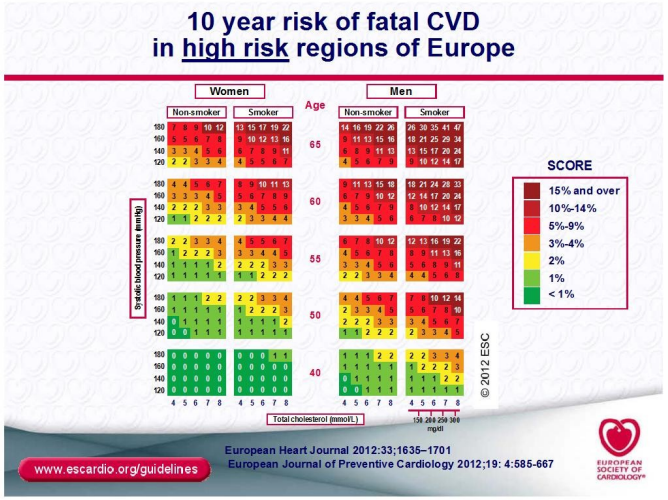
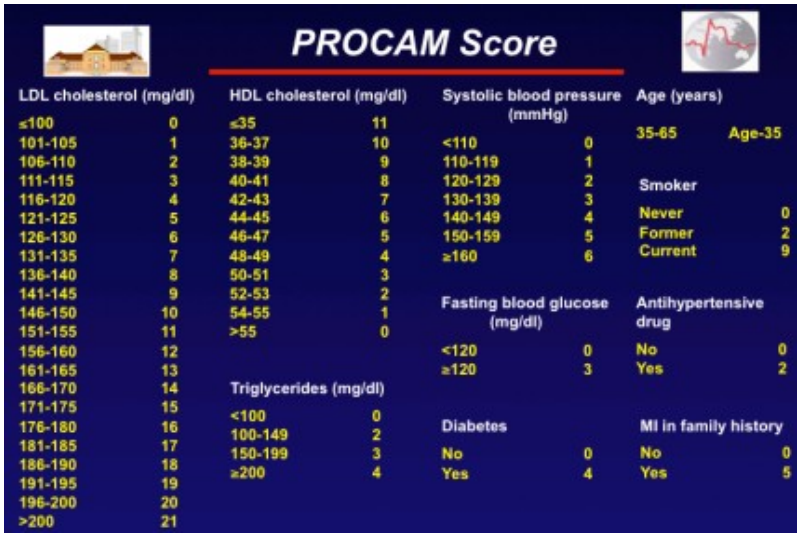
Нови инструментални методи за оценка на сърдечно-съдовия риск

Наталия Спасова
УМБАЛ “Царица Йоанна – ИСУЛ”

Системи за оценка на сърдечно-съдов риск

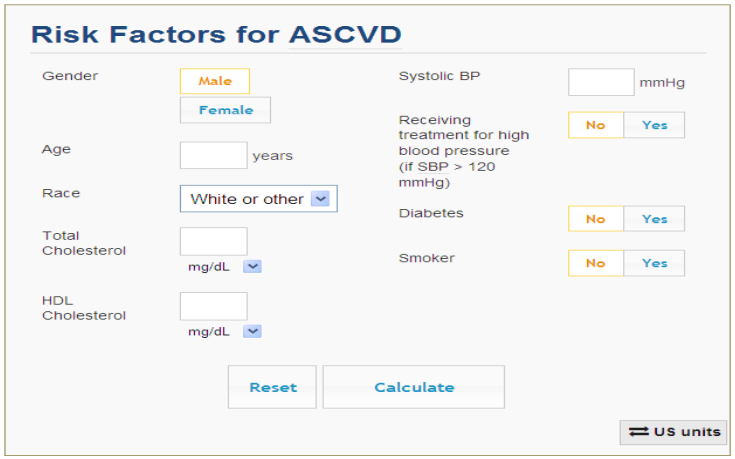




http://www.chd-taskforce.de/pdf/sk_procam_07e.pdf

Pooled Cohort Risk Assessment Equations

Predicts 10-year risk for a first atherosclerotic cardiovascular disease (ASCVD) event



http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx

2013 ACC/AHA Guideline on the Assessment of Cardiovascular Risk

- ***Много лесни и удобни за използване в клинична практика***
- ***Оценяват взаимодействието на рискови фактори***
- ***Не оценяват промените в артериалните съдове***

Screening for Atherosclerosis

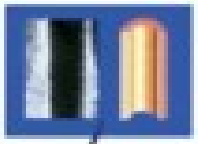
Risk Factors vs Disease

Numerous Risk Factors

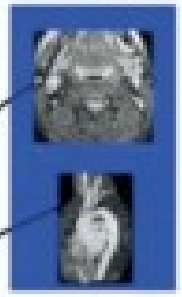
- High LDL
- Low HDL
- High BP
- Diabetes
- Smoking
- CRP
- Metabolic Syndrome
- Lp(a)
- Homocysteine
- Dense LDL
- Lp-PLA2
- ApoB/ApoA
- Family History
- Sedentary Life
- Obesity
- Stress
- ...
- ?

Over 200 risk factors have been reported.

Examples of Arterial Structure Tests



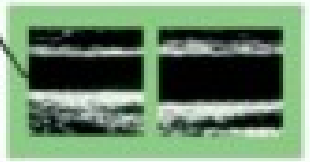
Carotid IMT and Plaque Measured by Ultrasound



Aortic and Carotid Plaque Detected by MRI

Coronary Calcium Score Measured by CT

Ankle—Brachial Index



Brachial Vasoreactivity Measured by Ultrasound

Vascular Compliance Measured by Radial Tonometry

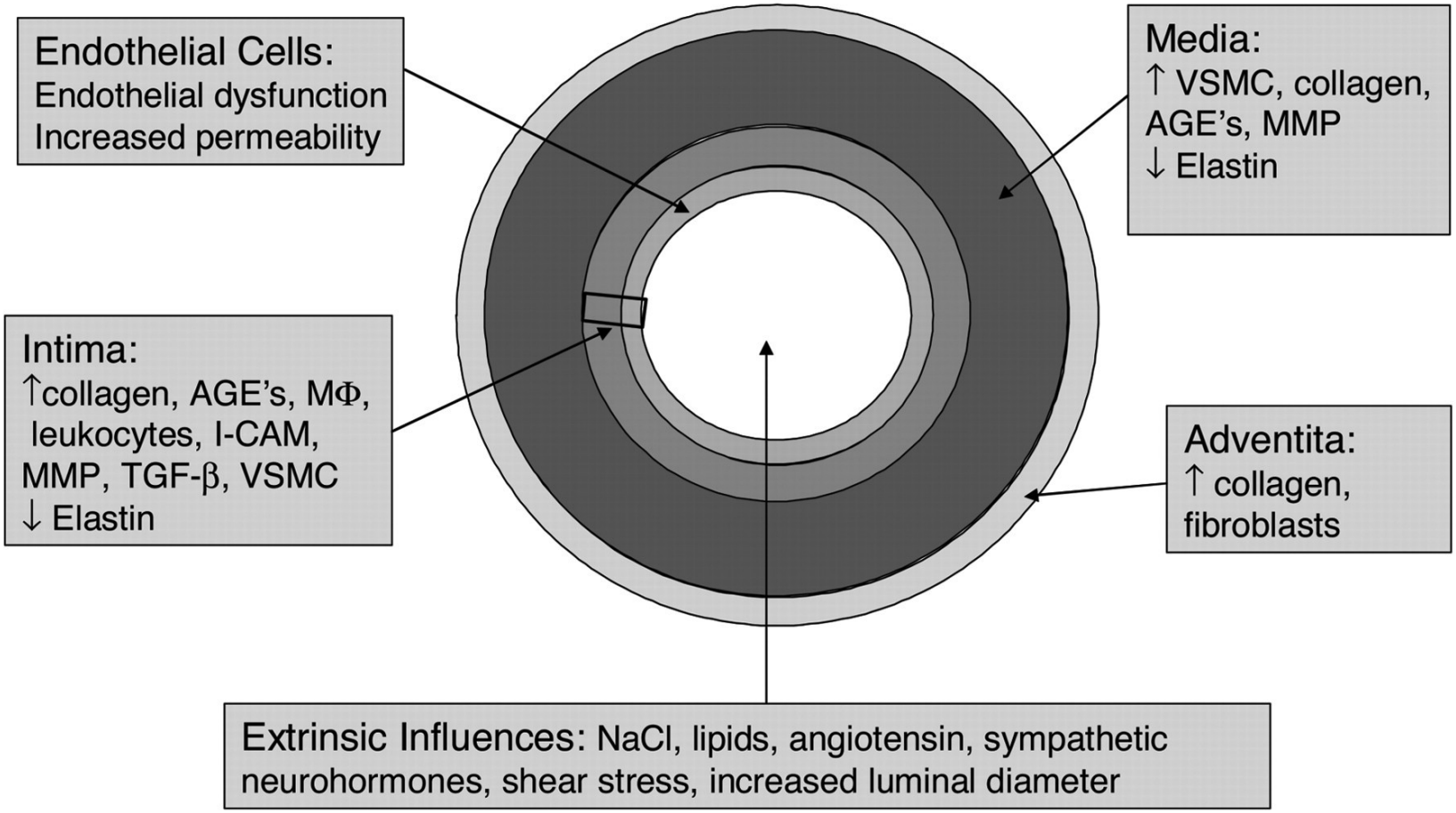
Examples of Arterial Function Tests

Microvascular Reactivity Measured by Fingertip Tonometry

Morteza Naghavi, et al. Am J Cardiol 2006;98

СЪДОВА РИГИДНОСТ

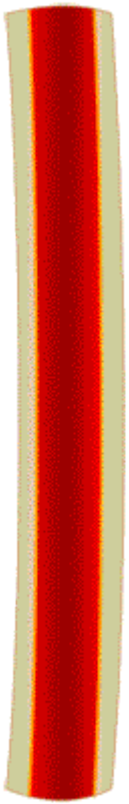
Figure 1. Summary of the multiple causes and locations of arterial stiffness.

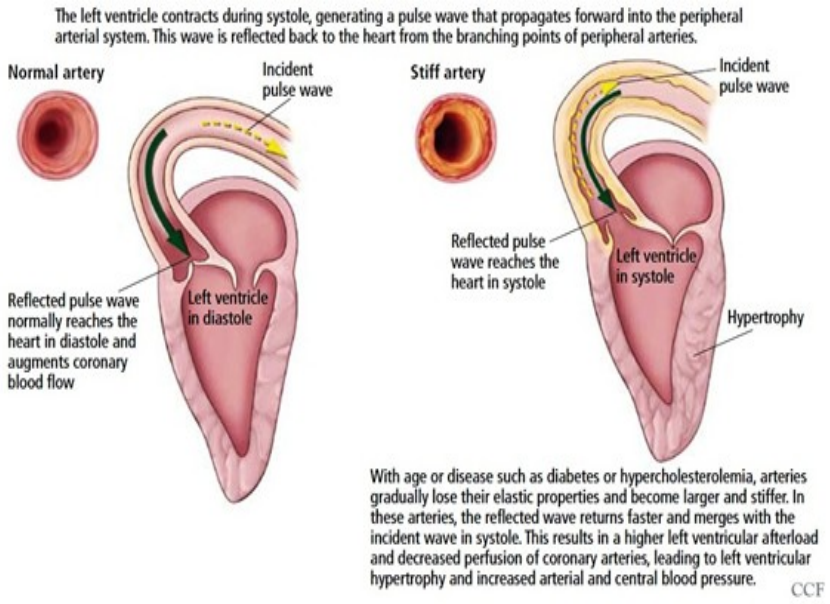


Zieman S J et al. Arterioscler Thromb Vasc Biol. 2005;25:932-943

American Heart Association.

Pulse Wave Velocity



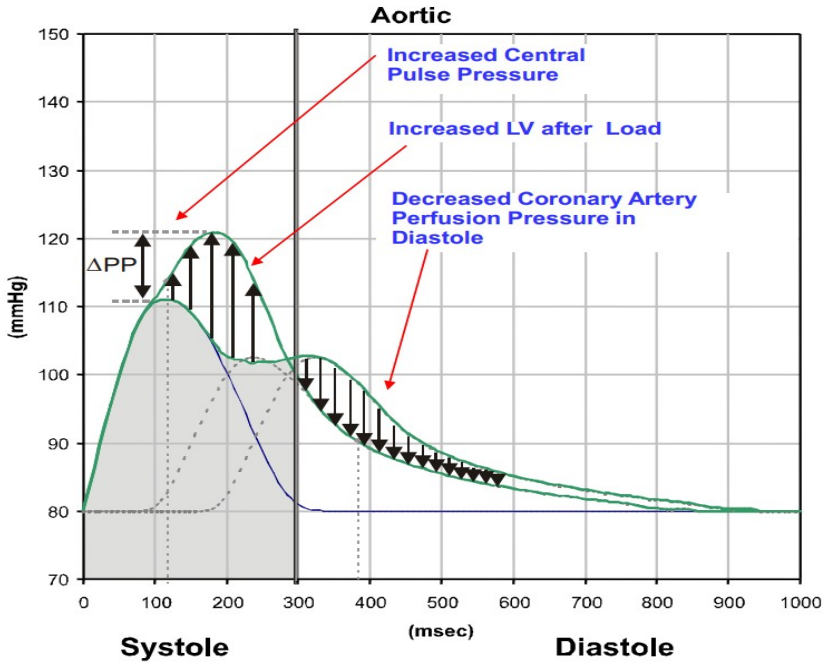


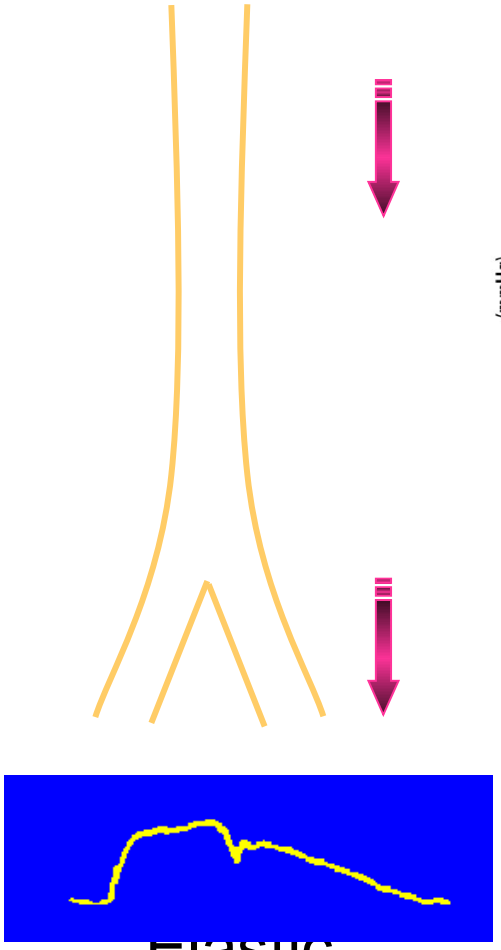
Elastic

Stiff

Модифицирано от: Dr Ian B. Wilkinson ***Vascular compliance as a novel cardiovascular risk factor***

Wave reflection





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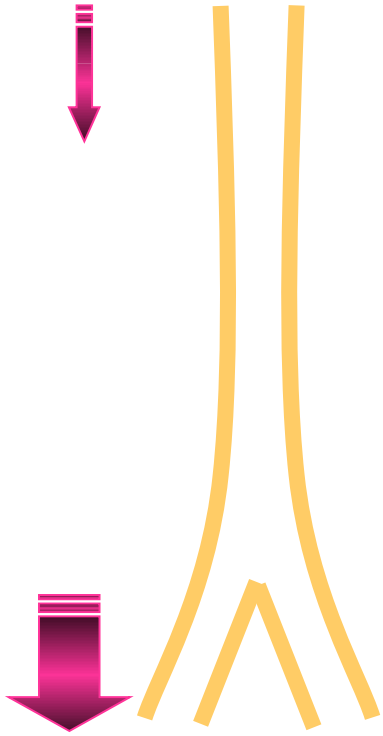
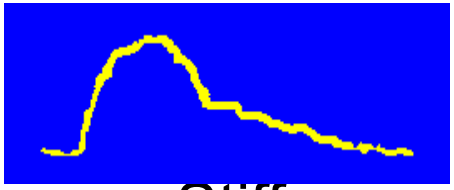


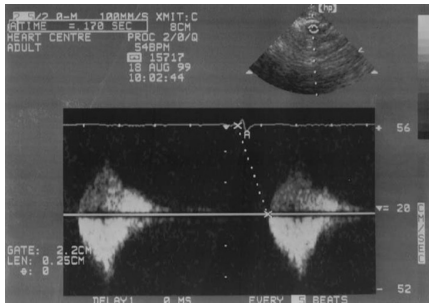


Stiff

Модифицирано от: Dr Ian B. Wilkinson ***Vascular compliance as a novel cardiovascular risk factor***

Mottram P M et al. Heart 2005;91:1551-1556

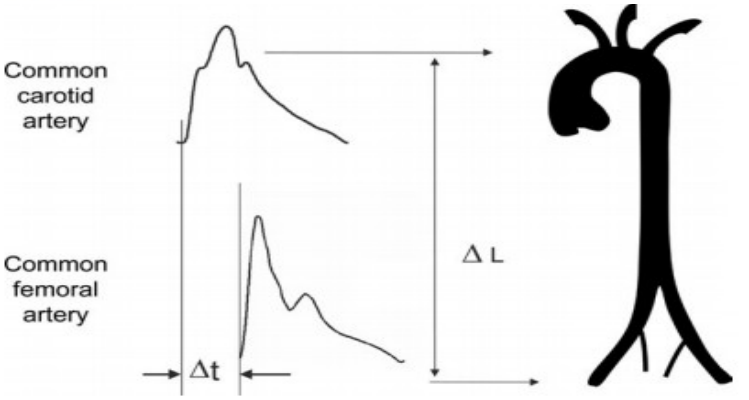
Методи за измерване на съдова ригидност



Pulsed Doppler на дясна обща феморална артерия. Изчисляване на интервала между началото на QRS комплекса и началото на систолната крива.
Локално измерване на съдова ригидност
Journal of Human Hypertension 2003; 17:407-412

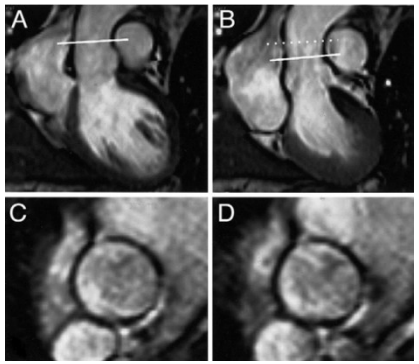
Expert consensus document on arterial stiffness: methodological issues and clinical applications

Position statement: PWV. Carotid-femoral PWV is considered as the 'gold-standard' measurement of arterial stiffness.

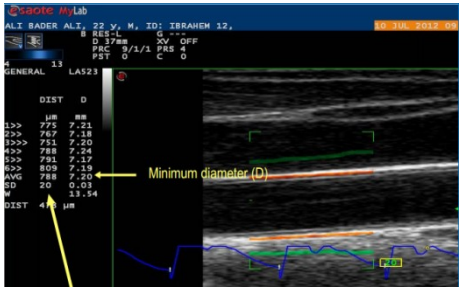


European Heart Journal (2006) 27, 2588–2605

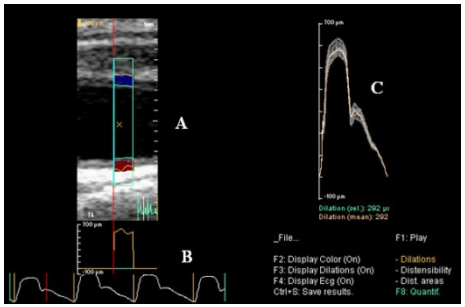
Измерване на каротидо-феморална скорост на пулсовата вълна,
SphygmoCor, AtCor



Distensibility measurment of the Aortic Root with Cardiac MRI
J Am Coll Cardiol 2011;57:1511–22

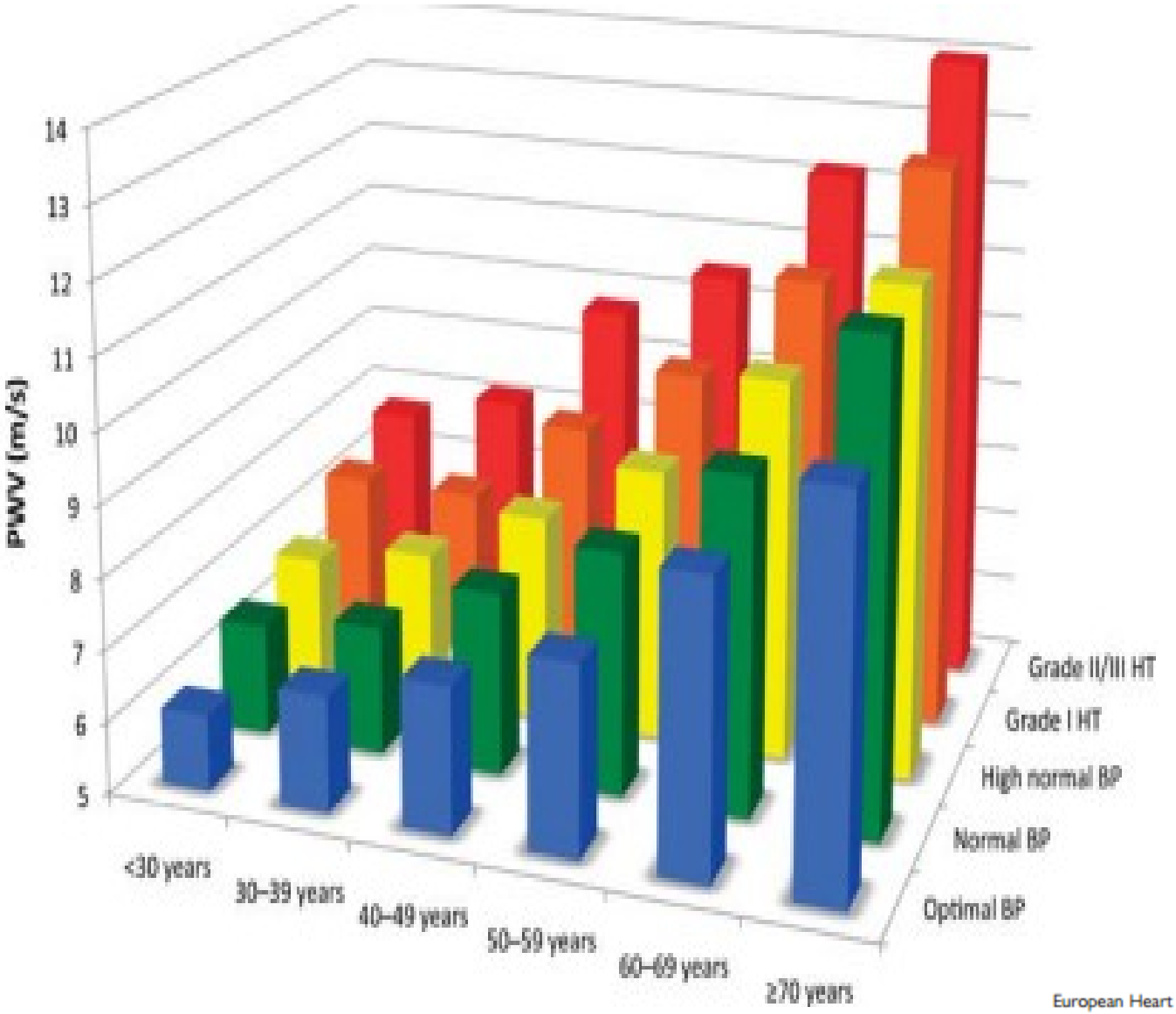


Измерване на локална съдова ригидност на каротидна артерия



Измерване на параметрите на съдова ригидност с помощта на TDI
Cardiovascular Ultrasound 2007

Determinants of pulse wave velocity in healthy people and in the presence of cardiovascular risk factors: 'establishing normal and reference values'



EUROPEAN SOCIETY OF CARDIOLOGY®

European Heart Journal (2010) **31**, 2338–2350

Aortic Pulse Wave Velocity Improves Cardiovascular Event Prediction

An Individual Participant Meta-Analysis of Prospective Observational Data From 17,635 Subjects

Table 1 Pooled Adjusted Hazard Ratios (95% CIs) of a 1-SD Increase in Log_e-Transformed aPWV for All-Cause Mortality, CVD Mortality, CHD Events, Stroke Events, and CVD Events

	Model 1*	Model 2*	Model 3*
CHD events (n = 1,195)	1.35 (1.22–1.50)	1.32 (1.18–1.48)	1.23 (1.11–1.35)
CVD events (n = 1,785)	1.45 (1.30–1.61)	1.37 (1.23–1.52)	1.30 (1.18–1.43)
Stroke events (n = 641)	1.54 (1.34–1.78)	1.37 (1.21–1.54)	1.28 (1.16–1.42)
CVD mortality (n = 395)	1.41 (1.27–1.56)	1.35 (1.20–1.53)	1.28 (1.15–1.43)
All-cause mortality (n = 2,041)	1.22 (1.16–1.27)	1.20 (1.15–1.26)	1.17 (1.11–1.22)

*Model 1 adjusts for sex and age group; model 2 adjusts for sex, age group, and systolic blood pressure; and model 3 additionally adjusts for other risk factors (cholesterol, high-density lipoprotein cholesterol, smoking status, presence of diabetes, and antihypertensive medication), stratified by race in the Sutton-Tyrell study (27). Not all studies had data on every risk factor.

aPWV = aortic pulse wave velocity; CHD = coronary heart disease; CI = confidence interval; CVD = cardiovascular disease.

Net Reclassification Statistics Showing Percent Change in 5-Year Risk Prediction (and 5- and 10-Year Overall Reclassification) Associated With Including log_e aPWV as a Risk Factor in the Fully-Adjusted Model

Reclassification indices showed that the addition of aPWV improved risk prediction (13% for 10-year CVD risk for intermediate risk) for some subgroups.

J Am Coll Cardiol 2014;63:636–46

Impact of Aortic Stiffness Attenuation on Survival of Patients in End-Stage Renal Failure

Alain P. Guerin, Jacques Blacher, Bruno Pannier, Sylvain J. Marchais, Michel E. Safar and Gérard M. London

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

150 пациенти
Проследяване 52 месеца

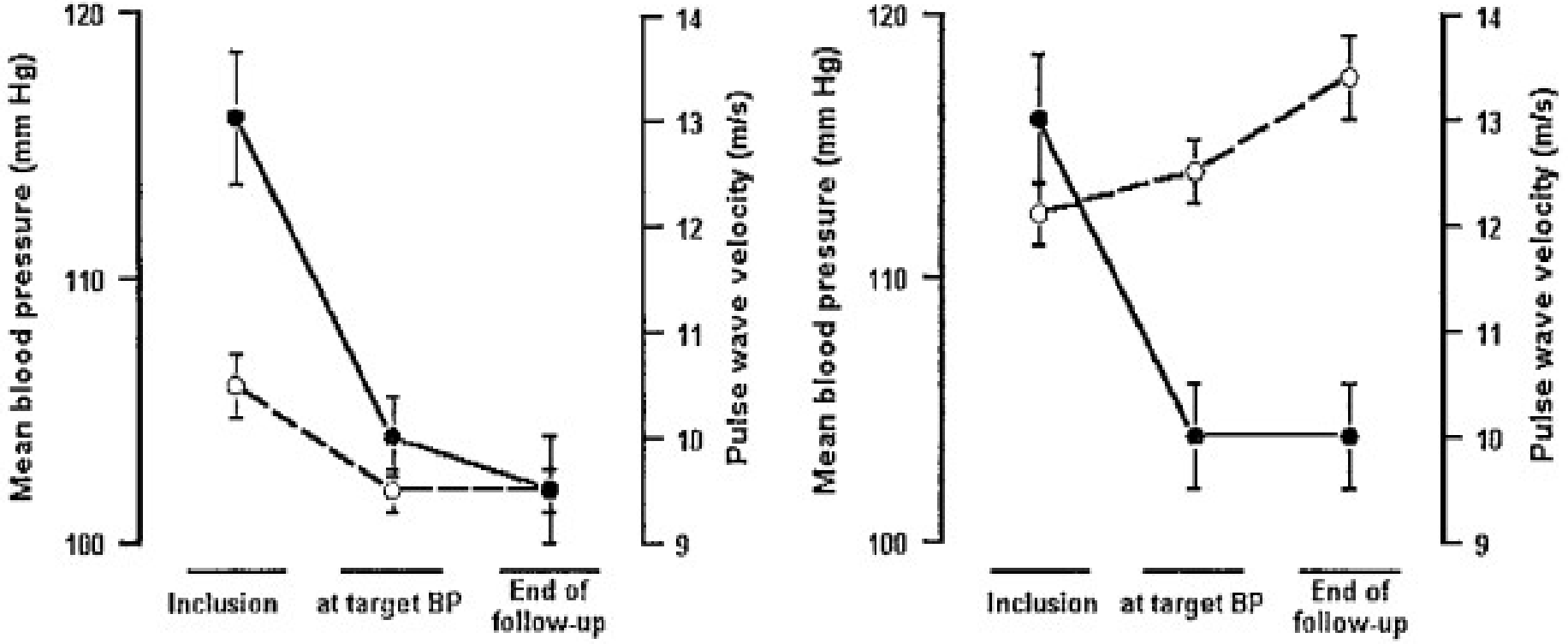


Figure 3. Changes of MBP (solid circle) and aortic PWV (open circle) from inclusion to end of follow-up for survivors and nonsurvivors. Values are mean±SEM.

Circulation. 2001;103:987-992

2013 ESH/ESC Guidelines for the management of arterial hypertension

Table 4 Factors—other than office BP—influencing prognosis; used for stratification of total CV risk in *Figure 1*

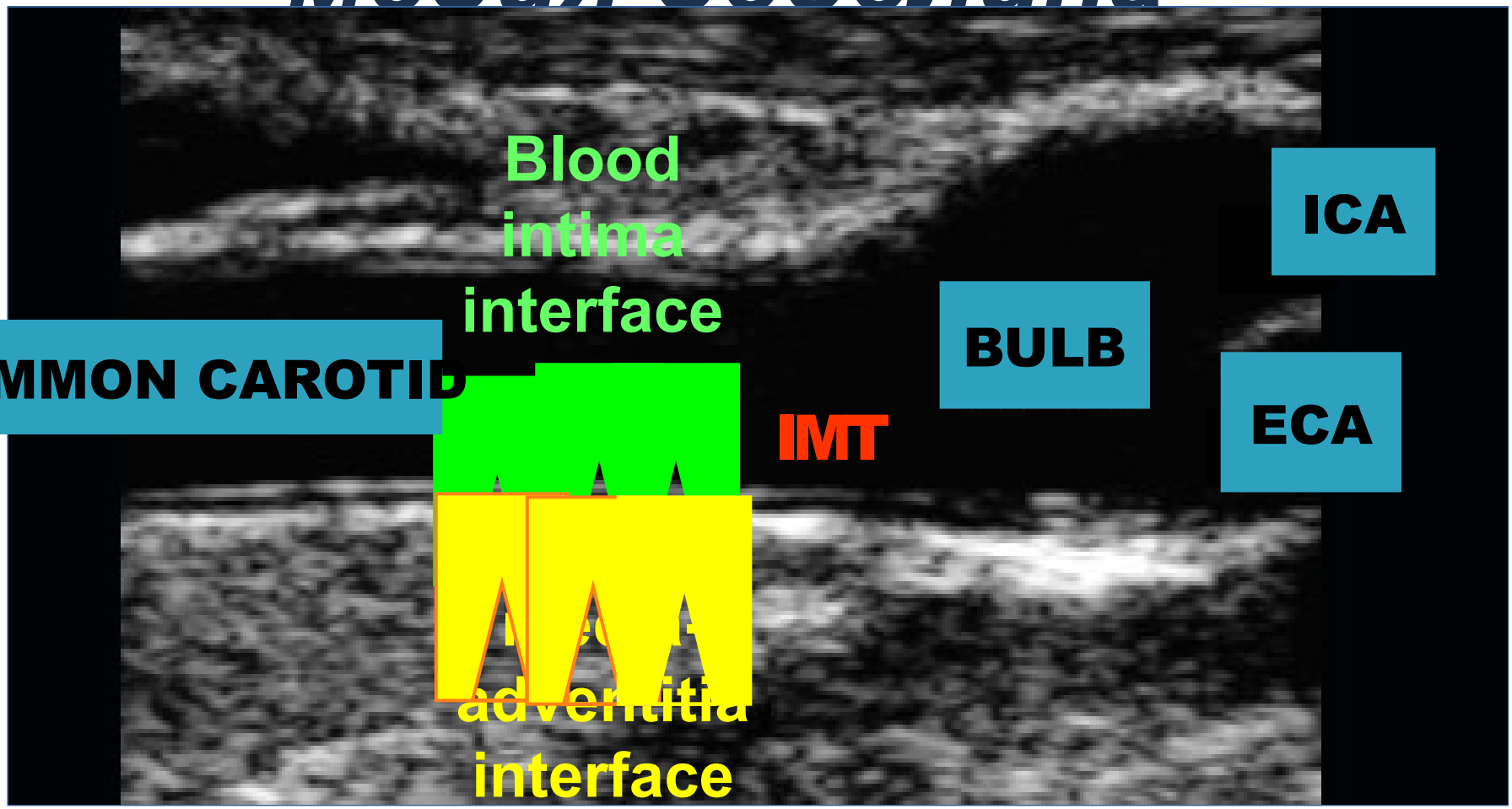
Asymptomatic organ damage
Pulse pressure (in the elderly) ≥60 mmHg
Electrocardiographic LVH (Sokolow–Lyon index >3.5 mV; RaVL >1.1 mV; Cornell voltage duration product >244 mV*ms), or
Echocardiographic LVH [LVM index: men >115 g/m^2; women >95 g/m^2 (BSA)][a]
Carotid wall thickening (IMT >0.9 mm) or plaque
Carotid–femoral PWV >10 m/s
Ankle-brachial index <0.9
CKD with eGFR 30–60 mL/min/1.73 m^2 (BSA)
Microalbuminuria (30–300 mg/24 h), or albumin–creatinine ratio (30–300 mg/g; 3.4–34 mg/mmol) (preferentially on morning spot urine)

Total cardiovascular risk assessment

Recommendations	Class[a]	Level[b]	Ref.[c]
In asymptomatic subjects with hypertension but free of CVD, CKD, and diabetes, total CV risk stratification using the SCORE model is recommended as a minimal requirement.	I	B	43
As there is evidence that OD predicts CV death independently of SCORE, a search for OD should be considered, particularly in individuals at moderate risk.	IIa	B	51, 53

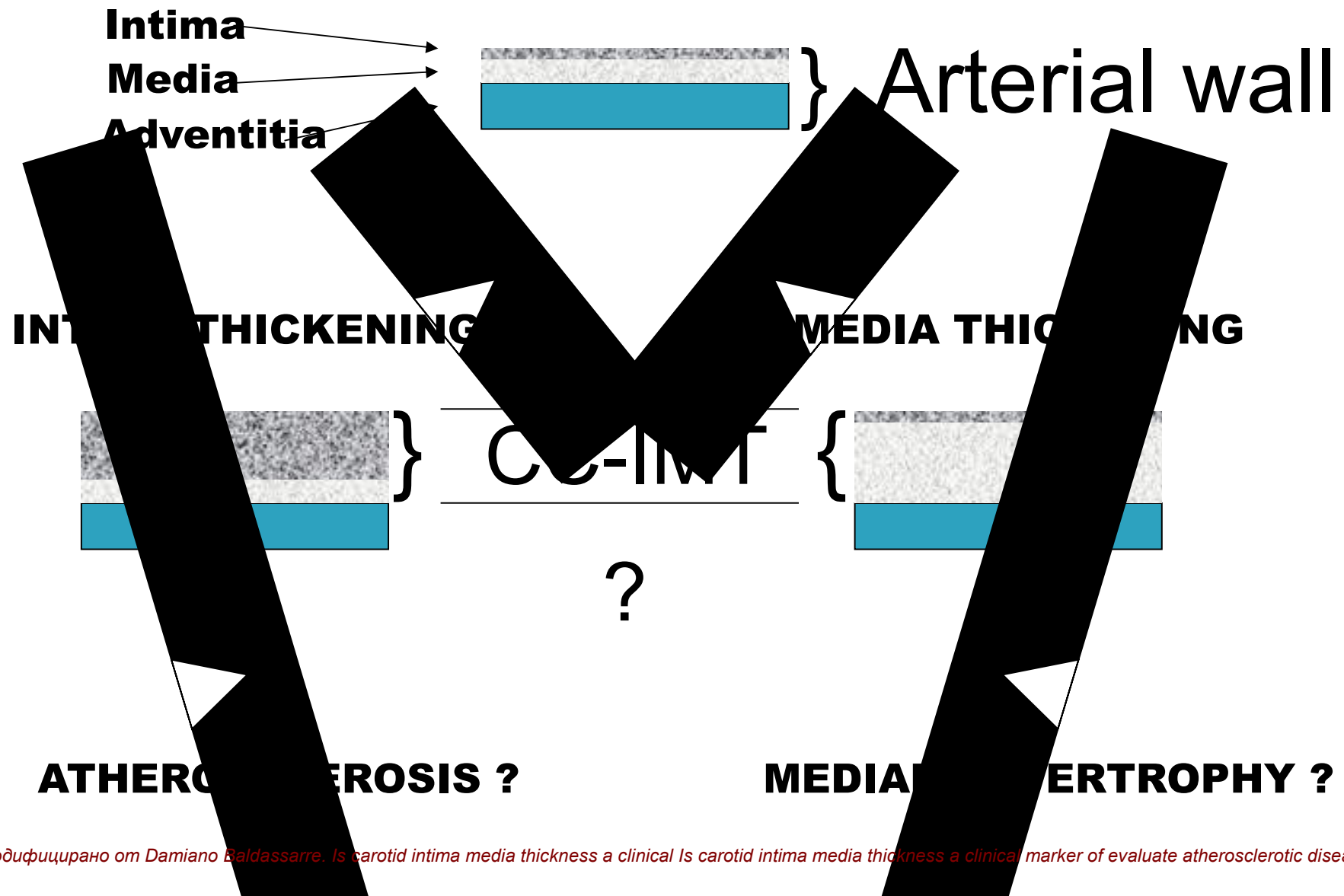
European Heart Journal (2013) **34**, 2159–2219

Измерване на интима-медия дебелина



Модифицирано от Damiano Baldassarre. Is carotid intima media thickness a clinical Is carotid intima media thickness a clinical marker of evaluate atherosclerotic disease

Ultrasonography cannot distinguish



Модифицирано от Damiano Baldassarre. Is carotid intima media thickness a clinical Is carotid intima media thickness a clinical marker of evaluate atherosclerotic disease

Carotid Intima-Media Thickness and Presence or Absence of Plaque Improves Prediction of Coronary Heart Disease Risk

The ARIC (Atherosclerosis Risk In Communities) Study

13145 пациенти
15 години просл.

Journal of the American College of Cardiology

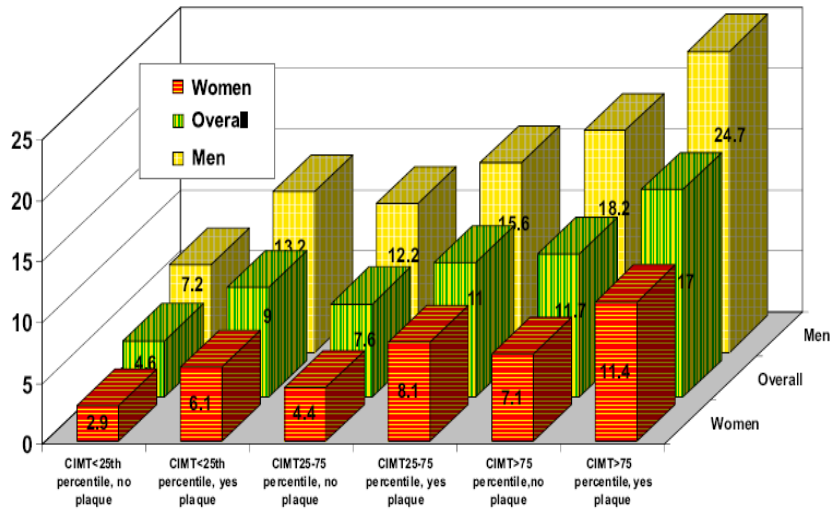


Figure 1 Adjusted Coronary Heart Disease Incidence Rate per 1,000 Person-Years Adjusted by CIMT Categories With and Without Plaque

For every carotid intima-media thickness (CIMT) category (i.e., <25th percentile, 25th to 75th percentile, and >75th percentile), for the overall group (**green bars**), men (**yellow bars**), or women (**orange bars**), having carotid artery plaque is associated with a higher incidence of coronary heart disease.

Table 2 Adjusted AUC for Different Models, With 95% Confidence Interval for Difference in Adjusted AUC Comparing Various Models With TRF-Only Model

Model	Overall	Men	Women
TRF only	0.742	0.674	0.759
TRF+CIMT	0.750 (0.005 to 0.012)	0.690 (0.009 to 0.022)	0.762 (−0.002 to 0.006)
TRF+plaque	0.751 (0.006 to 0.013)	0.686 (0.005 to 0.017)	0.770 (0.005 to 0.016)
TRF+CIMT+plaque	0.755 (0.008 to 0.017)	0.694 (0.011 to 0.027)	0.770 (0.005 to 0.017)
TRF+CIMT+plaque vs. TRF+IMT	(0.001 to 0.006)	(−0.001 to 0.006)	(0.003 to 0.012)
TRF+IMT+plaque vs. TRF+plaque	(0.001 to 0.005)	(0.002 to 0.011)	(−0.002 to 0.002)

AUC = area under the curve; CI = confidence interval; CIMT = carotid intima-media thickness; TRF = traditional risk factors.

Table 6 NRI Using Various Comparison Models in Overall Sample, Men, and Women

	Overall		Men		Women	
Model	NRI	Clinical NRI	NRI	Clinical NRI	NRI	Clinical NRI
TRF vs. TRF + CIMT	7.1 (2.2 to 10.6)	16.7 (9.3 to 22.4)	8.9 (3.4 to 15.1)	15.8 (8.6 to 24.6)	6.1 (−2.3 to 9.4)	15.9 (1 to 23.3)
TRF vs. TRF + plaque	7.7 (2.3 to 11.4)	17.7 (10.9 to 24.7)	4.2 (0.2 to 12.2)	10.5 (4.5 to 20.5)	10.2 (0.7 to 15.4)	25.6 (7.8 to 37.6)
TRF vs. TRF + CIMT + plaque	9.9 (3.8 to 13.5)	21.7 (13.4 to 28.2)	8.9 (4.1 to 17.1)	16.4 (9.5 to 27)	9.8 (1.1 to 15.4)	25.4 (9 to 37)
TRF + CIMT vs. TRF + CIMT + plaque	2.8 (−1.2 to 6.4)	10.6 (3.8 to 16.5)	0.03 (−2.6 to 6.3)	5.1 (0.3 to 13.2)	3.6 (−1.7 to 11.6)	12.8 (2.5 to 28.6)
TRF + plaque vs. TRF + CIMT + plaque	2.1 (−1.1 to 5.3)	7.9 (2.6 to 13.3)	4.8 (−0 to 10)	10.7 (4.3 to 19)	−0.3 (−3.7 to 3.6)	2.5 (−3.5 to 10.3)

Vol. 55, No. 15, 2010

European Guidelines on cardiovascular disease prevention in clinical practice (version 2012)

European Heart Journal (2012) **33**, 1635–1701

Recommendations	Class[a]	Level[b]	GRADE	Ref[c]
Measurement of carotid intima-media thickness and/or screening for atherosclerotic plaques by carotid artery scanning should be considered for cardiovascular risk assessment in asymptomatic adults at moderate risk.	IIa	B	Strong	130–132

2013 ACC/AHA Guideline on the Assessment of Cardiovascular Risk

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

5. CIMT is not recommended for routine measurement in clinical practice for risk assessment for a first ASCVD event.	N (No Recommendation For or Against)	Appendix 1	III: No Benefit†	B (12,16,18)

Journal of the American College of Cardiology (2014), doi: 10.1016/j.jacc.2013.11.005

Common Carotid Intima-Media Thickness Measurements in Cardiovascular Risk Prediction

A Meta-analysis

45828 пациенти

Table 3. Summary of the Indices of Added Value in the Total USE-IMT Cohort and in the Intermediate-Risk Categories, by Sex

	All	Men	Women
	USE-IMT		
NRI, % (95% CI)	0.8 (0.1 to 1.6)	0.9 (–0.2 to 1.9)	0.8 (–0.2 to 1.6)
IDI (95% CI)	0.0024 (0.0012 to 0.0036)	0.0024 (0.0004 to 0.0041)	0.0025 (0.0009 to 0.0040)
Relative IDI, %	3.6	3.6	3.7
	USE-IMT, Intermediate-Risk Group (5% to <20%)		
NRI, % (95% CI)	3.6 (2.7 to 4.6)	3.2 (2.3 to 4.4)	3.9 (2.7 to 4.9)
IDI (95% CI)	0.0024 (0.0012 to 0.0036)	0.0019 (0.0003 to 0.0034)	0.0031 (0.0013 to 0.0048)
Relative IDI, %	3.6	2.7	4.6

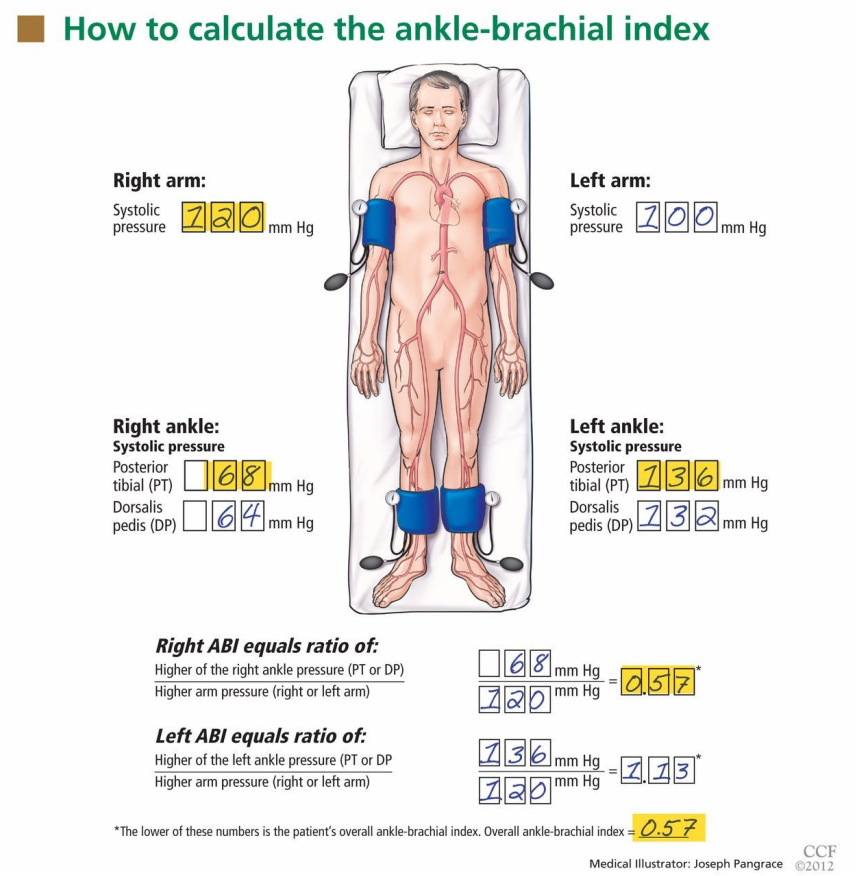
Abbreviations: IDI, integrated discrimination improvement; NRI, net reclassification improvement; USE-IMT, USE Intima-Media Thickness collaboration.

Conclusion The addition of common CIMT measurements to the Framingham Risk Score was associated with small improvement in 10-year risk prediction of first-time myocardial infarction or stroke, but this improvement is unlikely to be of clinical importance.

JAMA. 2012;308(8):796-803

www.jama.com

Измерване на тибио-брахиален индекс

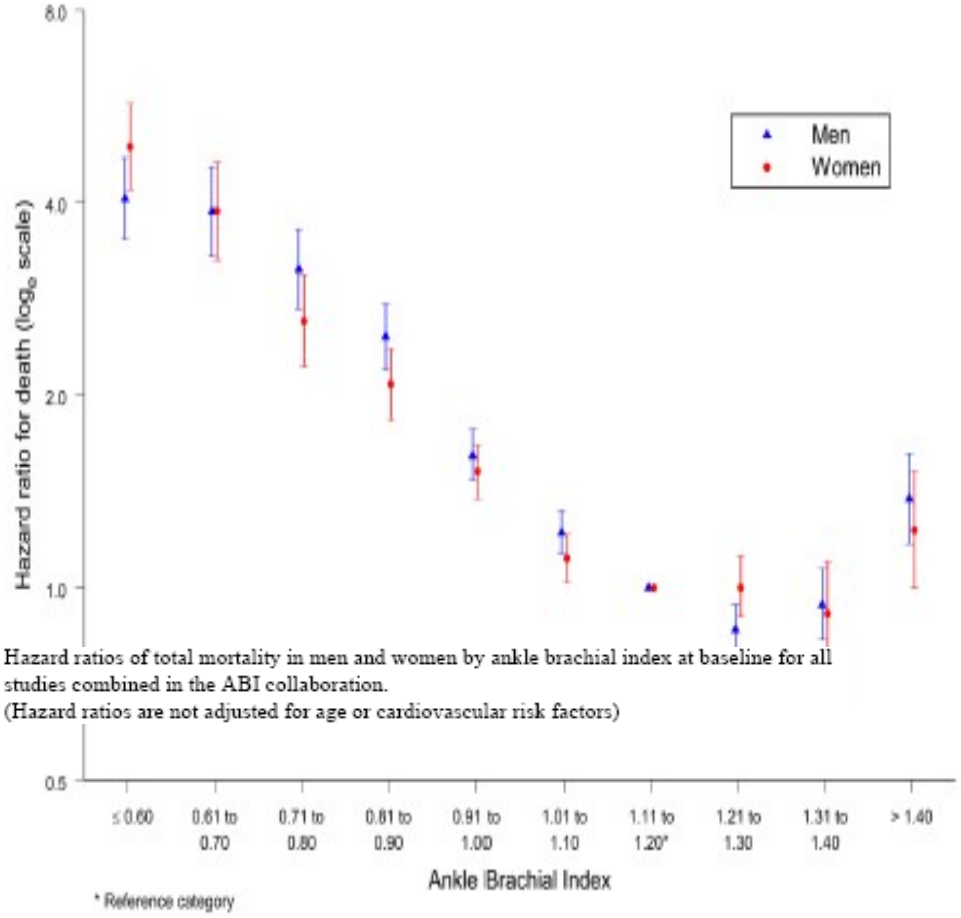


American Diabetes Association. Diabetes Care 2003: 26; 3333–

Ankle Brachial Index Combined with Framingham Risk Score to Predict Cardiovascular Events and Mortality: A Meta-analysis

Ankle Brachial Index Collaboration

- ***48 294 пациенти без установено ССЗ***



Hazard ratios of total mortality in men and women by ankle brachial index at baseline for all studies combined in the ABI collaboration.
(Hazard ratios are not adjusted for age or cardiovascular risk factors)

Ankle Brachial Index:	≤ 0.90	0.91 to 1.10	1.11 to 1.40	>1.40	Overall
	Total Coronary Heart Disease[3] % (n)				
Men					
Framingham Risk Category[2]					
Low < 10%	8 (76)	5 (1076)	4 (4255)	5 (216)	5 (5643)
Intermediate 10-19%	16 (245)	12 (2069)	12 (4815)	8 (283)	13 (7392)
High ≥20%	40 (1149)	21 (3406)	18 (3668)	14 (175)	23 (8398)
Women					
Framingham Risk Category[2]					
Low < 10%	21 (1083)	10 (6192)	9 (7909)	11 (321)	11 (15505)
Intermediate 10-19%	25 (558)	12 (2429)	11 (2433)	13 (143)	13 (5563)
High ≥20%	44 (200)	21 (598)	22 (577)	34 (43)	27 (1418)

Изследването на ABI в допълнение към FRS рекласифицира 19 % от мъжете и 36 % от жените

JAMA. 2008 July 9; 300(2): 197–208.

European Guidelines on cardiovascular disease prevention in clinical practice (version 2012)

Measurement of ankle–brachial index should be considered for cardiovascular risk assessment in asymptomatic adults at moderate risk.	IIa	B	Strong	133–135

European Heart Journal (2012) **33**, 1635–1701

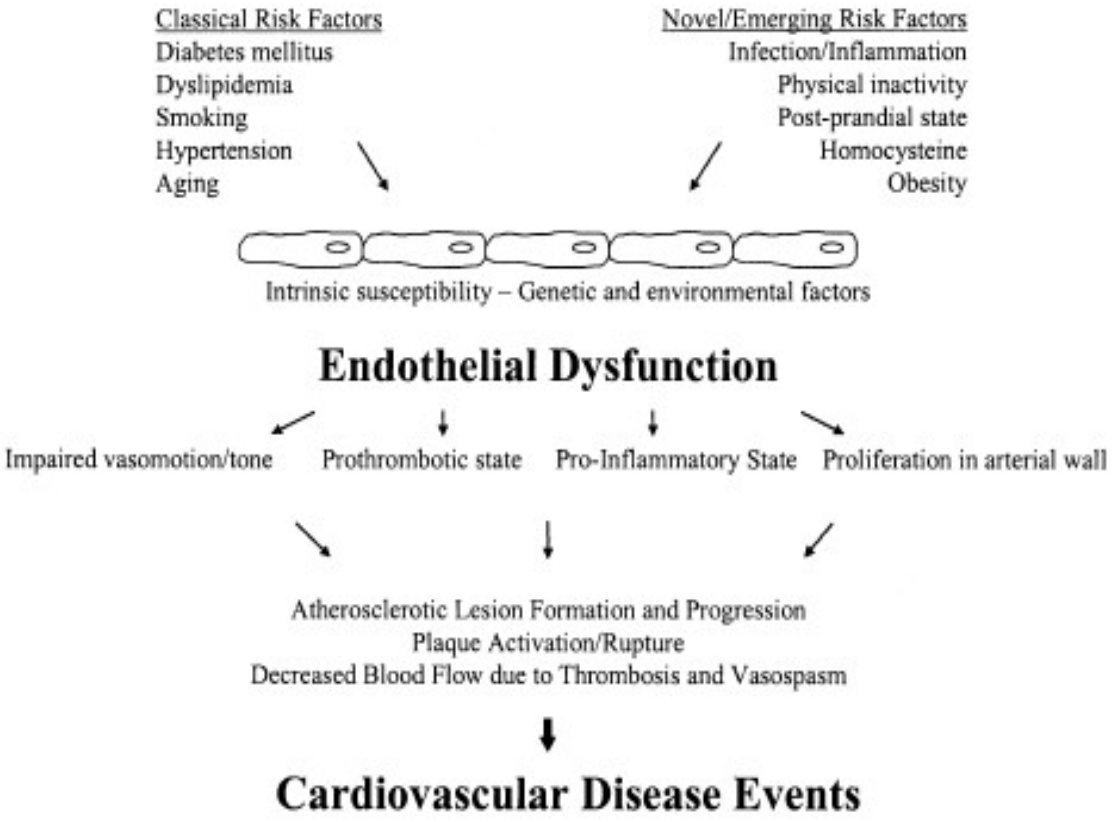
2013 ACC/AHA Guideline on the Assessment of Cardiovascular Risk

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

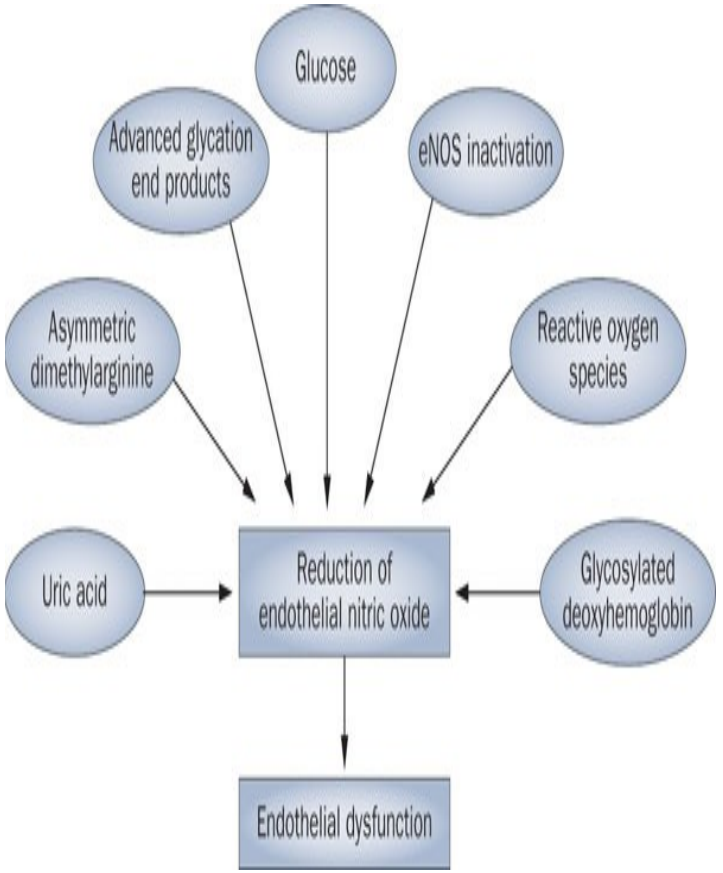
3. If, after quantitative risk assessment, a risk-based treatment decision is uncertain, assessment of 1 or more of the following—family history, hs-CRP, CAC score, or ABI—may be considered to inform treatment decision making.	E (Expert Opinion)	Appendix 1	IIb†

Journal of the American College of Cardiology (2014), doi: 10.1016/j.jacc.2013.11.005

Ендотелна дисфункция

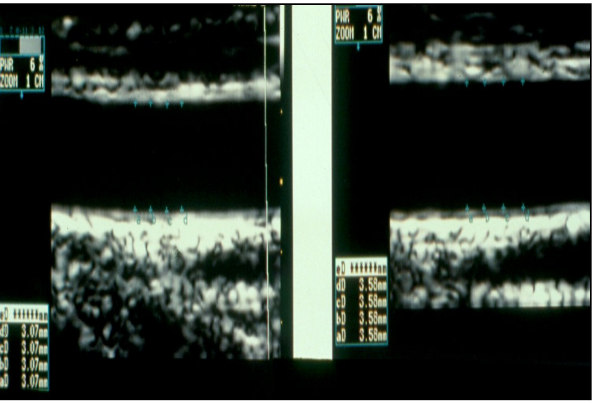


J Am Coll Cardiol 2003;42:1149–60

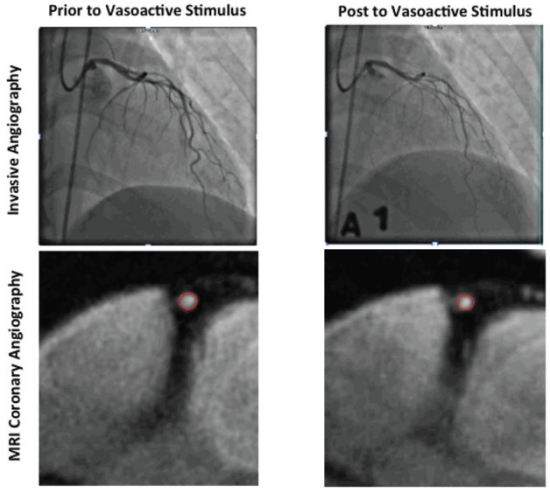


Nature Reviews Nephrology 7, 36-44 (January 2011)

Измерване на ендотелната функция



Поток-медиирана вазодилатация на брахиална артерия

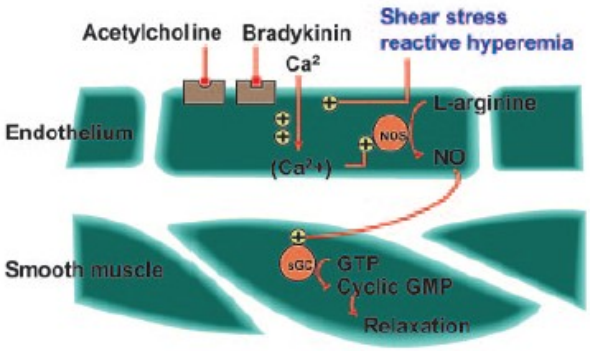


Корелация между инвазивна оценка на ендотелна функция и MRI

JACC April 1, 2014

Endo-PAT2000

Периферна артериална тонометрия



Circulation. 2005;111:363-368

Заключение

- Неинвазивните методи за изследване на периферните атериалните съдове помагат да се оценят биологичните промени в съдовете и са маркери за субклинична органна увреда
- Приложението им е особенно полезно при пациенти с интермедиерен риск за сърдечно-съдови усложнения
- Повишена съдова ригидност, централно аортно и пулсово налягане, ИМД, ABI, CAC, и ендотелна дисфункция са предиктори за неблагоприятна прогноза
- Дали намаляването на съдовата ригидност, ИМД, подобряване на ендотелната функция ще подобри прогнозата на пациентите все още предстои да бъде изследвано