Biomarkers of Cardiovascular diseases

By
Dr. Gouse Mohiddin Shaik

Biomarkers of CVD

- In this section we will discuss…
- Introduction
- Types of CVD
- CVD biomarkers
- Future CVD biomarkers

Biomarkers of CVD

- Introduction
  - CVD is the one of the leading causes of deaths worldwide
  - Almost 30% of global deaths account
  - Increasing rate every year
  - Can be addressed by identifying behavioral risk factors in high risk groups
  - Helpful if detected early
  - Biomarkers aid in detection and management

Biomarkers of CVD

- Types of CVD
  - As the name implies it is coronary (heart) and vascular (blood vessel) disease

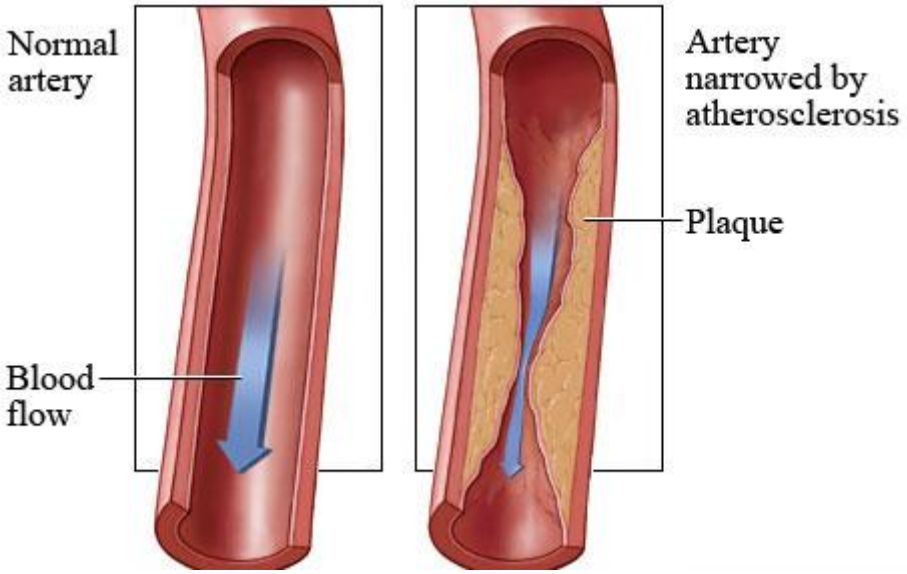
Types of CVD	
Coronary heart disease	Diseases of the blood vessels supplying blood to the heart
Cerebrovascular disease	Diseases of the blood vessels supplying blood to the brain
Peripheral arterial disease	Diseases of the blood vessels supplying blood to arms and legs
Rheumatic heart disease	Streptococcal infection – damage to heart muscle and valves from rheumatic fever
Congenital heart disease	Malformation of heart during fetus development

Biomarkers of CVD

- Coronary heart diseases
  - Mainly due to plaque build up inside the coronary arteries (atherosclerosis) which leads to
  - Ischemic heart disease & myocardial infraction
  - Congestive heart failure

Biomarkers of CVD

- Atherosclerosis
  - Characterized by deposition of fatty (mainly cholesterol) plaques in the inner walls of blood vessels leading to hardening and narrowing

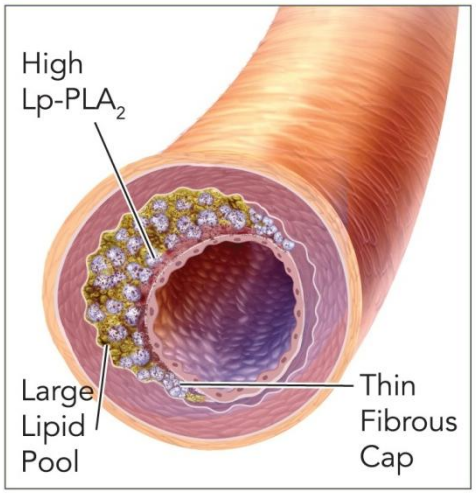


Biomarkers of CVD

- BMs of Atherosclerosis
  - Ghrelin :
  - Hunger hormone – regulates appetite
  - Empty stomach releases more hormone
  - stomach hormone observed to be increased in atherosclerotic conditions
  - Positive correlation between ghrelin concentration and atherosclerosis are established in males

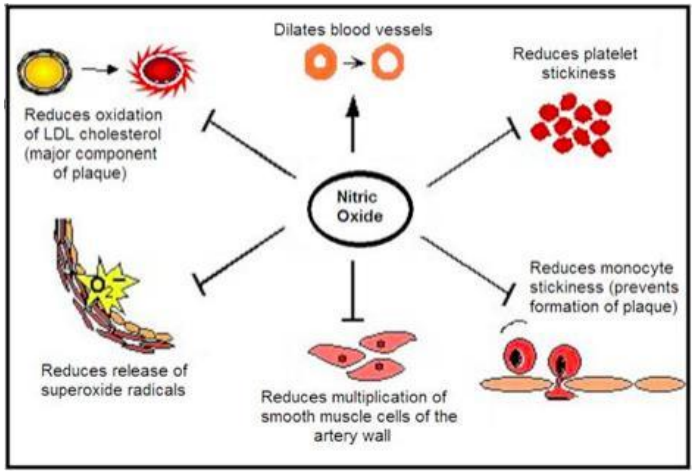
Biomarkers of CVD

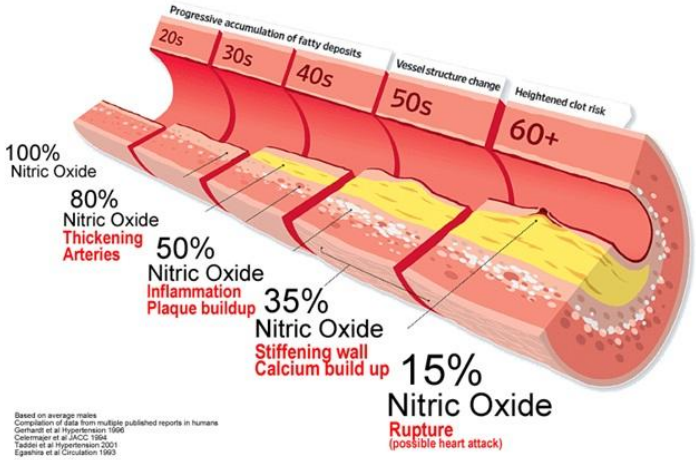
- BMs of Atherosclerosis
  - Lp-PLA2 :
  - Lipoprotein associated phospholipase A2
  - Member of phospholipase super family
  - Hydrolyze phospholipids
  - Can be predictive biomarker



Biomarkers of CVD

- BMs of Atherosclerosis
  - NO (nitric oxide) impairment
  - NO involved in many pathways
  - Important function as antioxidant
  - Reduces oxidation of LDL cholesterol
  - With age NO production decreases
  - Difficult to measure but good BM





Biomarkers of CVD

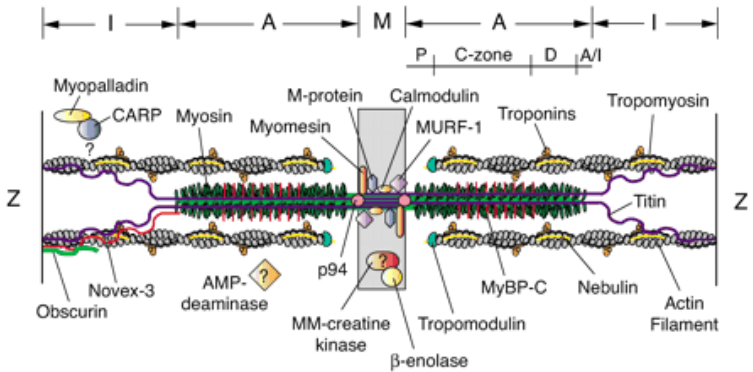
- BMs of Atherosclerosis
  - Other BMs
  - Proteomic profiles
  - Inflammatory markers
  - Lipid modified proteins
  - Free radicals….

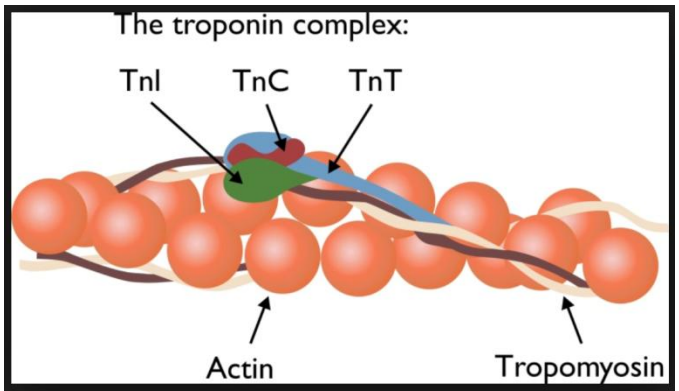
Biomarkers of CVD

- BMs of ischemic heart disease and myocardial infraction
  - Only two categories are approved so far
  - Troponins
  - Natriuretic peptide

Biomarkers of CVD

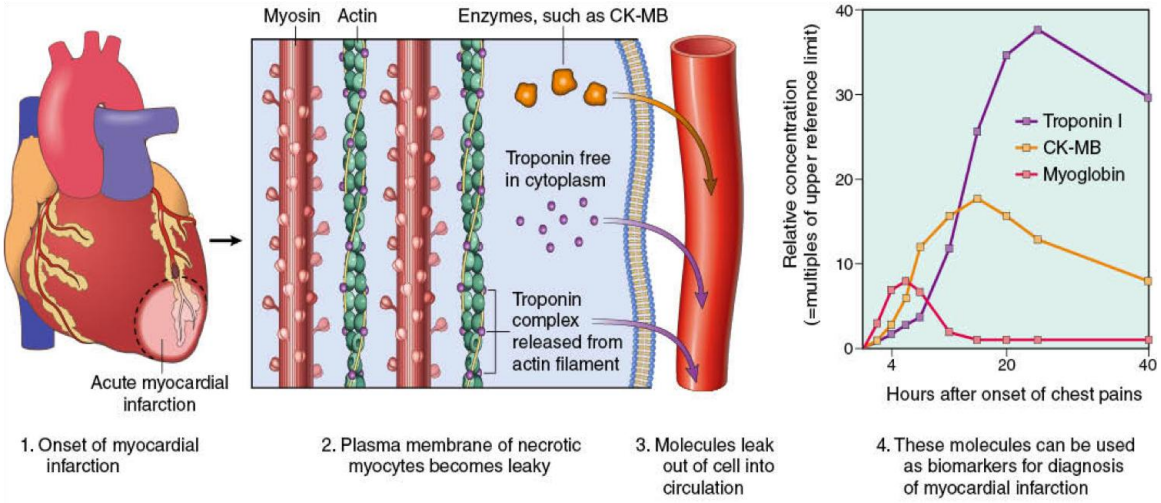
- BMs of ischemic heart disease and myocardial infraction
  - Troponins
  - Heart is a muscle
  - Contractile unit of muscle fiber has thick and thin filaments
  - Thick filaments – myosin
  - Thin filaments – actin, tropomyosin, troponin





Biomarkers of CVD

- BMs of ischemic heart disease and myocardial infraction
  - Troponins
  - Heart tissue damage leads to increased circulating troponins
  - Creatine kinase muscle brain (CK-MB) is also elevated



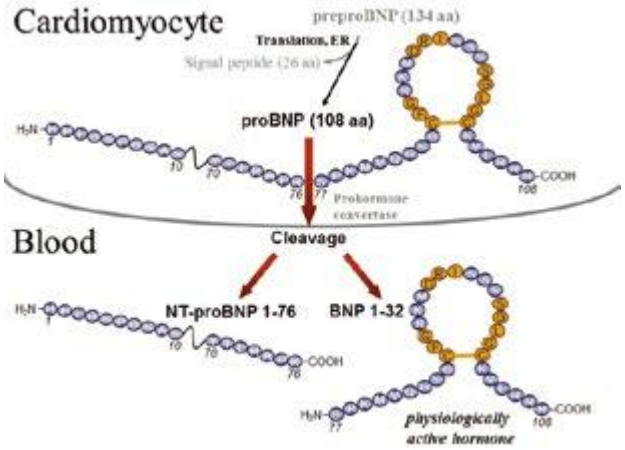
Biomarkers of CVD

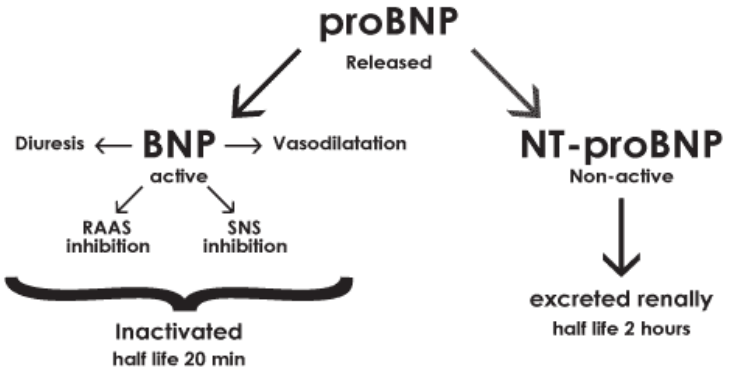
- BMs of ischemic heart disease and myocardial infraction
  - Natriuretic peptide
  - Primarily an endocrine system that maintains fluid and pressure homeostasis
  - Special peptides responsible for discharge of sodium through urine
  - High NP levels can serve as warning system to help identify patients at high risk
  - Troponin-NP complement tests are useful

Biomarkers of CVD

- BMs of ischemic heart disease and myocardial infraction
  - Natriuretic peptide

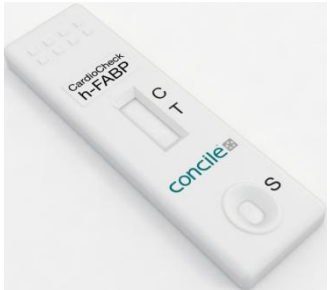
	ANP	BNP	CNP
Site of synthesis	Cardiac atrial cells+++, ventricular cells++, central and peripheral neurons	Ventricular cells ++++	Vascular endothelium, CNS, kidney
Factors stimulating release	Atrial stretch, ECF expansion, Heart Failure, Primary aldosteronism	Volume expansion	Not clear
actions	Natiuresis, diuresis, decrease in BP (vasodilation)	same as ANP	Vasodilator, lesser natriuretic and diuretic effects.
uses	Diagnostic / Prognostic marker in heart failure	In CHF	

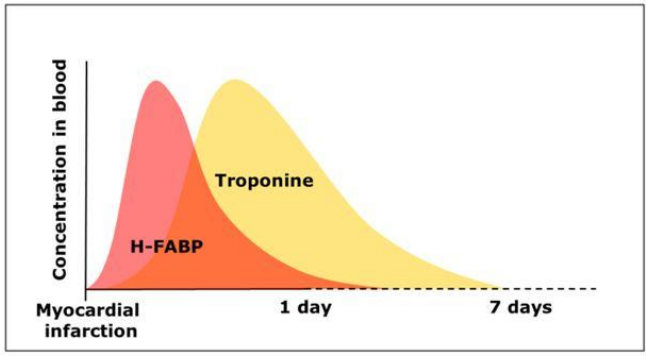




Biomarkers of CVD

- BMs of ischemic heart disease and myocardial infraction
  - Fatty acid binding protein (H-FABP)
  - Low molecular weight protein involved in myocardial fatty acid metabolism
  - Fast (30-45 min) elevation during early stages of infraction
  - Incombination with troponin and CK-MB can serve as excellent biomarker of diagnosis and prognosis



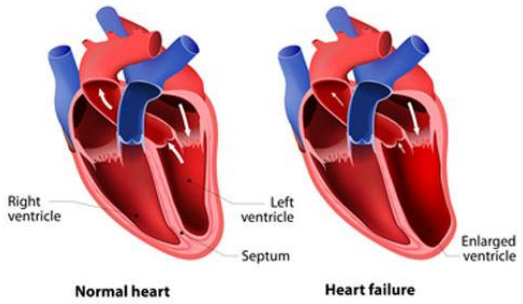


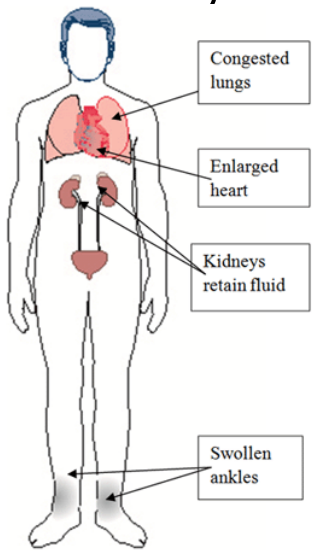
Biomarkers of CVD

- BMs of ischemic heart disease and myocardial infraction
  - Other BMs
  - Cripto -1 – also expressed in stem cells. Helpful in assessing tissue regeneration
  - Myoglobin – along with troponins
  - Plasma fetuin-A – produced by liver and induces insulin resistance. Increased levels directly correlated with risk of MI

Biomarkers of CVD

- BMs of congestive heart failure (CHF)
  - CHF occurs when infracted heart muscle can not pump blood efficiently
  - Resulting in organs receiving depleted blood supply
  - Organs like kidneys try to hold more water and salt, leading to edema of ankles, hands, legs and lungs - congestion
  - Diagnosis of CHF is difficult



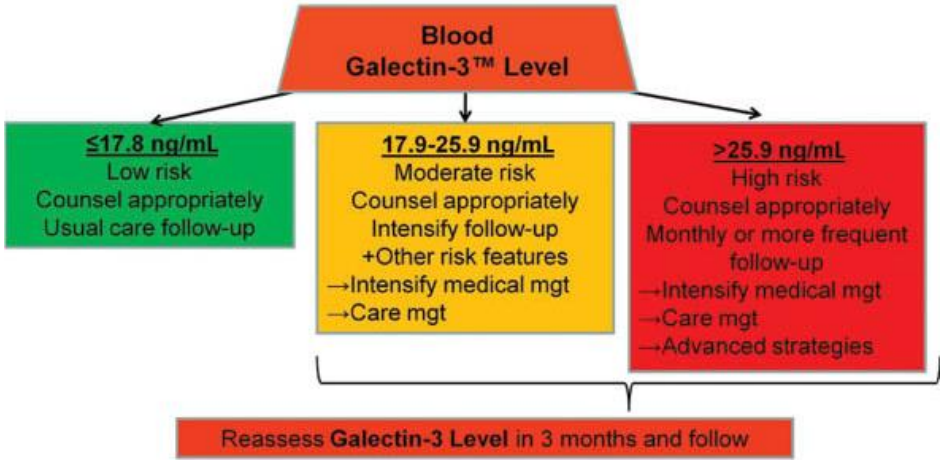


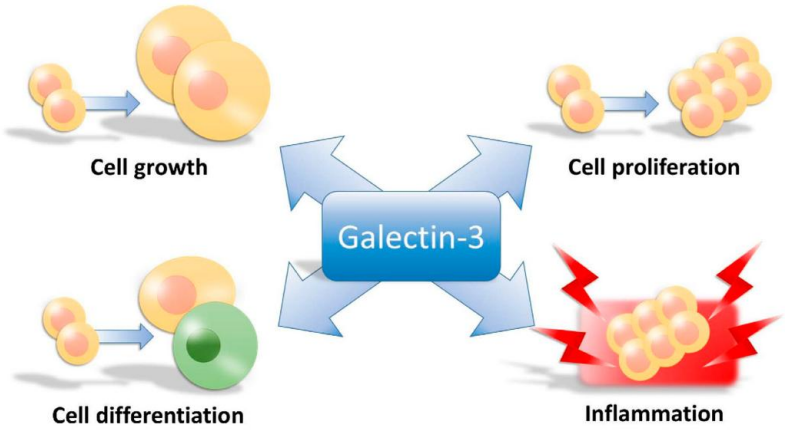
Biomarkers of CVD

- BMs of congestive heart failure (CHF)
  - Beta-2a protein
  - Calcium plays key role in heart function
  - Votage dependentCa++ (VDCC) channels are regulated by beta-2a
  - Beta-2a is elevated in many cases of heart failure
  - Can offer therapeutic possibilities

Biomarkers of CVD

- BMs of congestive heart failure (CHF)
  - Galectin-3
  - An inflammatory protein shown to be elevated in failing heart
  - Can be a prognosis marker in acute CHF
  - Indicates the role of inflammation in CHF
  - Also offers a therapeutic target



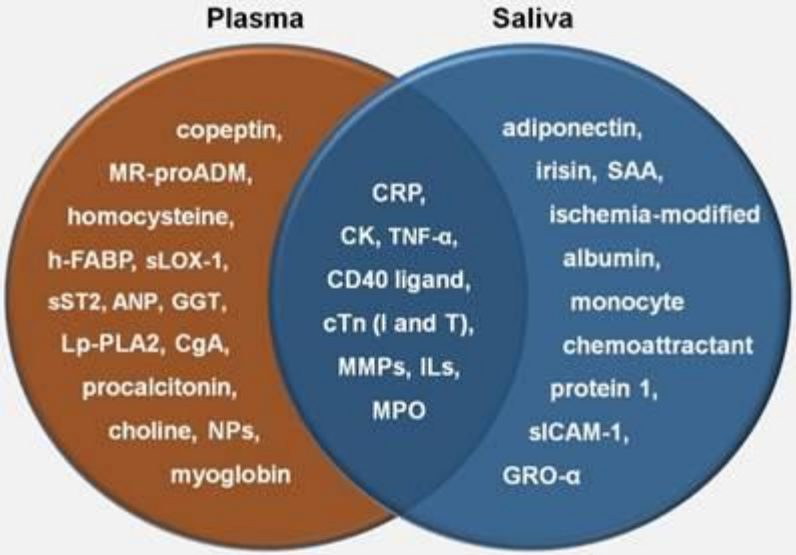


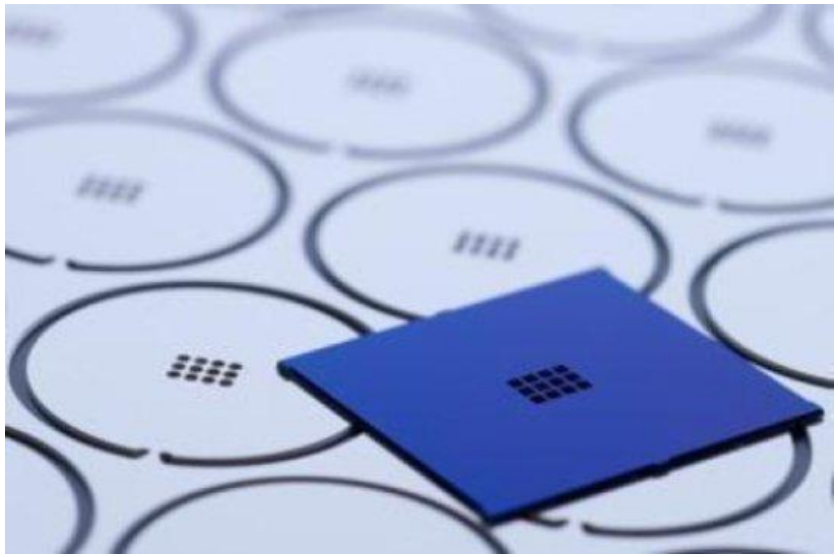
Biomarkers of CVD

- BMs of congestive heart failure (CHF)
  - KIF6 gene
  - Kinesin family member 6
  - Carriers of this gene are at high risk
  - Especially KIF6 719Arg allele carriers are 34% higher risk of MI and 24% higher risk of CHF
  - Can serve as predisposition marker to identify risk group
  - More research needed

Biomarkers of CVD

- Future CVD biomarkers
  - Instead of relying on one biomarker combination of biomarkers can be useful
  - Employment of Bionanochips toa analyze saliva





Next class

- Next class…..
  - Biomarkers of neurological diseases