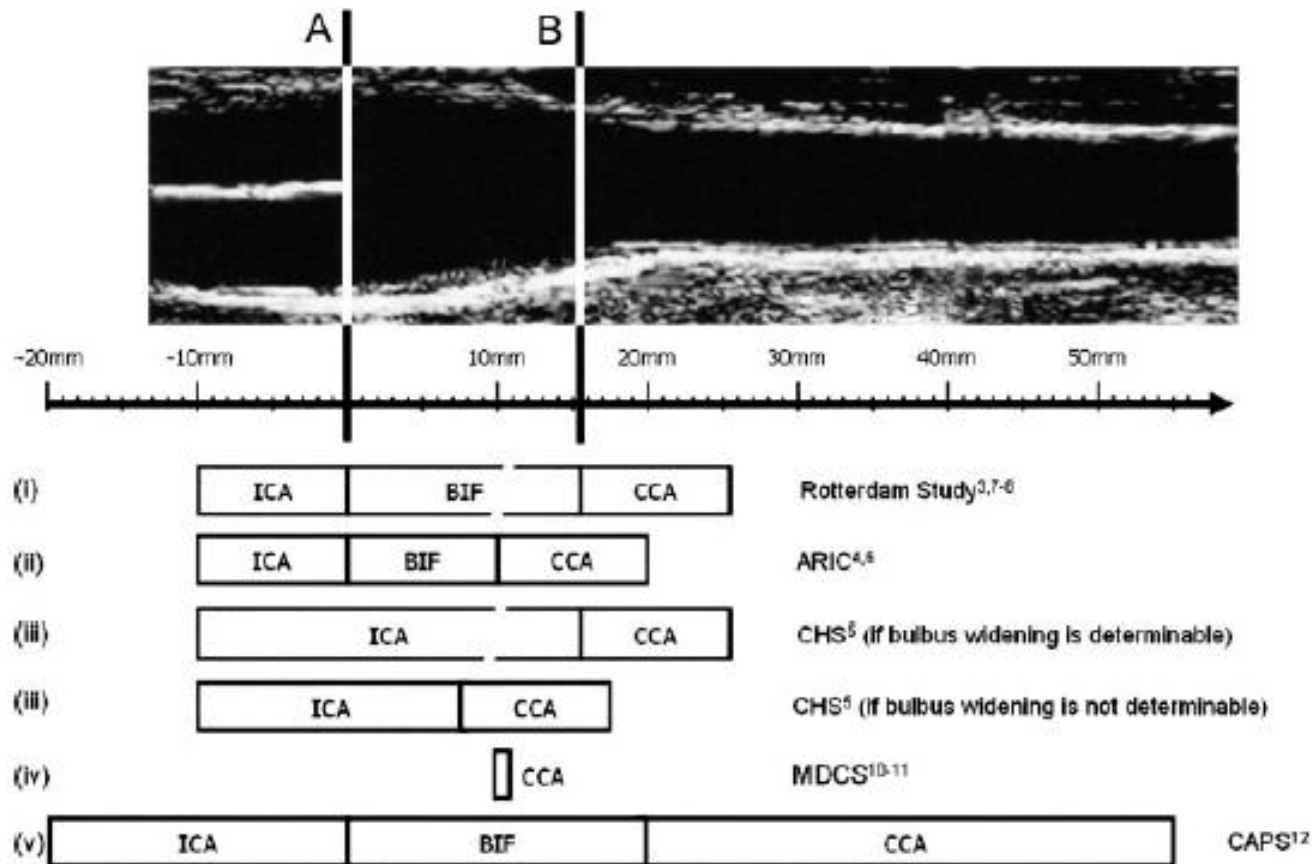
Pignoli P et al, Circulation 1986; 74: 1399-406.

Prediman K. Shah, MD

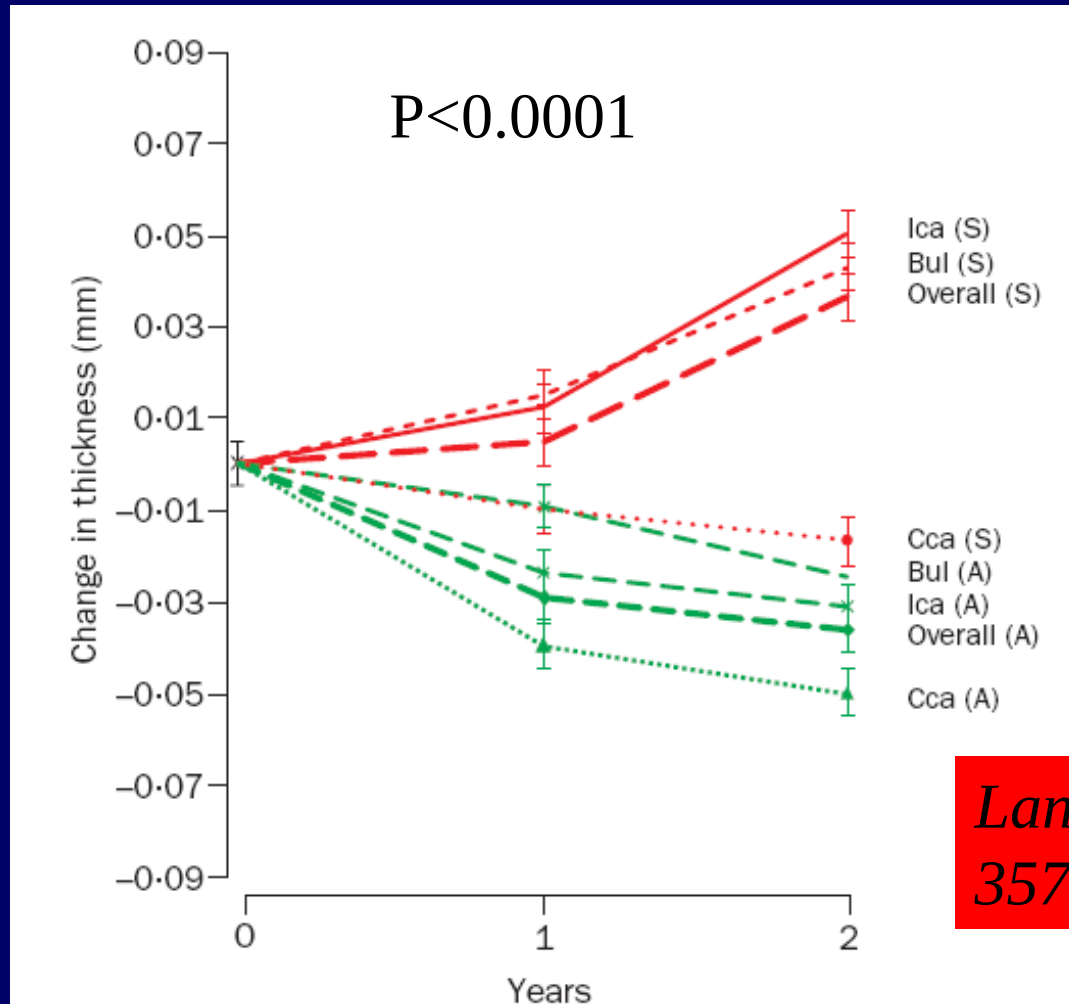
at the 2005 American Heart Association
Meeting



Circulation.2007;115:459-467

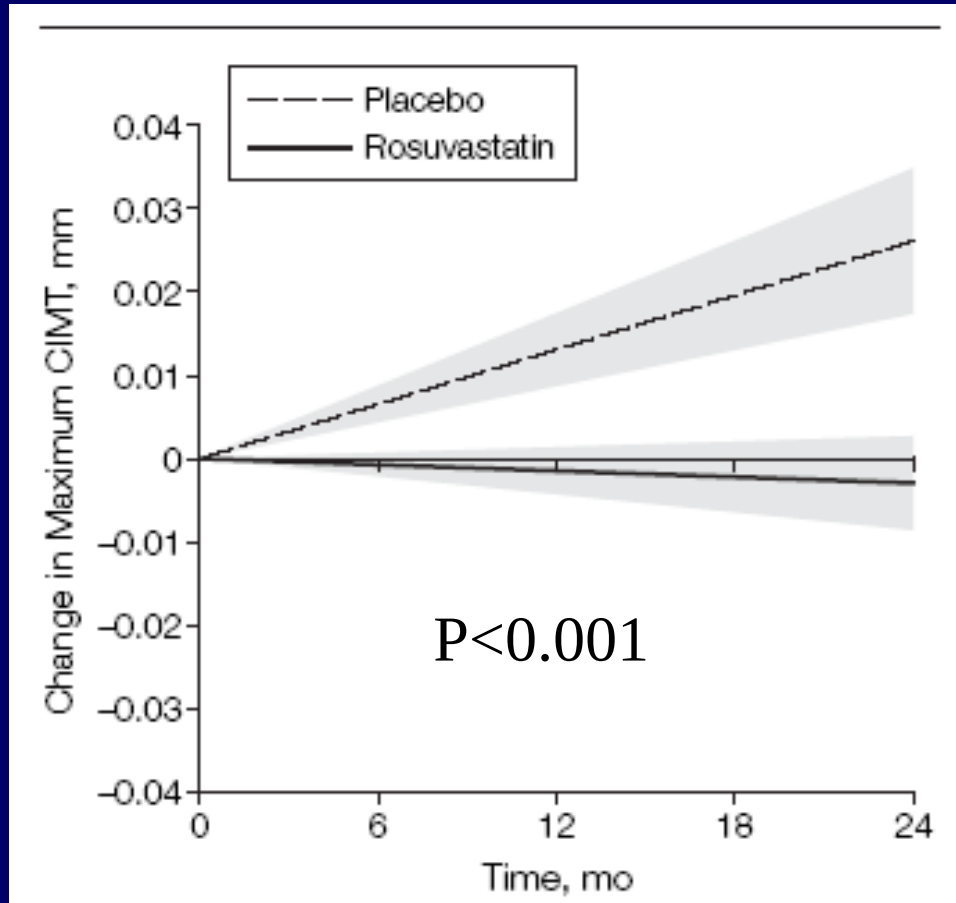


Effect of aggressive versus conventional lipid lowering on atherosclerosis progression in familial hypercholesterolaemia (ASAP): a prospective, randomised, double-blind trial



*Lancet 2001;
357: 577–81*

METEOR



Type of Adverse Event	No. (%) of Patients With Adverse Events in Safety Population	
	Rosuvastatin (n = 700)	Placebo (n = 281)
Any event	583 (83.3)	226 (80.4)
Myalgia	89 (12.7)	34 (12.1)
Arthralgia	71 (10.1)	20 (7.1)
Back pain	59 (8.4)	29 (10.3)
Muscle spasms	26 (3.7)	8 (2.8)
Diarrhea	24 (3.4)	11 (3.9)
Tendinitis	23 (3.3)	6 (2.1)
Pain in extremity	20 (2.9)	6 (2.1)
Creatine phosphokinase increased*	18 (2.6)	2 (0.7)
Hematuria*	16 (2.3)	8 (2.8)
Nausea	16 (2.3)	7 (2.5)
Constipation	16 (2.3)	12 (4.3)
Shoulder pain	14 (2.0)	8 (2.8)
Neck pain	11 (1.6)	3 (1.1)
Hepatic enzyme increased*	11 (1.6)	2 (0.7)
Arthritis	11 (1.6)	2 (0.7)
Alanine aminotransferase increased*	10 (1.4)	0
Musculoskeletal stiffness	8 (1.1)	10 (3.6)
Aspartate aminotransferase increased*	7 (1.0)	0
Proteinuria*	6 (0.9)	3 (1.1)
Muscular weakness	5 (0.7)	3 (1.1)

JAMA, March 28, 2007—Vol 297, N. 12

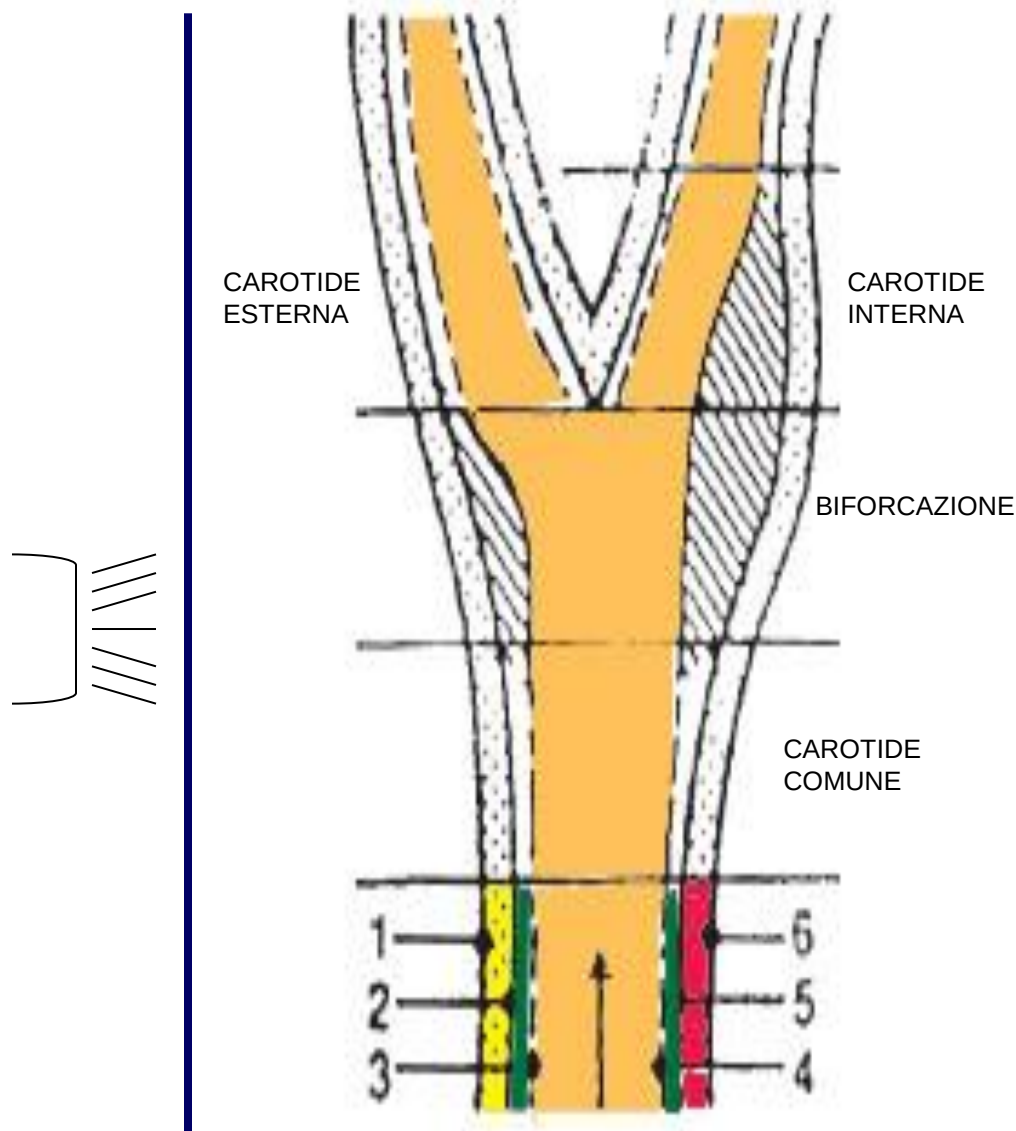
Methodology

Carotid Intima-Media thickness (cIMT) measurements

- Measurements were made at a predefined angle of insonation
- Only the far-walls of all segments were imaged
- Images were stored in DICOM for offline image analyses



de Groot E, et al. *Circulation*. (2004) 109[Suppl III]:III-33-III-38.



Parete vicina

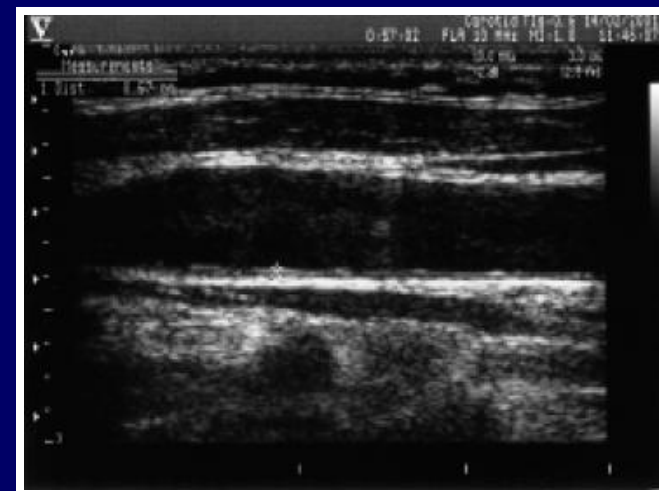
1. Periaavventizia – Avventizia
2. Avventizia – Media
3. Intima - Lume

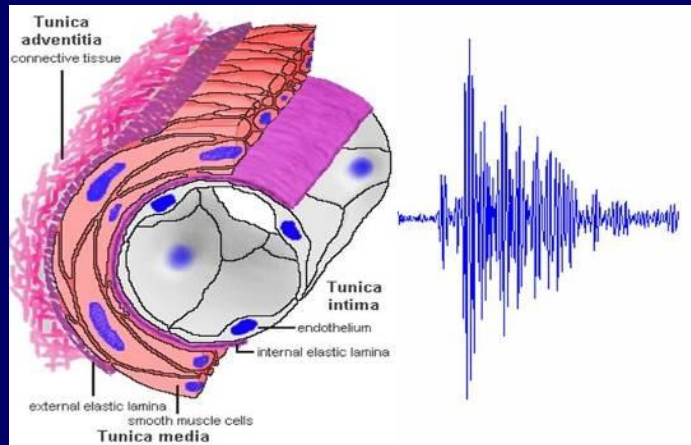
Parete lontana

4. Periaavventizia – Avventizia
5. Avventizia – Media
6. Intima - Lume

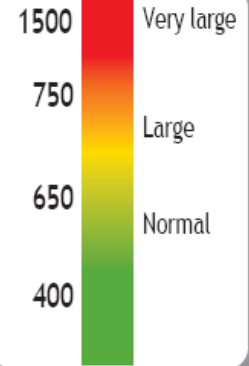
Methods of measuring IMT

1. **T max**: overall single maximum IMT
2. **CBM max**: mean of the maximum IMT of the 4 far walls of the carotid bifurcations and distal common carotid arteries
3. **M max**: mean maximum thickness of up to 12 different sites (right and left, near and far walls, distal common, bifurcation and proximal internal carotid)

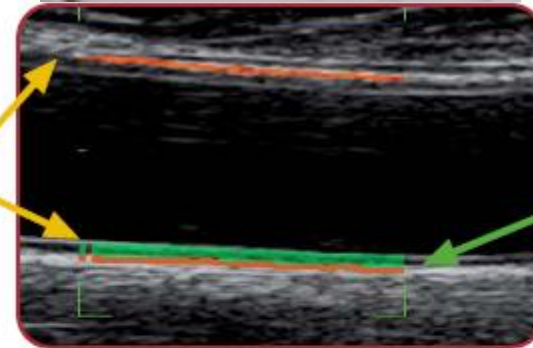




Quality Intima Media

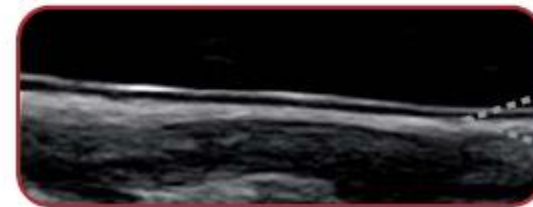


Diameter tracking

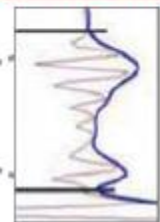


IMT tracking

RF QIMT : 778 μm



RF Signal



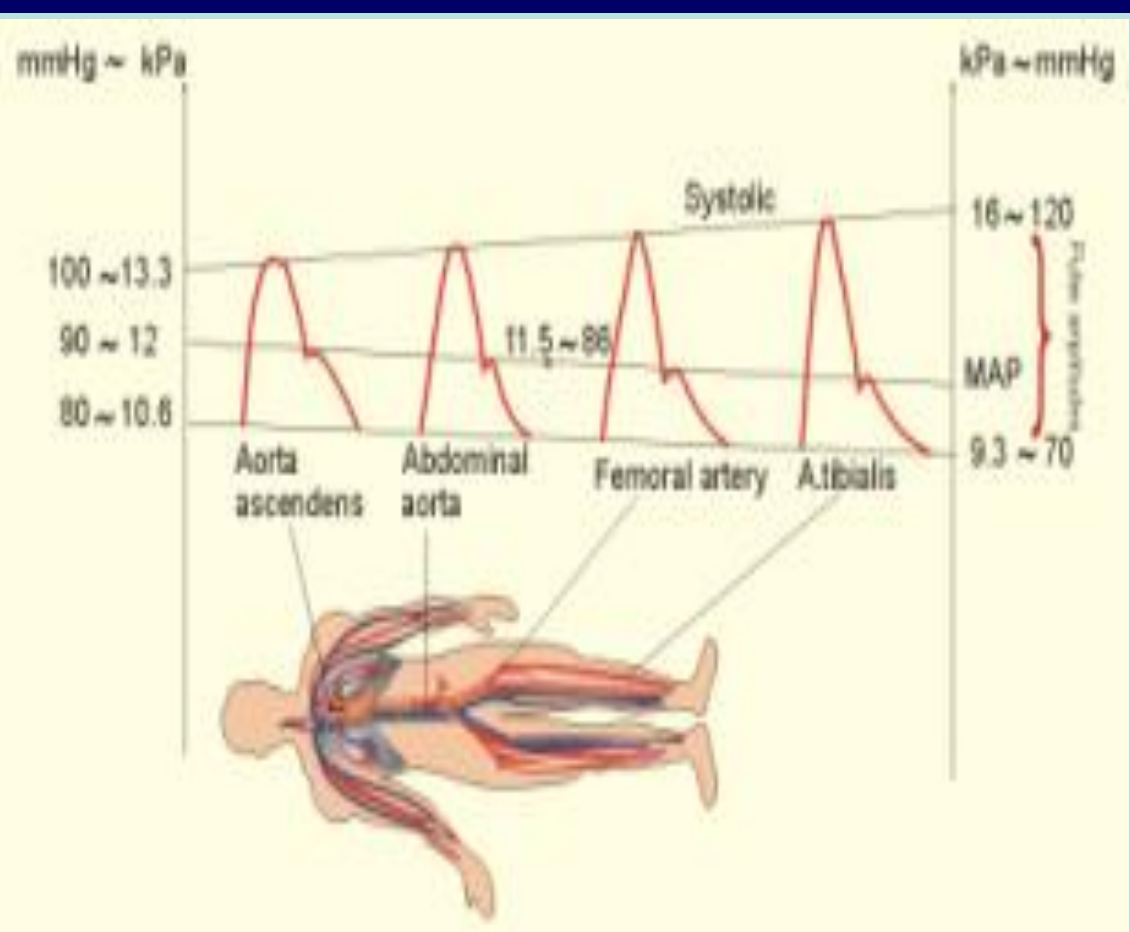
STATO APERTO

COGNOME	GRATISTI MARIA	NOME	MARIA
NATO/A IL	03 GEN 1936	ETÀ	73 A
SESSO	F		
MEDICO CURANTE		OPERATORE	
DIAGNOSI DI AMMISSIONE		MEDICO ESECUTORE	



QIMT (RF) *

QIMT S		
QIMT S :	726	µm
QIMT D		
QIMT D :	904	µm
QIMT (RF)		
QIMT (RF) :	904	µm
DS :	8	µm
DIAMETRO :	7.4	mm
DS :	0.03	mm
LARGHEZZA :	10.2	mm
TABELLA QIMT:	HOWARD (BIANCA)	
QIMT PRESUNTO:	810	µm



“...studies clearly demonstrate that **PWV** and the **augmentation index** are associated with the structural changes of atherosclerosis”

Davies, J.I., *J Hypertens* 21:463-472; 2003

- **Pulse Wave Velocity (PWV)**

- Complior (Carotid-Femoral PWV)
- SphygmoCor (Applanation Tonometry)
- Tensiomed Arteriograph

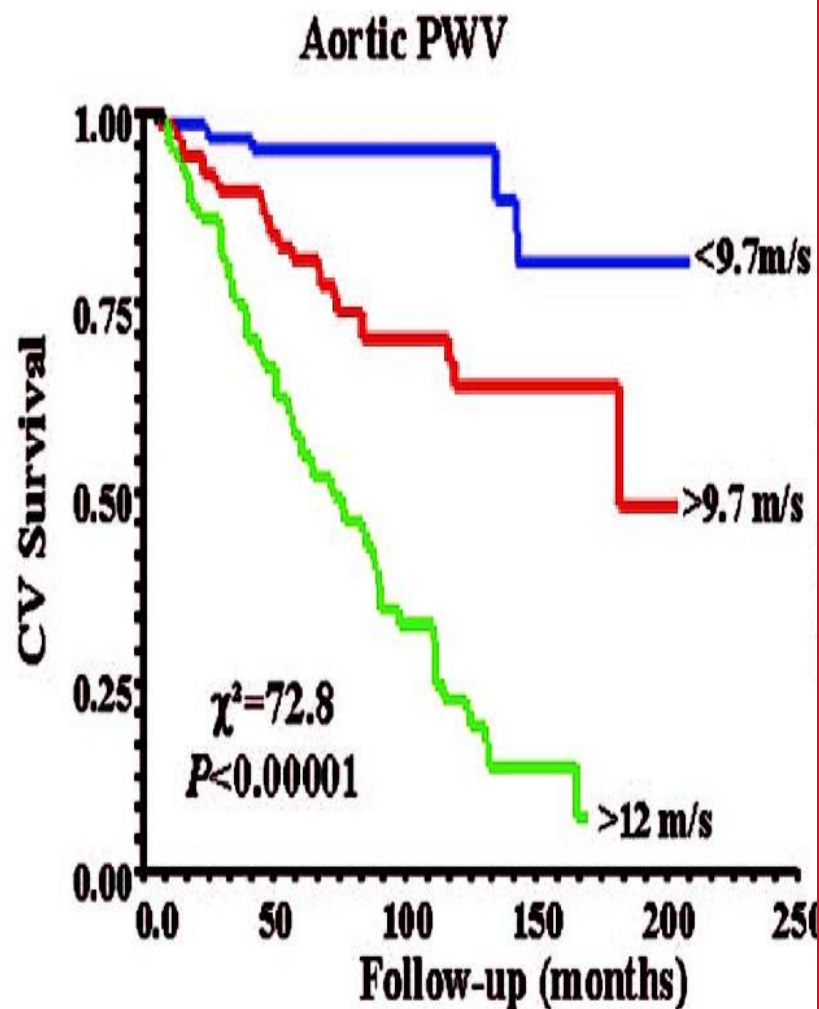
- **Augmentation Index (Aix)**

- SphygmoCor (Applanation Tonometry)
- Tensiomed Arteriograph

- **Central Blood pressure (SBP, PP)**

- SphygmoCor (Applanation Tonometry)
- Tensiomed Arteriograph

Pulse Wave Velocity (PWV)



-Arterial wave reflections and survival in end stage renal failure.

London GM et al Hypertension 2001;38:434-438.

- Central pulse pressure and mortality in end stage renal failure.

Safar ME et al Hypertension 2002;39:735-738.

- Increased arterial wave reflections predict severe cardiovascular events in patient undergoing percutaneous coronary interventions

Eur Heart J 2005;26:2657-2663

- Central pressure more strongly relates to vascular disease and outcome than does brachial pressure: the Strong Heart Study.
Roman MJ et al Hypertension 2007;50:197-203.

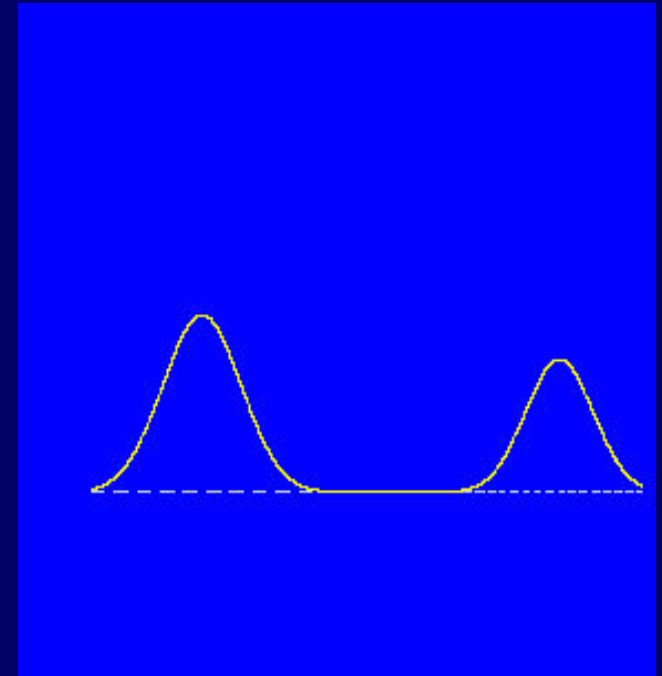
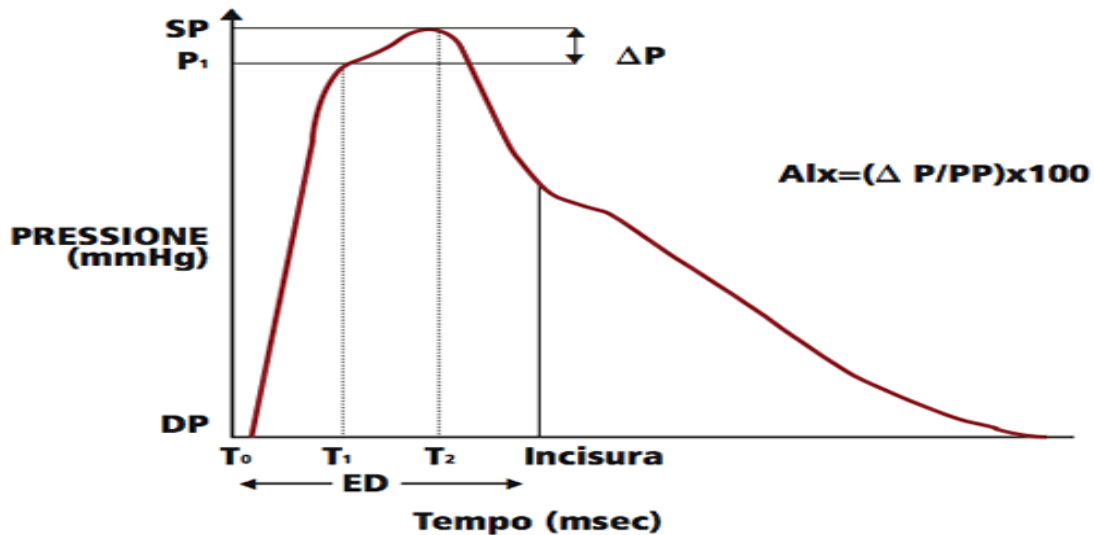
Augmentation Index (Aix)

THE AUGMENTATION INDEX (Aix)

E' DEFINITO COME LA DIFFERENZA TRA IL SECONDO (ONDA RIFLESSA) ED IL PRIMO PICCO (ONDA INCIDENTE) ED ESPRESSO COME PERCENTUALE DELLA PRESSIONE DIFFERENZIALE.

$$\text{Augmentation index (Aix \%)} = (P_2 - P_1 / PP) \times 100$$

MORFOLOGIA DELL'ONDA DI POLSO



First author (year; country)	Events	Follow-up (years)	Type of patient (number)	Mean age at entry (years)
<i>Central pulse pressure</i>				
Safar (2002;Fr)	All cause mortality	4,3	ESRD (180)	54
Williams (2006;UK)	CV events	3,4	HT, ASCOT study (2073)	63
<i>Carotid augmentation index</i>				
London (2001;Fr)	All cause and CV mortal	4,3	ESRD (180)	54
Weber (2005;Austria)	Severe CV events	2	Undergoing PCI (262)	66
Chirinos (2005;USA)	CV events	3,2	Undergoing PCI (297)	64
Williams (2005;UK)	CV events	3,4	HT, ASCOT study (2073)	63
PCI: percutaneous coronary intervention				By Laurent S

First author (year; country)	Events	Follow-up (years)	Type of patient (number)	Mean age at entry (years)
<i>Aortic PWV – YES</i>				
Blacher (1999;Fr)	CV mortality	6,0	ESRD (241)	51
Laurent (2001;Fr)	CV mortality	9,3	Hypertension (1980)	50
Meaume (2001;Fr)	CV mortality	2,5	Elderly (>70) (141)	87
Shoji (2001;Jp)	CV mortality	5,2	ESRD (265)	55
Boutouyrie (2002;Fr)	CHD events	5,7	Hypertension (1045)	51
Cruickshank (2002;GB)	All cause M.	10,7	Diabetes and MS (571)	51
Laurent (2003;Fr)	Fatal strokes	7,9	Hypertension (1715)	51
Sutton-Tyrrell (2005;USA)	CV events	4,6	Elderly (2488)	74

Arterial Stiffness

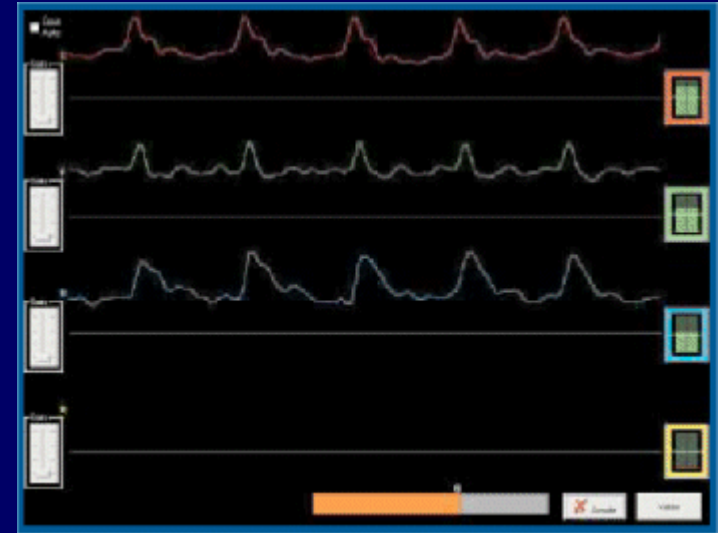
PULSE WAVE VELOCITY (PWV)

AUGMENTATION INDEX (Aix)

	Aix	PWV
Ottimale	<- 30%	<7m/s
Normale	da -30% a < -10%	da 7m/s a < 9.7m/s
Aumentato	da -10% a <10%	da 9.7m/s a <12m/s
Anormale	> 10%	>12m/s

PULSE WAVE VELOCITY

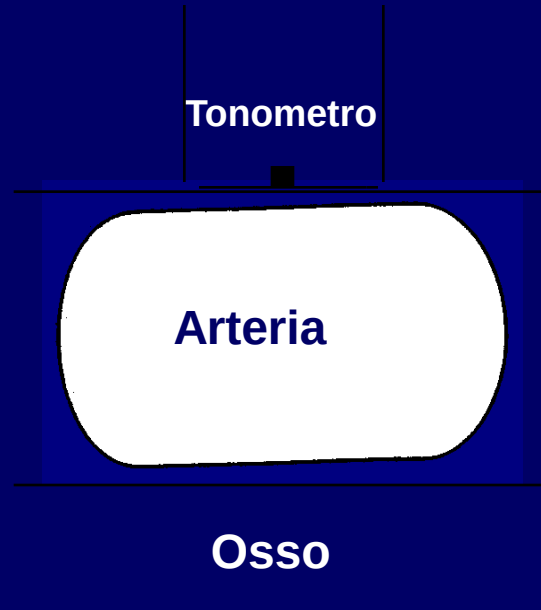
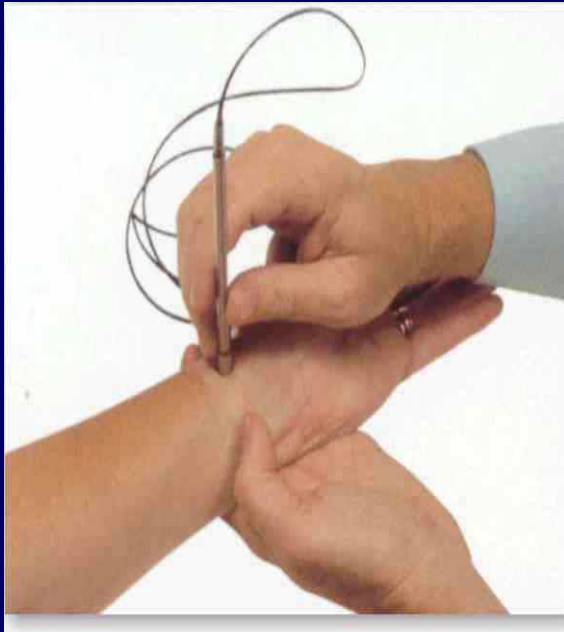
The Complior® device



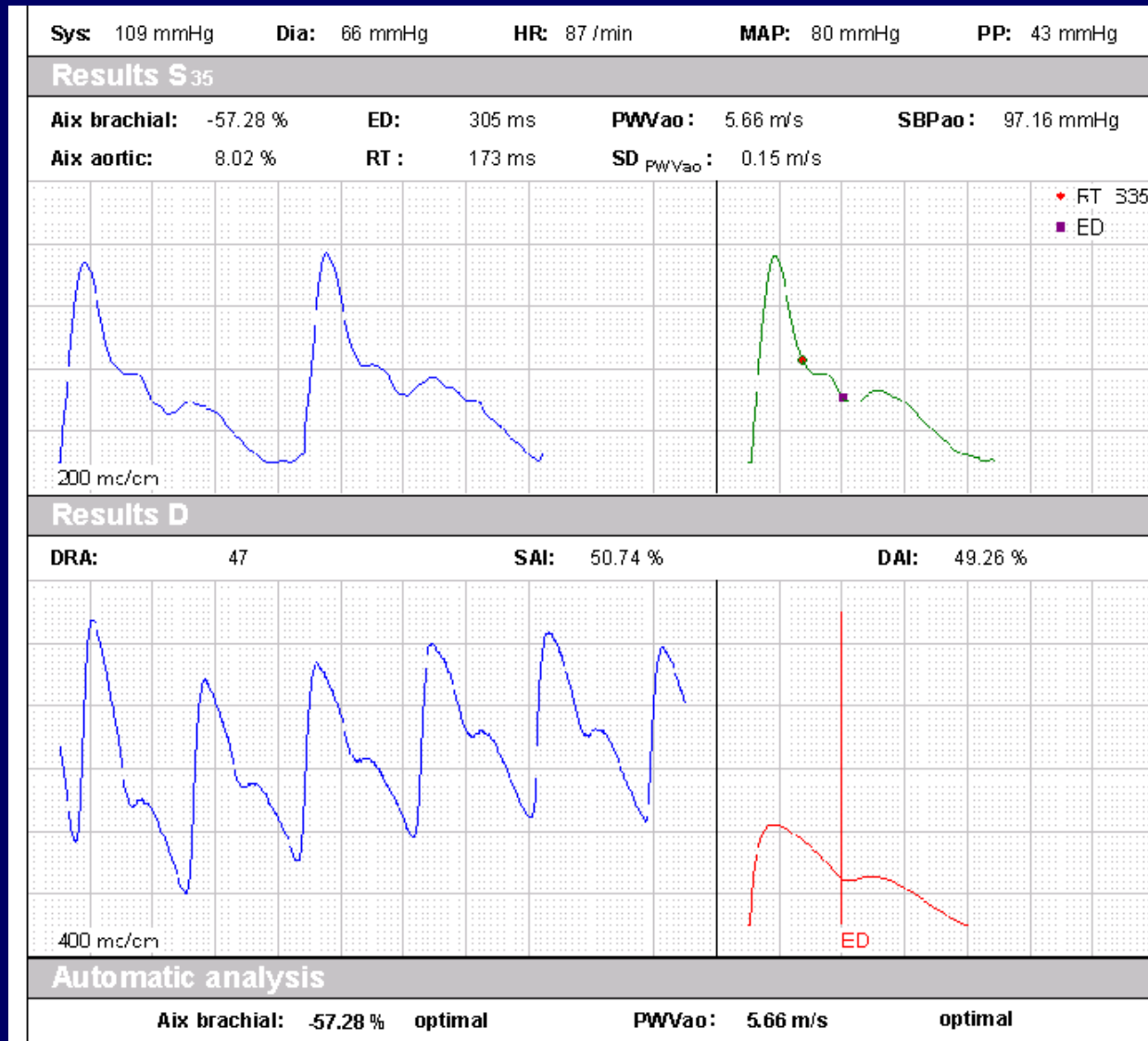
PULSE WAVE VELOCITY

Augmentation Index (Aix)

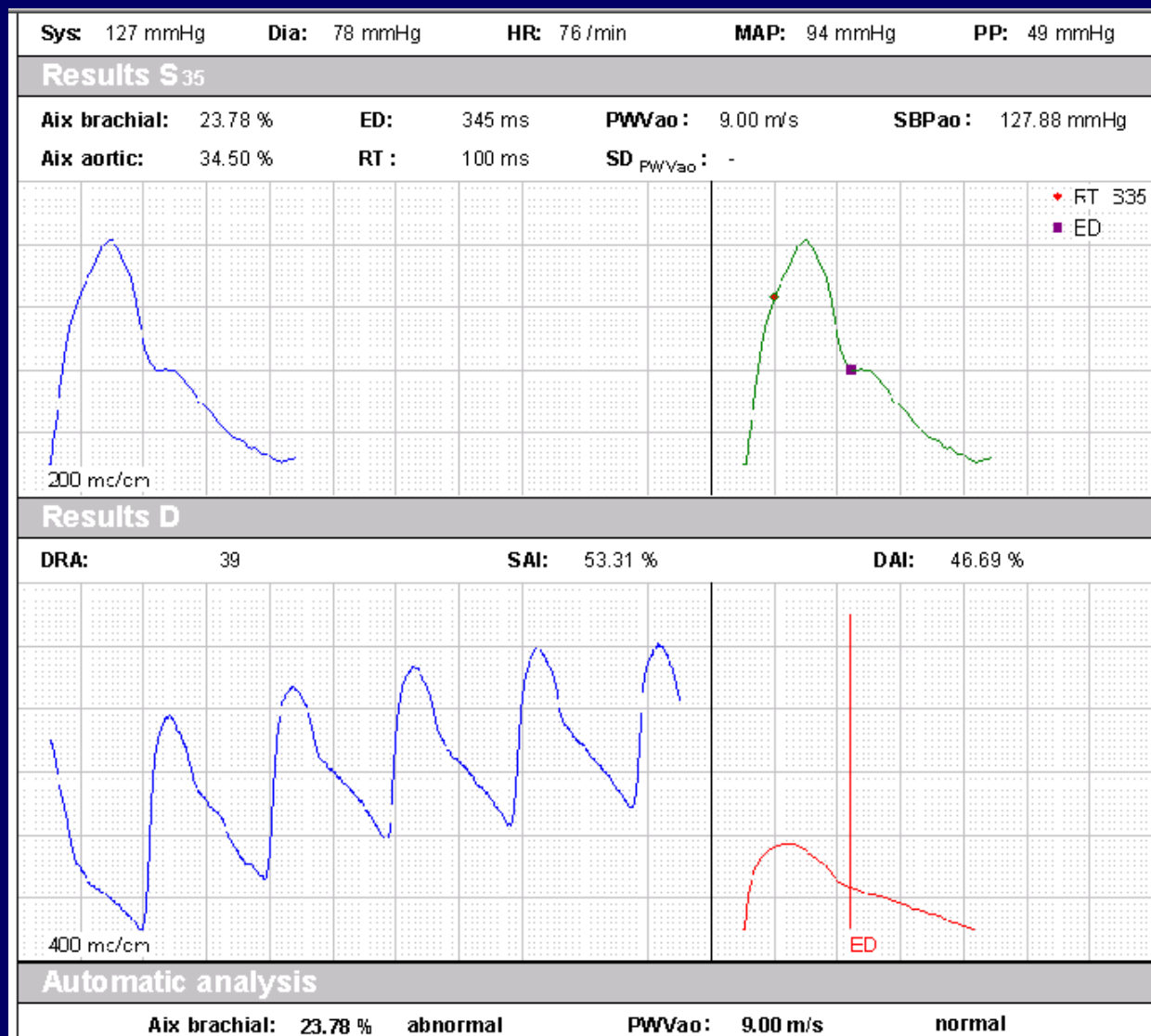
The SphygmoCor device



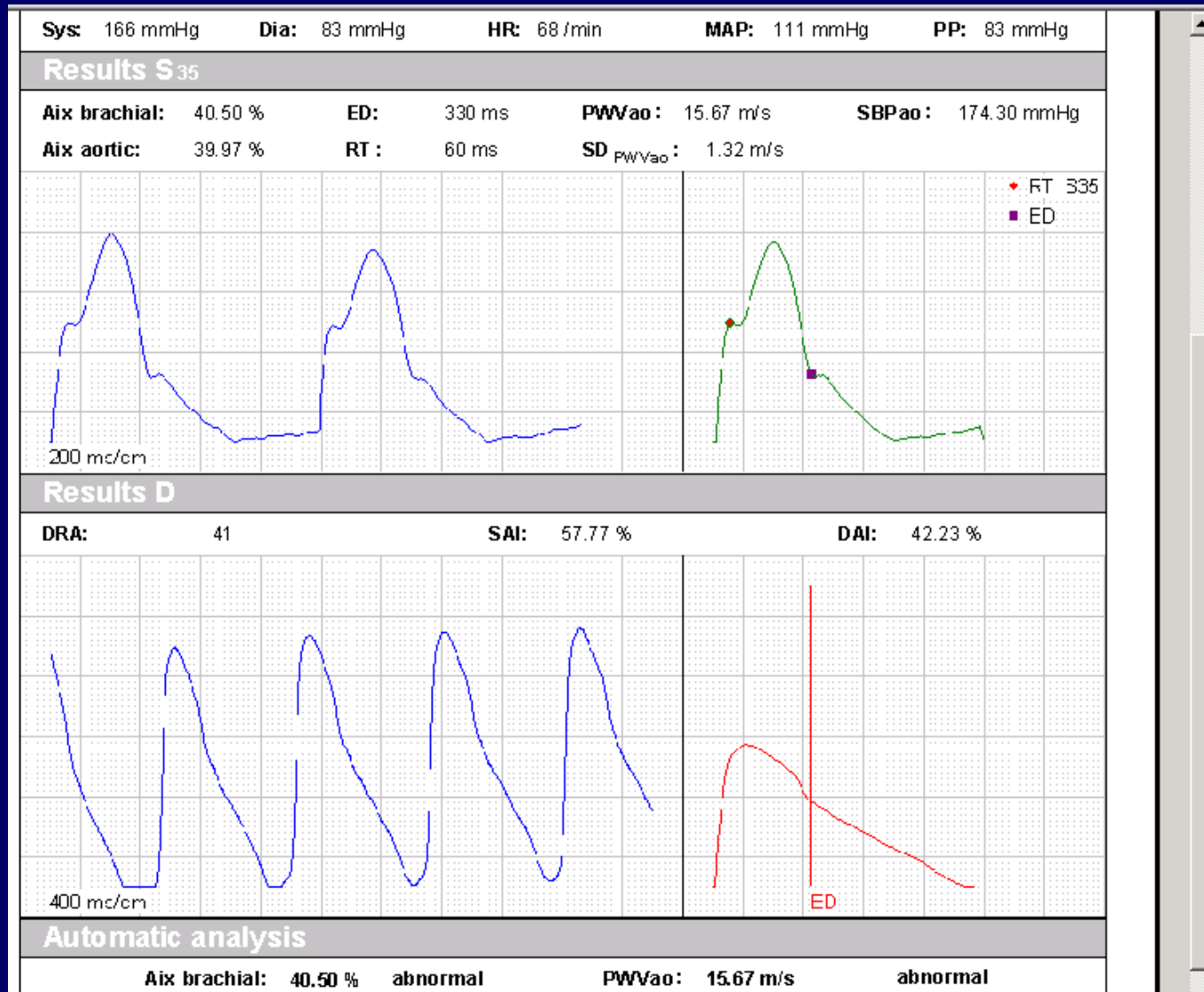
Subject 30 y old



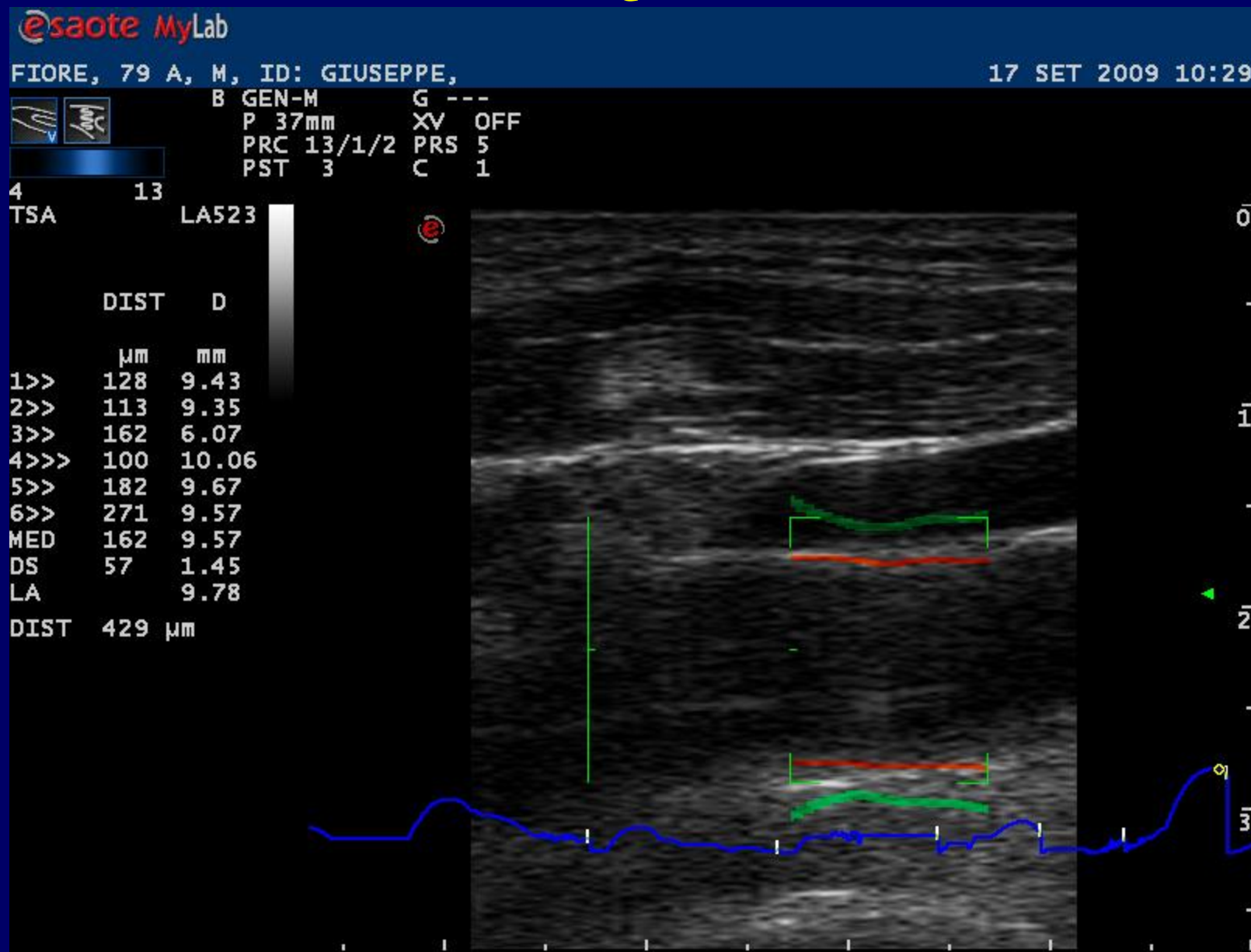
Subject 60 year old



Subject 90 y old

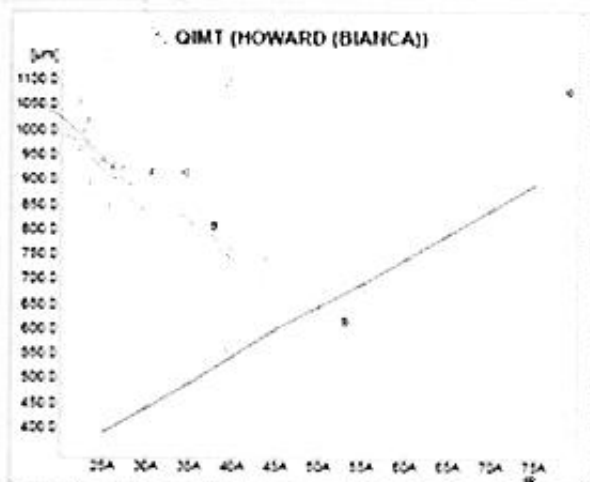


QAS



NATO/A IL 28 MAR 1930
 SESSO M
 MEDICO CURANTE
 DIAGNOSI DI AMMISSIONE

ETÀ 79 A
 OPERATORE
 MEDICO ESECUTORE



QIMT (RF)

QIMT S

QIMT S : 1088 μm

QIMT D

QIMT D : 885 μm

QIMT (RF)

QIMT (RF) : 1088 μm

DS : 10 μm

DIAMETRO : 5.5 mm

DS : 0.22 mm

LARGHEZZA : 10.2 mm

TABELLA QIMT: HOWARD (BIANCA)

QIMT PRESUNTO: --- μm

QAS ACC SIN

DISTENSIONE : 129 μm
 DS : 52 μm
 DIAMETRO : 10.60 mm
 DS : 0.28 mm
 PR BR sis : 154.0 mmHg
 PR BR dia : 84.0 mmHg

CALCOLI

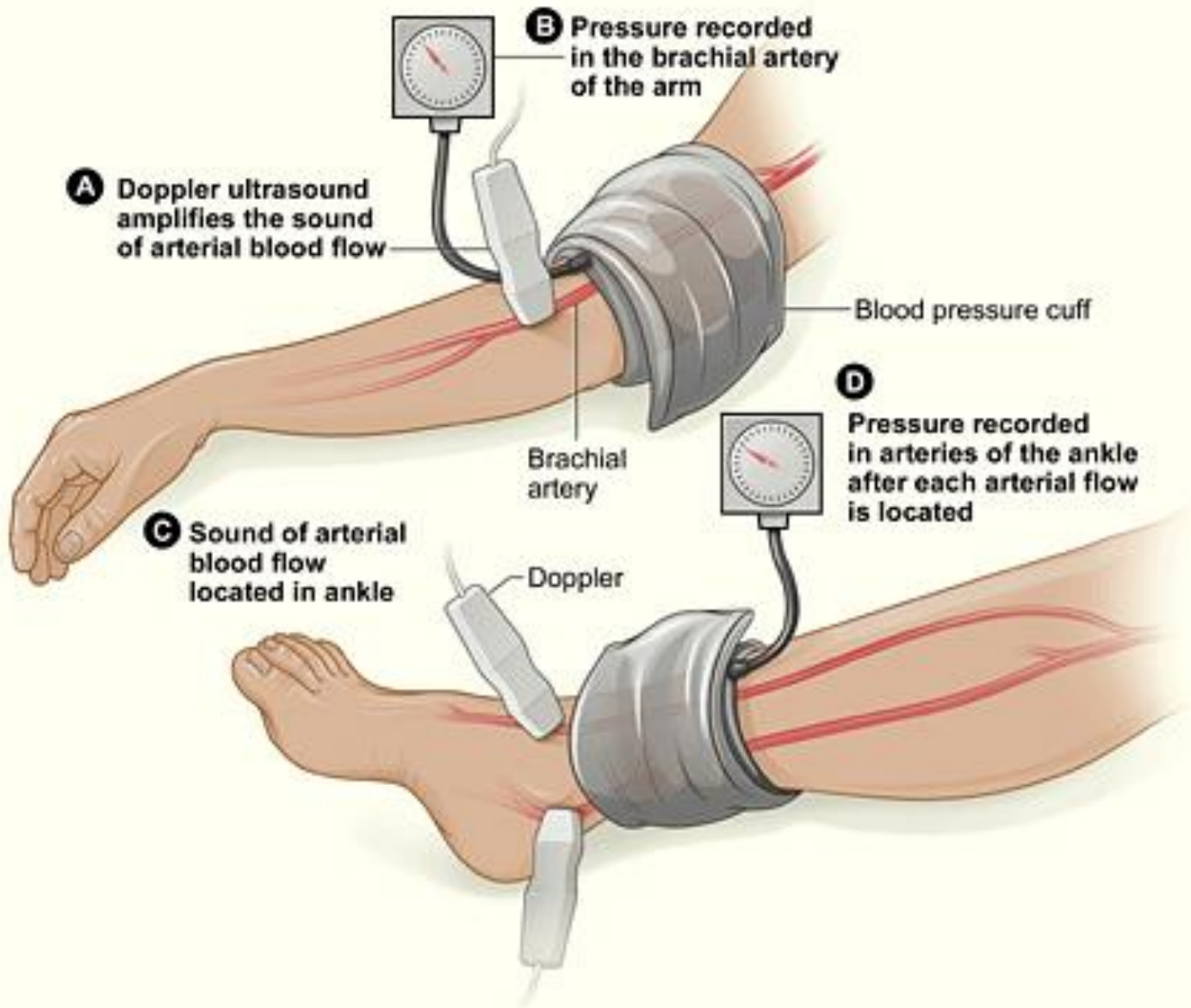
V PIV: 16.06 m/s

QAS ACC DES

DISTENSIONE : 162 μm
 DS : 57 μm
 DIAMETRO : 9.57 mm
 DS : 1.45 mm
 PR BR sis : 154.0 mmHg
 PR BR dia : 84.0 mmHg

CALCOLI

V PIV: 13.33 m/s



MISURAZIONE DELL'ANKLE-BRACHIAL INDEX

