



CARDIOVASCULAR LAB TESTS IN PRIMARY CARE: SMARTER ORDERING, BETTER OUTCOMES

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OVERVIEW

- Established risk factors
 - Metabolic and monitoring profiles
 - Electrolyte and kidney investigations
 - Cardiac specific markers



INTRODUCTION

- Atherosclerotic cardiovascular disease (ASCVD)
 - Coronary heart disease
 - Fatal/non fatal myocardial infarction and angina pectoris
 - Cerebrovascular disease
 - Ischaemic stroke and transient ischaemic attack
 - Peripheral artery disease
 - Intermittent claudication and critical limb ischaemia
 - Aortic atherosclerosis
 - Thoracic/abdominal aortic aneurysm



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE

- Age
- gender
- Hypertension
- Diabetes mellitus
- Lipids and lipoproteins
- Diabetes mellitus and hyperglycaemia
- Obesity
- Metabolic syndrome
- Chronic kidney disease and microalbuminuria
- Lifestyle factors: Cigarette smoking, Diet, physical inactivity, alcohol, sleep, psychosocial factors
- Environmental exposures
- Inflammation
- HIV infection
- Mediastinal radiation

- **Coronary heart disease risk equivalent**
 - T2 DM
 - Peripheral arterial disease
 - Carotid artery disease
 - Abdominal aortic aneurysm
 - CKD
- *Patients without CHD have a risk of cardiovascular event comparable to patients with established CHD*



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE

Determining risk

- Risk calculators
 - Based on end-point data for ASCVD outcomes (MI, Stroke, CHD)
 - Guides primary prevention
 - ~10 year risk

	FRAMINGHAM	USA			EUROPE		UK	CHINA	WHO CVD RISK
		PREVENT	PREVENT add on	ASCVD risk estimator plus	SCORE2	SCORE2-OP	QRISK3	CHINA-PAR RISK PREDICTOR	
DATE IMPLEMENTED		2023		2018	2021	2021	2018	2016	2019
AGE	X	X	X	X	X	x (>75yrs)	X	X	X
SEX				X	X	X	X		X
RACE				X			X		
TOTAL CHOL	X	X	X	X	X	X		X	X
LDL CHOL					x (optional)	x (optional)			
HDL CHOL	X	X	X	X	X	X		X	
CHOL/HDL RATIO							X		
SYSTOLIC BP	x (Syst)	X	X	X	X	X	X	X	X
ANGINA/MI 1' RELATIVE							x (<60yrs)	x (M)	
AF							X		
BMI		X	X						X
HEIGHT							X		
WEIGHT							X		
WAIST CIRC								x (M/F)	
Egfr/CKD		X	X				X		
DIABETES	X	X	X	X			X	X	X
SMOKING	X	X	X	X	X	X	X	X	X
ANTIHPT Rx	X	X	X	X			X		
STATIN Rx		X	X						
UACR			X						
HbA1C			X						
ADDITIONAL:							Migraines, sle, severe mental illness, atypical antipsychotic Rx, steroid Rx, erectile dysfunction Rx		

RISK CALCULATORS



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE:

Box 1 Risk modifiers for consideration beyond the risk estimation based on the SCORE2 and SCORE2-OP algorithms

Demographic/clinical conditions

- Family history of premature CVD (men: <55 years; women: <60 years)
- High-risk ethnicity (e.g. Southern Asian)
- Stress symptoms and psychosocial stressors
- Social deprivation
- Obesity
- Physical inactivity
- Chronic immune-mediated/inflammatory disorders
- Major psychiatric disorders
- History of premature menopause
- Pre-eclampsia or other hypertensive disorders of pregnancy
- Human immunodeficiency virus infection
- Obstructive sleep apnoea syndrome

Biomarkers

- Persistently elevated hs-CRP (>2 mg/L)
- Elevated Lp(a) [>50 mg/dL (>105 nmol/L)],

CVD, cardiovascular disease; hs-CRP, high sensitivity C-reactive protein; Lp(a), lipoprotein(a).



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE: Where can the lab fit in?

- Age
- gender
- **Hypertension**
- **Diabetes mellitus**
- **Lipids and lipoproteins**
- **Diabetes mellitus and hyperglycaemia**
- Obesity
- Metabolic syndrome
- **Chronic kidney disease and microalbuminuria**
- Lifestyle factors: Cigarette smoking, Diet, physical inactivity, alcohol, sleep, psychosocial factors
- Environmental exposures
- **Inflammation**
- **HIV infection**
- Mediastinal radiation



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE: Metabolic markers

- Diagnostic markers:
 - Glucose analysis: Fasting, OGTT, Random
 - HbA1c
 - HPLC
 - Immunoassay
 - Newer markers: Glycated albumin, Fructosamine

Table I: interpretation of tests used for screening and diagnosis of diabetes

Fasting plasma glucose ^a (FPG) ^a (mmol/L)	<5.6 Diabetes excluded	6.0 - 6.9 Impaired fasting glucose ^e	≥ 7.0 Diabetes ^e
2hr-plasma glucose (2-hr PG) ^b (mmol/L)	<7.8 Normal glucose tolerance	7.8 - 11.0 Impaired glucose tolerance ^e	≥ 11.1 Diabetes ^e
Glycated haemoglobin A _{1c} (HbA _{1c}) ^c (%)	<6.5 Inconclusive ^f		≥ 6.5 Diabetes ^e
Random plasma glucose (RPG) ^d (mmol/L)	<5.6 Diabetes excluded	5.6 - 11.0 Inconclusive ^f	≥ 11.1 Diabetes ^e

- Hypertension
- Diabetes mellitus
- Met. Synd.
- Lipids and lipoproteins
- Diabetes mellitus and hyperglycaemia
- Chronic kidney disease and microalbuminuria
- Inflammation
- HIV infection



METABOLIC MARKERS: Risk screening: what to include annually

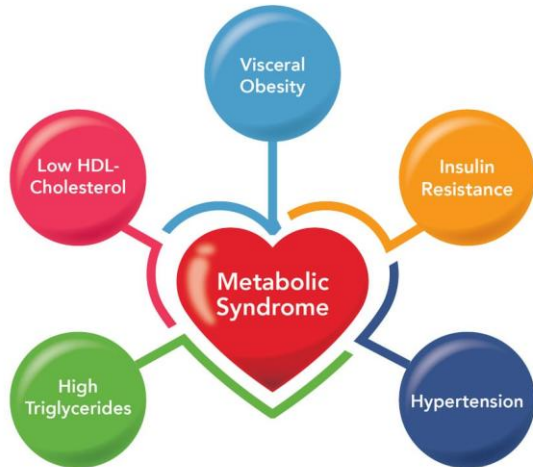
Investigations	Initial visit	3-6 monthly visit	Annually
Blood			
Glucose	X		
HbA _{1c}	X	X	X
Lipids (TC, HDLc, TG, LDLc)	X		X
Creatinine and calculation of eGFR	X		X
Potassium	X		X
HIV	X		
Urine			
Dipstix			
Glucose	X	X	X
Ketones	X	X	X
Protein	X	X	X
Albumin/creatinine ratio	X		X
ECG	X		X
Continuous glucose monitoring*	X	X	X

*Refer to Chapter 8



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE: Metabolic markers

What is Metabolic Syndrome?



- **Metabolic syndrome**
 - Elevated waist circumference:
 - >102cm (M)
 - >88cm (F)
 - Raised TG >1.7 mmol/L
 - Low HDL
 - <1.03 (M)
 - <1.3 mmol/L (F)
 - Raised BP
 - Syst \geq 130 and/or
 - Dias \geq 85 mmHg
 - Raised fasting glucose \geq 5.6 mmol/L

- Hypertension
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- **Met. Synd.**
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ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE: Metabolic markers

Table 2: Definitions of the metabolic syndrome

Parameters	NCEP ATP III 2005 ^a	IDF 2009	EGIR 1999	WHO 1999	AACE 2003
Required			Insulin resistance or fasting hyperinsulinemia (i.e. in top 25% of the laboratory-specific reference range)	Insulin resistance in top 25% ^b ; fasting glucose ≥ 6.1 mmol/L (110 mg/dL); 2-hour glucose ≥ 7.8 mmol/L (140 mg/dL)	High risk of insulin resistance ^d or BMI ≥ 25 kg/m ² or waist ≥ 102 cm (men) or ≥ 88 cm (women)
Number of abnormalities	≥ 3 of:	≥ 3 of:	And ≥ 2 of:	And ≥ 2 of:	And ≥ 2 of:
Glucose	Fasting glucose ≥ 5.6 mmol/L (100 mg/dL) or drug treatment for elevated blood glucose	Fasting glucose ≥ 5.6 mmol/L (100 mg/dL) or diagnosed diabetes	Fasting glucose 6.1 to 6.9 mmol/L (110 to 125 mg/dL)		Fasting glucose ≥ 6.1 mmol/L (110 mg/dL); ≥ 2 -hour glucose 7.8 mmol/L (140 mg/dL)
HDL cholesterol	< 1.0 mmol/L (40 mg/dL; men); < 1.3 mmol/L (50 mg/dL; women) or drug treatment for low HDL cholesterol ^e	< 1.0 mmol/L (40 mg/dL; men); < 1.3 mmol/L (50 mg/dL; women) or drug treatment for low HDL cholesterol	< 1.0 mmol/L (40 mg/dL)	< 0.9 mmol/L (35 mg/dL; men); < 1.0 mmol/L (40 mg/dL; women)	< 1.0 mmol/L (40 mg/dL; men); < 1.3 mmol/L (50 mg/dL; women)
Triglycerides	≥ 1.7 mmol/L (150 mg/dL) or drug treatment for elevated triglycerides ^f	≥ 1.7 mmol/L (150 mg/dL) or drug treatment for high triglycerides	or ≥ 2.0 mmol/L (180 mg/dL) or drug treatment for dyslipidemia	or ≥ 1.7 mmol/L (150 mg/dL)	≥ 1.7 mmol/L (150 mg/dL)
Obesity	Waist ≥ 102 cm (men) or ≥ 88 cm (women) ^g	Waist ≥ 94 cm (men) or ≥ 80 cm (women) ^h	Waist ≥ 94 cm (men) or ≥ 80 cm (women)	Waist/hip ratio > 0.9 (men) or > 0.85 (women) or BMI ≥ 30 kg/m ²	
Hypertension	$\geq 130/85$ mmHg or drug treatment for hypertension	$\geq 130/85$ mmHg or drug treatment for hypertension	$\geq 140/90$ mmHg or drug treatment for hypertension	$\geq 140/90$ mmHg	$\geq 130/85$ mmHg



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE:

Metabolic markers

- Total cholesterol, LDL, HDL, triglycerides
- When to treat vs lifestyle
- Cost-saving consideration: **Calculated LDL**
 - Friedewald equation: $LDL(\text{mmol/L}) = \text{Total chol} - HDL - (TG/2.2)$
 - Invalid with $TG > 4.5 \text{ mmol/L}$
 - Martin-Hopkins: $LDL(\text{mmol/L}) = \text{Chol} - HDL - (TG/\text{factor} * 0.43658)$
 - Sampson: $LDL(\text{mmol/L}) = (\text{Chol}/0.948) - (HDL/0.971) - ([TG/3.74] + \{TG * \text{nonHDL}\}/24.16) - [TG^2/79.36] - 0.244$
 - Fasting vs non-fasting samples
 - Fasting for correct triglyceride result NOT LDL
- Ratios
- Lipid electrophoresis
 - LDL particle size
 - Fredrickson classification

- **Lipid profile reference ranges**
 - TC <5.0
 - HDL >1.2
 - TG <1.70
 - LDL Variable

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THERAPEUTIC GOALS (mmol/L):

	Low risk	Mod risk	High risk	Very high risk	ASCVD with 2nd:vascular event:within 2 years:
LDL-C (mmol/L)	<3.0	<2.6	<1.8*	<1.4*	<1.0*
Non-HDL-C (mmol/L)	-	<3.4	<2.6	<2.2	-

* plus reduction of baseline by at least 50%

Ref: ESC/EAS Guidelines dyslipid. EHJ(2020) 41, 111-88

For cardiovascular risk categories, Please see: 2019 ESC/EAS Guidelines for the management of dyslipidaemias (doi:10.1093/eurheartj/ehz455).



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE:

Metabolic markers: Additional risk markers

Lipoprotein(a)

- Genetically determined
 - Apolipoprotein (a)
 - Cholesterol carrying lipoprotein
- High association to
 - MI (2-3x)
 - Aortic stenosis
 - Some assoc: Stroke, heart failure
- Genetic risk marker
 - 1:5 risk
- Harmful actions ;
 - Inflammation
 - Clotting (Similarity to plasminogen)
 - atherogenic

- Hypertension
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- Chronic kidney disease



CHOL:HDL RATIO	3.4	< 4.0
TC:HDL >4: Moderate risk; TC:HDL >5: High CVD risk For more accurate CVD risk, ApoB & ApoA1 is recommended		
Lipoprotein(a)	59.60	H 0 - 50 mg/dl

Lp(a) is not a standardized test. Always monitor individuals with the same method.
Lp(a) is a weak risk factor for atherosclerotic CVD, although lifelong high levels are strongly and causally associated with CVD.
Lp(a) > 180 mg/dL: CVD risk compares to the risk as seen in patients with heterozygote FH.
Lp(a) cut off > 50 mg/dL: use as risk marker in HIGH risk individuals with family history of premature CVD and in borderline moderate- to high risk individuals.
Ref: 2019 -ESC/EAS guidelines for the management of dyslipidemias; 2012- SA consensus dyslipidemia guidelines



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE:

Metabolic markers: Additional risk markers

Apolipoprotein

- Apo B (Specifically Apo B100)
 - Synthetic site: Liver
 - Lipoprotein: VLDL, LDL, IDL
- Apo A1
 - Synthetic site: GIT, Liver
 - Lipoprotein: Chylomicrons, HDL
- Yields similar information to LDL and HDL
- More expensive
- B (ApoB) Better reflection of atherogenic particles
 - Use when LDL appears normal but risk is high

APOLIPOPROTEINS			
APOLIPOPROTEIN A1	1.09	L	> 1.20 g/L
APOLIPOPROTEIN B	0.65		< 1.20 g/L
Moderate total CVD risk: ApoB therapeutic goal <1.00 g/L High total CVD risk: ApoB therapeutic goal <0.80 g/L Very high total CVD risk: ApoB therapeutic goal <0.65 g/L Ref: ESC/EAS Guidelines dyslipid. EHJ(2020) 41,111-88.			
APOB:APOA1 Ratio	0.59		< 0.70
ApoB/ApoA1 ratio interpretation:			
<0.70 : ApoB/ApoA1 ratio suggests low CVD risk			
0.70 - 0.90 : ApoB/ApoA1 ratio suggests moderate CVD risk			
>0.90 : ApoB/ApoA1 ratio suggests high CVD risk			
NON-HDL-CHOL	2.20		mmol/L

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- HIV infection



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE:

Metabolic markers: Additional risk markers

Lipoprotein ratios

- Total/HDL cholesterol
- LDL/HDL chol
 - Not reliable when LDL cannot be calculated, eg Raised Trig
- Apo B/Apo A1
- Log (Trig/HDL cholesterol)
- LDL cholesterol/Apo B
- Non-HDL/HDL cholesterol
 - Non-HDL = Total chol-HDL

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CHOL:HDL RATIO

3.5

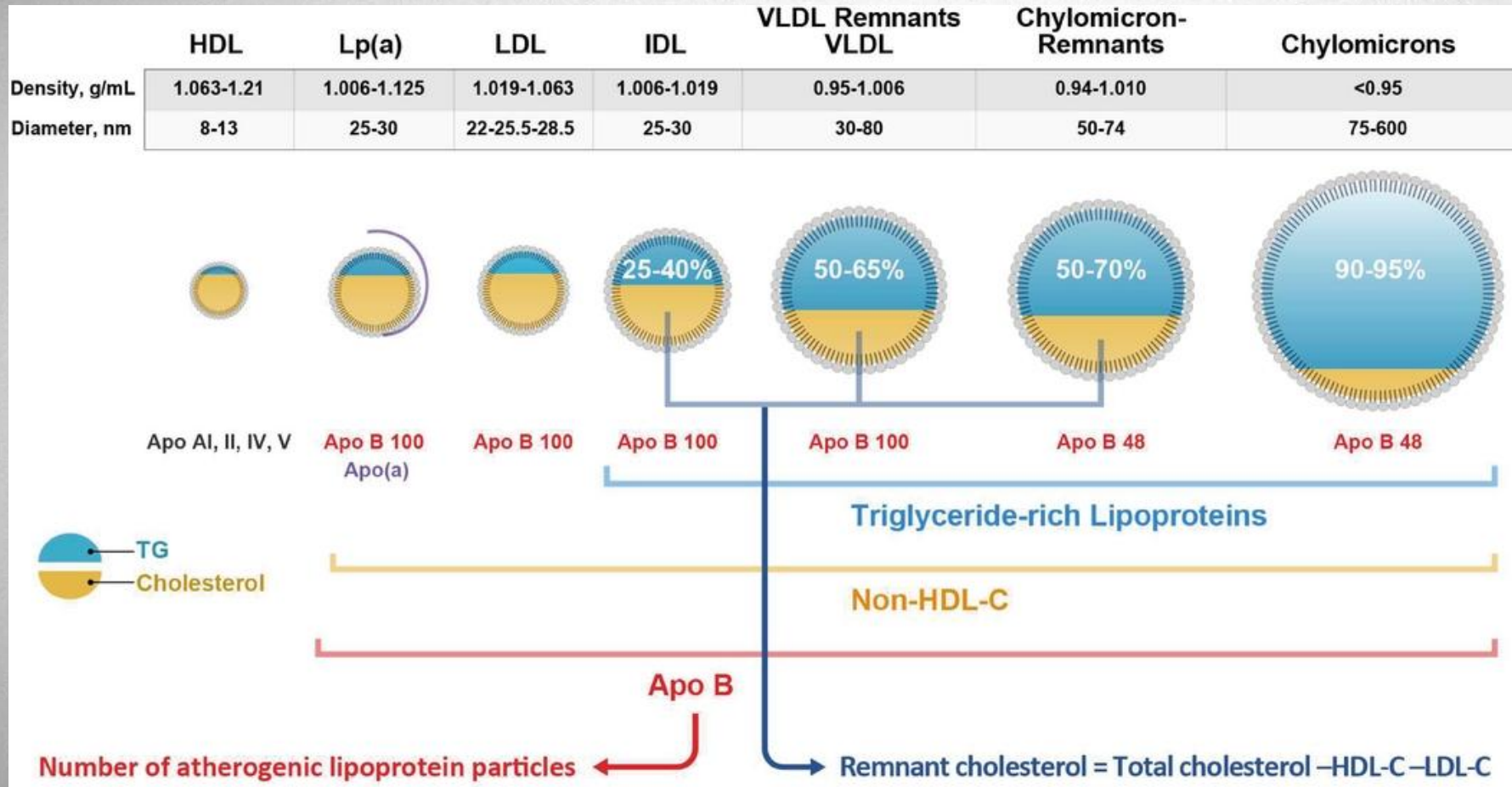
< 4.0

TC:HDL >4: Moderate risk; TC:HDL >5: High CVD risk
For more accurate CVD risk, ApoB & ApoA1 is recommended



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE:

Metabolic markers: Additional risk markers



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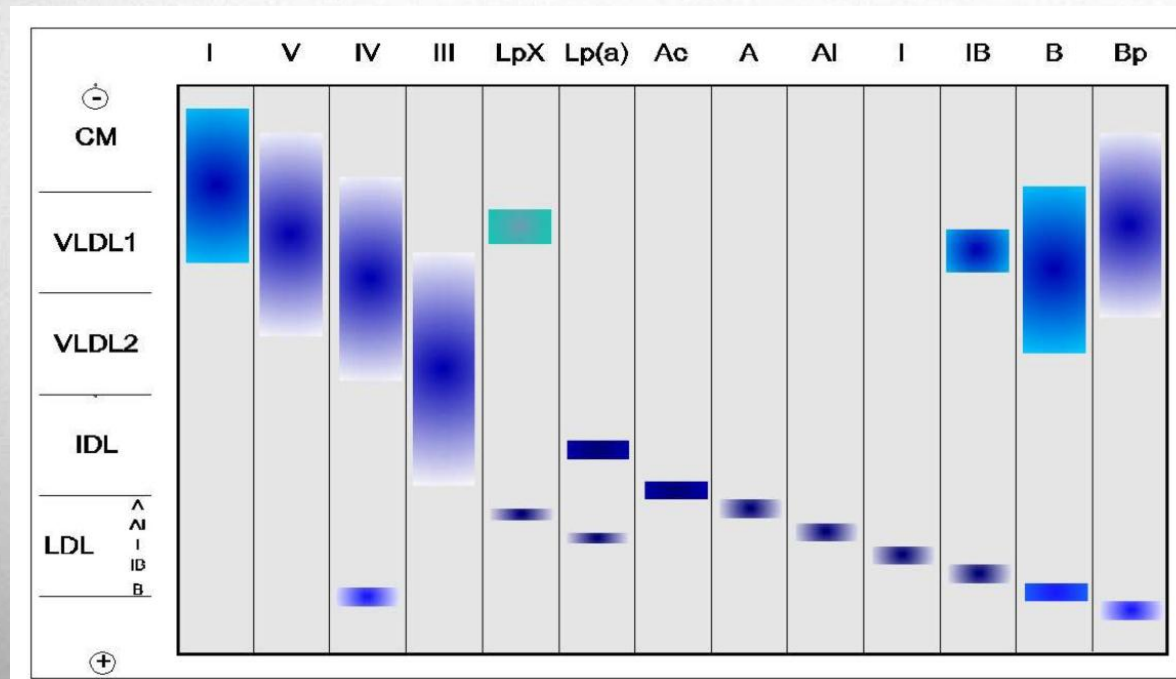


ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE:

Metabolic markers: Additional risk markers

Lipoprotein electrophoresis

- Types:
 - Agarose gel electrophoresis
 - Gradient gel electrophoresis: small dense LDL
- Not a routine test



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ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE: Metabolic markers

hs-CRP

CRP vs hs-CRP

Risk modifier

Chronic low-grade inflammation and atherosclerosis

Role in risk stratification

- Intermediate risk group vs All patients

Not for acute diagnosis

HIGH SENSITIVE CRP	0.6	< 1.00 mg/L
INTERPRETATION:		
<1 mg/L	-	LOW RISK
1 - 3 mg/L	-	MODERATE RISK
>3 mg/L	-	HIGH RISK
>5.0 mg/L	-	Consider active infection/inflammation

Us-CRP is an independent risk factor for cardiovascular disease. Combining Us-CRP with a lipid screening significantly improves risk prediction and identifies in whom aggressive primary prevention efforts e.g. weight loss, exercise, cessation of smoking and diet are indicated.

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ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE:

Metabolic markers: Additional risk markers

Homocysteine

- Some association with
 - Vascular disease
 - Cardiovascular and cerebrovascular disease
 - Venous thromboembolism
- Homocysteine lowering therapy has not shown effective reduction/prevention of cardiovascular disease or venous thromboembolism
 - Homocysteine lowering therapy: Vit B9, vit B12, and/or Vit B6
- Risk indicator vs therapeutic target?

P-HOMOCYSTEINE	24.5	*H	5.5 - 16.2 umol/L
Raised levels of HOMOCYSTEINE predispose to atherogenesis and thrombosis. Levels increase with age. Lower levels in females. Levels fall with pregnancy and oestrogen treatment.			
Causes for moderate increase (up to 30 umol/L) include:			
1. Improper sample collection (EDTA specimen must be on ice and reach the lab within 6 hours).			
2. High protein meal the previous night; excessive coffee or alcohol consumption; smoking.			
3. Heterozygous genetic defects of methionine metabolism.			
4. Acquired conditions: Renal impairment, hypothyroidism, SLE, vitamin B12, B6, or folate deficiency.			
5. Drugs: Methotrexate, anticonvulsants, sulphonamides, L-dopa, nicotinic acid, fibrates, antacids, metformin.			
6. Interference with assay: S-adenosyl-methionine; heterophile antibodies.			
Severe increase (>100 umol/L) probably due to inherited enzyme defect.			
Follow-up in 4-8 weeks of vitamin supplementation.			
Ref: SonicEdu Pathology Handbook			

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ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE:

Hypertension

- American college of cardiology (ACC)/American heart association
 - Normal BP Systolic <120 mmHg **and** Diastolic <80 mmHg
 - Elevated BP Systolic 120 – 129 **and** Diastolic <80 mmHg
 - Hypertension
 - Stage 1 Systolic 130 – 139 **or**
Diastolic 80 – 89 mmHg
 - Stage 2 Systolic 140 mmHg **or**
Diastolic \geq 90 mmHg

*disparity between the systolic and diastolic pressures category: **higher value** determines the stage*

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ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE:



Lab-Based Diagnostic Pathway for Secondary HT

01

Baseline Labs for All Hypertensive Patients

- o Serum Creatinine and estimated GFR
- o Urinalysis (dipstick) +/- Urine albumin-to-creatinine ratio (ACR)
- o Serum Sodium and Potassium
- o Fasting blood Glucose and/or HbA1c
- o Total Cholesterol (+/- Full Lipid Profile)

02

Secondary Hypertension Red Flags

- o Onset age <30 years or sudden onset age >60 years
- o Resistant HT
- o Sudden deterioration/fluctuation in BP control
- o Family History
- o Suspicious symptoms/signs/baseline-results*

Exclude: Sleep Apnoea; Medication/Drugs; Aortic Coarctation

03

Focused Workup Based on Scenario

*Suspicious symptoms/signs	Suspected Cause	Targeted Screening
Hypokalaemia (muscle weakness, cramps, tetany)	Hyperaldosteronism or Reninoma	Aldosterone-Renin Ratio (ARR)
Proteinuria; Haematuria; Increased ACR; Decreased eGFR	Renal Parenchymal Disease	Repeat eGFR and urine ACR
>30% drop in eGFR after ACE-I/ARB Rx; Bruits (abdominal or major arteries)	Renovascular disease	Duplex Doppler +/- ARR
Central Obesity; Prox. Muscle Weakness; Striae; Hypokalaemia; Hyperglycaemia	Cushing's Syndrome	Dex. Suppression Test or Salivary/Urine Cortisol
Spells of Palpitations + Sweating + Headaches	Phaeochromocytoma	Urine or Plasma Metanephrines
Amenorrhoea; Hirsutism; Infertility; Hypokalaemia or Hyperkalaemia	Congenital Adrenal Hyperplasia	17-OHP; 11-DOC; Androgens
Heat/cold intolerance; weight loss/gain; tremor; palpitations; dry brittle hair	Thyroid Disease	TSH +/- Free T4
Kidney stones; Osteoporosis; Polydipsia/Polyuria; Lethargy; Constipation	Hypercalcaemia (e.g., HyperPTH)	Serum calcium +/- PTH
Large hands/feet; Coarse Face; Headache; Apnoea; Hyperglycaemia	Acromegaly	IGF-1

04

Next Steps: Confirmatory Testing, Imaging and Specialist Referral

Lab-Based Diagnostic Pathway for
Secondary Hypertension
Dr. Reinhardt Hesse | PathCare | 2025



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ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE: Electrolytes and Kidney function

Renal Function and Cardiovascular Disease

Routine biomarkers:

- Urea, creatinine, eGFR
- Classifying CKD: Creatinine, Cystatin C, eGFR, Albuminuria

Cardio-renal syndrome

- Close relationship between CVD and CKD
- Both can be caused by systemic disease
- Associated observations
 - Increased mortality in heart failure with reduced eGFR
 - CKD has increased risk for Atherosclerotic cardiovascular disease and heart failure

Impact on drug choice

- Drug dose adjustments often required
- Higher risk of adverse events

Electrolytes and Arrhythmias

Potassium

- Membrane action potential effect
- Hyper-/hypo-kalaemic effects

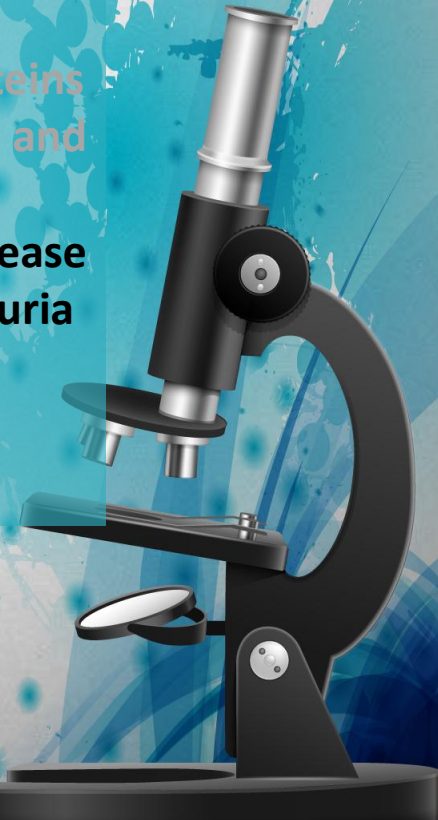
Sodium and its indirect CV implications

- Sodium/water dysregulation and association to hypertension
 - Causes and work up of secondary hypertension

Magnesium

- Hypomagnesaemia
 - Potentially broad cardiac implications

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CARDIAC SPECIFIC:

Troponin (I/T)

High-sensitivity assays: early detection vs overdiagnosis

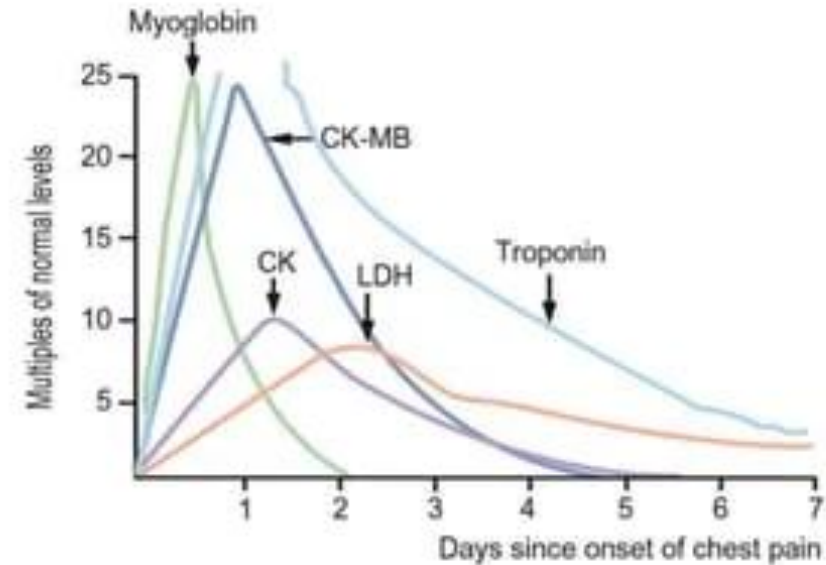
Criteria for high sensitivity cardiac troponin (IFCC TF-CB):

- (1) %CV must be <10% at the 99th percentile,
- (2) at least 50% of normal individuals tested must have detectable values above LoD.
- (3) Other recommendations: sex-derived 99th percentile, standardised unit (ng/L), POC currently not adequate for criteria

Alternate cardiac markers

- **CK-MB**
 - Equivocal troponin result
 - Heterophile antibodies
 - Macro-Troponin

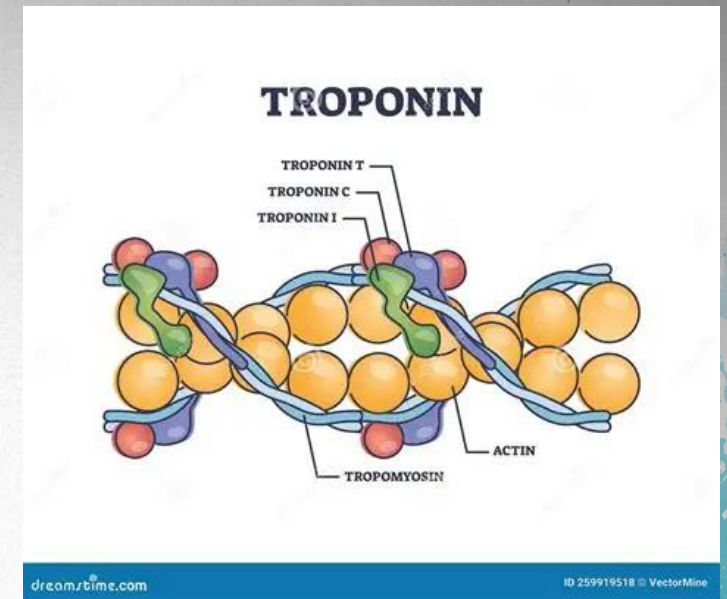
Cardiac markers in myocardial infarction



CARDIAC SPECIFIC: Cardiac Biomarkers in Acute Care

Troponin (I/T)

- High-sensitivity assays: early detection vs overdiagnosis
 - **Criteria for high sensitivity cardiac troponin (IFCC TF-CB):**
 - (1) %CV must be <10% at the 99th percentile,
 - (2) at least 50% of normal individuals tested must have detectable values above LoD. Other recommendations: sex-derived 99th percentile, standardised unit (ng/L), POC currently not adequate for criteria
- Troponin in frequent use: Troponin I (TnI) and Troponin T (TnT)(Roche)
 - High sensitivity Troponin I assay (Abbott, Alinity). Reference interval based on 99th percentile (26 ng/L).
 - hsTropI 0 – 26 ng/L Low risk (MI unlikely)
 - hsTropI > 130 ng/L High risk (MI likely; > 90% PPV for acute type 1 MI)
- **Delta changes:** Interpreting dynamic changes (not just a single value)
 - Applicable if chest pain onset was > 3 hours prior to first trop I measurement. Rising/falling troponin levels differentiate acute from chronic cardiomyocyte damage.
 - The following can guide diagnosis in NSTEMI patients, depending on the protocol used: ECS 2023 guidelines when repeat testing done within 1 – 2 hrs (delta values apply to the Abbott Alinity/Architect platform).
 - Rule out: 1h or 2 h change < 2 ng/L
 - Rule in: 1 h change \geq 6 ng/L; 2 h change \geq 15 ng/L
 - SAHA consensus statement (2012)
 - Troponin I rise or fall > 50% in two samples collected 3 hours apart is diagnostic of MI
- Considerations:
 - Troponin I assays are not standardized. Results from different platforms are not comparable, and serial monitoring **MUST** be performed using the same platform. Analytical interference may cause false positive/negative results. Should the result not correlate with the clinical picture, please contact the laboratory.
 - False positives
 - Other causes for raised troponin: cardiac failure, myocarditis, cardiomyopathy, cardiac contusion, arrhythmias, pulmonary embolism, aortic dissection, gastro-intestinal bleed, acute neurologic disease, sepsis, renal failure, extreme exertion, etc.



CARDIAC SPECIFIC: Cardiac Biomarkers in Acute Care

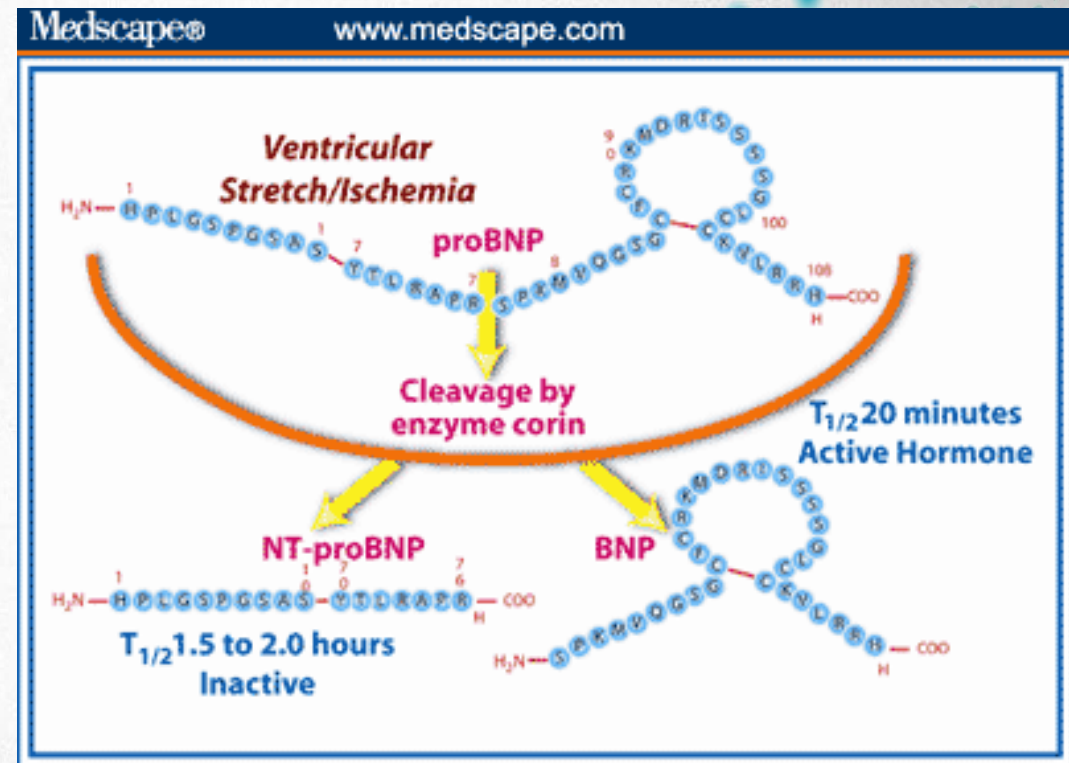
S-MYOGLOBIN	26	L	28-72 ng/mL
CK-MB MASS (Roche)	2.22		< 7.71 ng/mL
TROPONIN-T (Elecsys ng/L)	5		0-14 ng/L

Elevated HS-Trop-T > 14 ng/L (99th percentile cut-off) in a clinical setting suggestive of myocardial ischaemia (e.g., symptoms and/or ECG changes) is diagnostic of AMI. Serial measurement to demonstrate the typical rise and/or fall of Trop-T may be indicated. Other causes of increased Trop-T include pulmonary embolism, cardiac failure, myocarditis, cardiomyopathy, cardiac contusion, arrhythmia, acute neurologic disease, aortic dissection, sepsis, renal failure, extreme exertion, etc. Analytical interference may cause false positive/negative results. Should the test result not correlate with the clinical picture, please contact the laboratory.



Cardiac specific: NT-Pro-BNP

- NT- ProBNP: N-Terminal Pro Brain Natriuretic Peptide
 - BNP $t_{1/2}$ = 20 minute, Active hormone
 - BNP function: Natriuresis (Sodium/water excretion)
- $t_{1/2}$ = 2 hours
- Inactive hormone
- Production:
 - Left ventricular dilatation, hypertrophy, \uparrow Wall stretch
 - Normal heart: Atrial synthesis
 - Congestive heart failure: Left ventricular synthesis
- Renal clearance
- Considerations:
 - Rule-out test in dyspnoea
 - Age-adjusted cut-offs
 - Elevated in renal failure, AF, elderly



Cardiac specific: NT-Pro-BNP

NT-proBNP	50	< 125 pg/mL
INTERPRETATION		
< 125pg/ml : Congestive Cardiac Failure excluded. Acute presentations:		
< 300pg/ml : Acute CCF unlikely.		
> 1800 pg/ml: Acute CCF likely.		
300 - 1800 pg/ml: Age related cut-off values required:		
:.....:.....:.....:		
:Patient age :	NT-proBNP values:	
: <50 yrs :	300 - 450 :	>450
: 50 - 75 yrs :	300 - 900 :	>900
: >75 yrs :	300 - 1800 :	>1800
:.....:.....:.....:	:.....:.....:.....:	
: Interpretation :	Acute CCF less likely.	Acute CCF likely.
: :	Consider alternative :	:
: :	causes.	:
:.....:.....:.....:		
Other causes for elevated levels: Acute Coronary Syndrome, pulmonary embolism, shock, atrial arrhythmias, severe pneumonia, renal insufficiency, prior CCF.		
Please note: Result obtained from the Minividas platform, not comparable =to results obtained from the Alinity (ABBOTT) platform in view of assay =specific reference ranges.		



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE: Additional markers to consider

Haematological: Coagulation and Thrombosis Risk

- INR (warfarin monitoring)
- aPTT, PT
- D-dimer

HIV infection

Coronary artery calcium (CAC) scan

Carotid intima media thickness

- Hypertension
- Diabetes mellitus
- Met. Synd.
- Lipids and lipoproteins
- Diabetes mellitus and hyperglycaemia
- Chronic kidney disease and microalbuminuria
- Inflammation
- HIV infection



ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE: Final points...

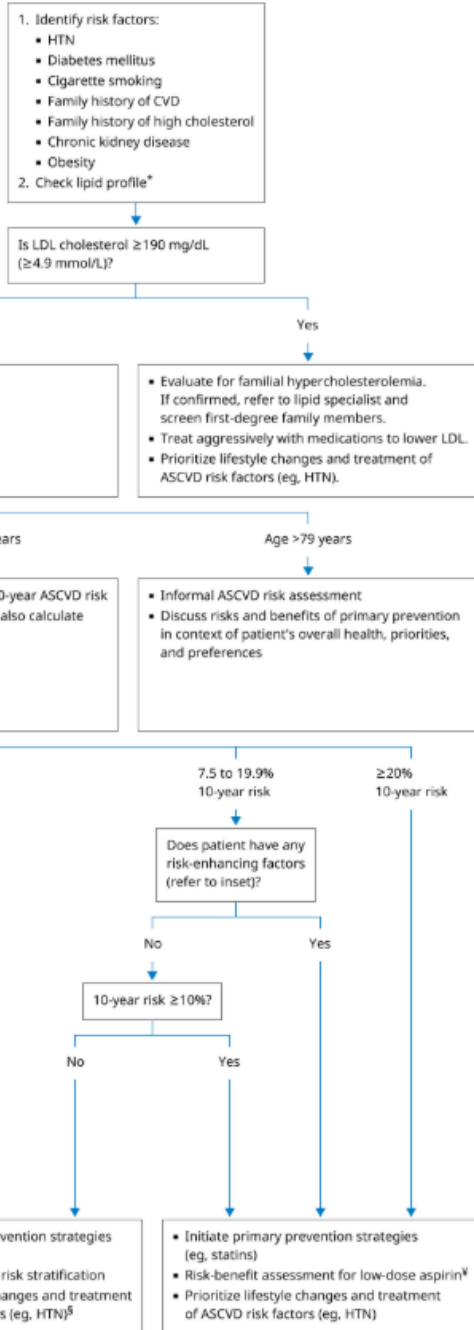
- When should testing start?
- How often should testing occur?

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Cardiovascular disease risk assessment in adults without a history of atherosclerotic cardiovascular disease

- Risk-enhancing factors**
- Family history of premature ASCVD
 - Primary hypercholesterolemia
 - Metabolic syndrome
 - Chronic kidney disease
 - Chronic inflammatory conditions (eg, RA, HIV)
 - History of premature menopause
 - High-risk race/ethnicity (eg, South Asian ancestry)
 - Primary hypertriglyceridemia
 - Biomarkers associated with increased ASCVD risk (eg, elevated hsCRP, Lp(a), apoB)
 - Abnormal ABI
- For complete list and definitions, refer to UpToDate table on risk-enhancing factors.



THANK YOU!!

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ESTABLISHED RISK FACTORS IN CARDIOVASCULAR DISEASE: Metabolic markers

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