

**Biochemistry CVS**

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**Lecture title: New Risk Factors for Heart Diseases**

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**New Risk Factors for Heart Diseases**

\* Revision of part one:

Risk factors and cardiac markers are different from total cholesterol , TG , LDL HDL and their ratios.

**Cardiac markers:**

* Aspartate transaminase (AST)
* Glycogen phosphorylase isoenzyme BB (GPBB)
* Lactate dehydrogenase
* Certain kinase (CK) : CK-MM, CK-MB and CK-BB

**Risk factors:**

* CRP
* Fibrinogen
* Apolipoproteins
* Myoglobin
* Troponins (I&T)
* Homocysteine

\* determining your non-HDL cholesterol level may be more useful than calculating your cholesterol ratio.

\* identifying the type of LDL is more important than identifying level of LDL.

Types of LDL :

* Small size 🡺 more dangerous / more risk factor (go deep inside gel and take more time to reach other pole)
* Large size

***Extra note:***

some researchers now believe that a key factor is the size and density of LDL particles, which range from very small, densely concentrated particles to large “fluffy” ones. Studies have linked smaller, dense LDL particles to a higher risk of heart disease compared to larger particles, which may be relatively benign. This is true even if your LDL level is in the desirable range. Moreover, small, dense LDL tends to go along with a constellation of related problems that increase the risk of cardiovascular disease—

* **fibrinogen :**

largest plasma protein in blood

**Fibrinogen test 🡪 is usually ordered with other blood clotting tests** ( PT and PTT)

**When is it ordered?**

1. **open heart surgery**
2. **people with pervious** MI (patients take anticoagulant)

This test done regularly to evaluate the risk of developing heart disease.

* **CK :**

CK-BB >> isoenzymes of CK predominates in brain. Different forms of cancer result in clinically significant levels of elevated CKBB in serum so it is Important in cases of tumor metastasis it helps us to know whether tumor reach brain or not.

CK-MB >> isoenzyme found primarily in heart muscle cell. Usually this test isn’t ordered alone we order🡺 total CK-MB and troponin.

\*Part 2 :

Apolipoprotein :

* **Apo A1** 🡺 major apolipoprotein of HDL
* **Apo B** 🡺 main apolipoprotein of chylomicrons and low density lipoproteins

Ratio of apolipoprotein B/A1 more important than ratio of total cholesterol/HDL cholesterol

* ***The most important thing in cardiovascular disease: prediction 🡺 "predictive value"🡺 prognosis of angina , MI and stroke.***
* Apo B and the apo B/apo A1 ratio have been shown to be predictive of ischaemic stroke in patients with previous TIA.
* Why get tested?
  + To determine levels of Apo A-I especially if you have decreased levels of HDL-C HDL-C,
  + determine your risk of developing coronary artery disease (CAD).
  + ***The most important thing in cholesterol to have high levels of HDL (above 60) and low levels of LDL (less than 160)***
* When to get tested?
  + Hyperlipidemia and/or a family history of CAD or peripheral vascular disease.
  + ***Genetics play important role in cardiovascular diseases* *and MI*. *some people die (at age of 20) because they have family history.***
* Function of **Apo A1**: to activate **LCAT** within the HDL complex, which catalyzes the esterification of cholesterol.  This results in a more soluble cholesterol-HDL complex which increases the cholesterol transport capacity of the HDL particle for subsequent removal by the liver.
  + ***Function of apolipoprotein🡺 help lipids to become soluble in blood***
* Deficiencies in **Apo A-I** appear to correlate well with an increased risk of developing coronary artery disease (CAD) and peripheral vascular disease.
* Results from recent epidemiological studies and statin trials suggest that **apolipoprotein B-100 (apoB),** with or without **apoA-I**, is superior to LDL cholesterol in predicting coronary events.
  + ***Old lipid profile 🡺 cholesterol, triglyceride, LDL and HDL. 🡺 no longer enough.***
  + ***Nowdays 🡺 ratios and apolipoprotein (apoB and possibly apoA-I) are added to the routine lipid profile.***
  + ***People who take drugs continuously should check their lipid profile and apolipoprotein B***

* **Lipoprotein(a):** whose levels vary as a result of diet, exercise, etc. is predominantly a genetic trait whose level remains more or less constant after puberty.
  + ***Lipo(a) related to number of fat cells.***
  + ***Number of Fat cells remain constant after puberty.***
  + ***Size of fat cells increase after puberty. (it could increase six times normal size***)

Myoglobin

* ***Oxygen carrier in muscle.***
* ***Usually in car accident 🡺 directly myoglobin (blood) appear in urine result from damage in muscle.***
* When to get tested?
  + ***2-3 hours on arrival***

TROPONINS , I & T

* ***Ordered in any second the patient suffer from chest pain.***
* ***First test order when patient arrive to hospital with chest pain.***
* ***Direct result : positive or negative.***
* The cTn-I was significantly more specific for AMI than was the cTn-T, but not significantly better than CK-MB or myoglobin***.*** 
  + ***Troponin I 🡺 quantitative test 🡺 Result: levels 🡺 more specific and takes time***
  + ***Troponin T 🡺 qualitative test 🡺 Result: positive or negative 🡺 available in all hospital***
* Myoglobin is the biochemical marker having the highest combination of sensitivity, specificity, and negative predictive value for AMI within 2 hours of ED presentation***.***
* ***The most important one and one with the shortest duration (fast result) 🡺 myoglobin***
* The troponin test will usually be ordered when a patient first comes into the emergency room and then may be ordered again at 6 and 12 hours.
* When the patient has significantly elevated troponin concentrations and other clinical signs, such as an abnormal electrocardiogram (ECG), then it is likely the patient has had a heart attack.
  + ***Normal ECG does not necessary mean normal heart, when clinical signs are present you should order other enzyme test.***
* If the first troponin performed is normal but subsequent (6 hour and 12 hour samples) troponin tests are increased, then the heart injury likely occurred within a couple of hours prior to the first test and had not had time to increase.
* ***Troponin will remain high for one to two weeks after heart attack.***

Homocysteine

* ***It is biosynthesized from methionine (essential amino acid)***
* ***homocysteine may have an effect on atherosclerosis***
* ***Folic acid and other B vitamins help break down homocysteine in the body.***
* ***Homocysteine can be recycled into methionine or converted into cysteine with the aid of certain B-vitamins.***
* ***Folic acid sources : Leafy green vegetables***
* ***B12 deficiency + folic acid deficiency 🡺 megaloblastic anemia***
* ***B12 deficiency 🡺 Pernicious anemia 🡺 specific anemia🡺 case of losing weight***
* ***B12 taking as 🡺 Cyanocobalamin injections🡺 1 per month***
* ***homocysteine 🡺 screening for life style or health. Another test for normal or abnormal people 🡺 CRP***
* Homocysteine is commonly used as a screen for people at high risk for heart attack or stroke. It may be useful in patients who have a family history of coronary artery disease but no other known risk factors.
* Some recommend homocysteine testing in malnourished patients, such as the elderly (who often absorb less vitamin B12 from their diets).
* ***In old people metabolism is low , absorption is low 🡺*** *B12 deficiency*
* If the patient has a strong ***family history*** of early atherosclerosis or a family member has been diagnosed with homocystinuria, then the patient should be tested for the gene mutation that was found in the family member.
* Blockage of a coronary artery, a precursor to a heart attack, occurs with more than double the average frequency in people with homocysteine levels in the highest 25% as compared to those in the lowest 25%.
* ***Peptic ulcer due to infection. Atherosclerosis and thrombus formation start as infection, this why CRP indicator of infection.***
* ***Statins 🡺 anti-inflammatory drug and reduce level of cholesterol***
* ***Cortisone🡺 anti-inflammatory drug.***